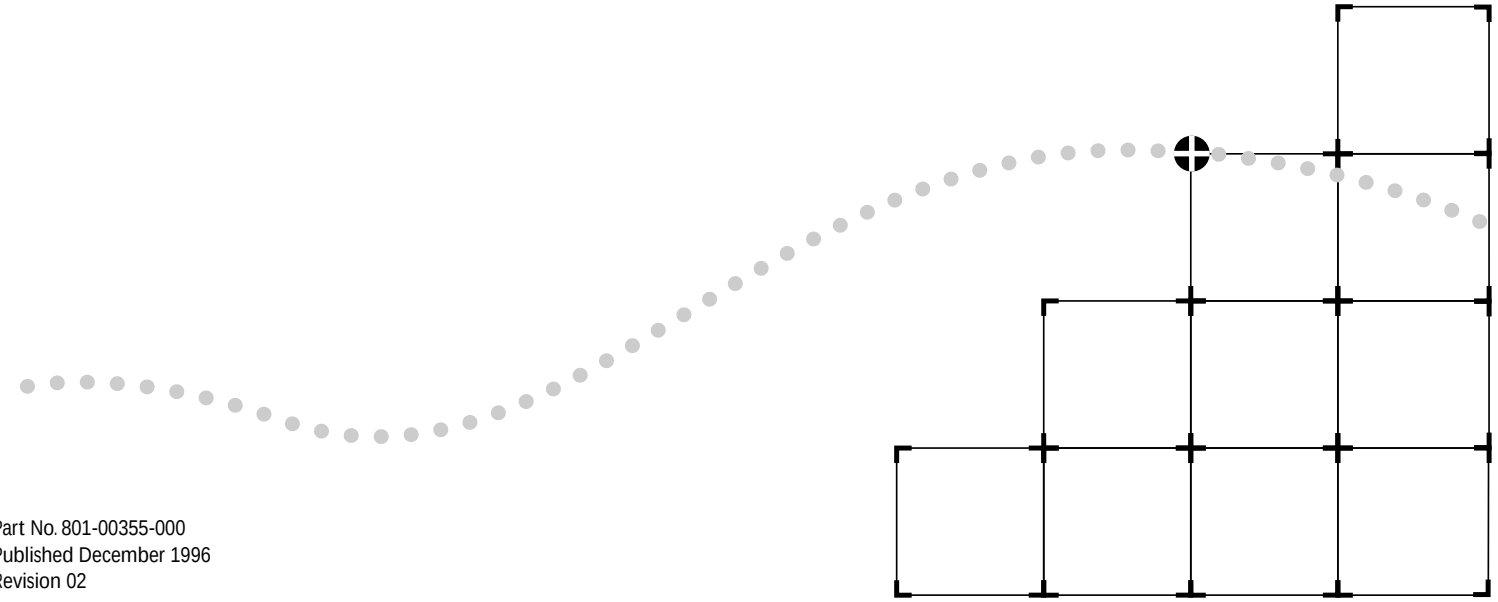
SuperStack™ II Switch 2200
Getting Started



Part No. 801-00355-000
Published December 1996
Revision 02

3Com Corporation ■ 5400 Bayfront Plaza ■ Santa Clara, California ■ 95052-8145

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About This Guide

Introduction

Your *SuperStack™ II Switch 2200 Getting Started* guide provides all the information you need to set up your SuperStack™ II Switch 2200 system and get it operating in your network. This guide provides an overview of your system and step-by-step procedures for planning your configuration, installing your system, cabling, powering up, and troubleshooting. When you are ready to configure your system, refer to the *SuperStack™ II Switch 2200 Administration Console User Guide*.

If the information in the release notes shipped with your Switch 2200 system differs from the information in this guide, follow the release notes.

This guide is intended for the system or network administrator who is responsible for installing and managing the network hardware. It assumes a working knowledge of local area network (LAN) operations, but it does not assume prior knowledge of 3Com's Switch 2200 high-performance networking equipment.

How to Use This Guide

Table 1 shows where to find specific information.

Table 1 Locating Information in This Guide

If you are looking for information on…	Turn to…
An overview of the Switch 2200 system	Chapter 1
Installing your Switch 2200 system	Chapter 2
Planning your configuration and cabling your Switch 2200 system	Chapter 3
Powering up your Switch 2200 system	Chapter 4
Setting up your Switch 2200 system for management access	Chapter 5
Troubleshooting	Chapter 6
Switch 2200 system specifications	Appendix A
Site requirements and safety codes	Appendix B
Multi-mode fiber standards	Appendix C
3Com Technical Support	Appendix D

Conventions

Tables 2 and 3 list icon and text conventions that are used throughout this guide.

Table 2 Notice Icons

Icon	Type	Description
	Information Note	Information notes call attention to important features or instructions.
	Caution	Cautions contain directions that you must follow to avoid immediate system damage or loss of data.
	Warning	Warnings contain directions that you must follow for your personal safety. Follow all instructions carefully.

Table 3 Text Conventions

Convention	Description
Italics	Italics are used for *emphasis* or to denote terms defined in the glossary.
"Enter" vs. "Press"	The word "enter" means to type something and then press the Return or Enter key. Do not press the Return or Enter key when an instruction simply says "press."

(continued)

Table 3 Text Conventions (continued)

Convention	Description
"Syntax" vs. "Command"	The word "syntax" indicates that the general form of a command syntax is provided. You must evaluate the syntax and supply the appropriate value and time. Example: Set the date by using the following syntax: `mm/DD/yy hh:mm:ss xm` The word "command" indicates that all variables in the command have been supplied and that you can enter the command as shown in the text. Example: To update the system software, enter this command: **`system softwareUpdate`**
Text for `screen display`	`This typeface` is used to represent displays that appear on your terminal screen. Example: `Select a menu option:`
Text for **`commands`**	**`This typeface`** is used to represent commands that you enter. Example: **`bridge port address display`**
Keys	When specific keys are referred to in the text, they are called out by their labels, such as the Return key or the Escape key, or they may be shown as [Return] or [Esc]. If you must press two or more keys simultaneously, the keys are linked with a plus sign (+). Example: Press [Ctrl]+[Alt]+[Del].

Switch 2200 Documentation

The following documents comprise the Switch 2200 documentation set. To order a document that you do not have or additional documents, contact your sales representative for assistance.

- *SuperStack™ II Switch 2200 Unpacking Instructions*

  Describes how to unpack your Switch 2200 system. It also provides you with an inventory list of all the items shipped with your system. (Shipped with your system/Part Number 801-00312-000)

- *SuperStack™ II Switch 2200 Software Installation and Release Notes*

  Provides information about the software release, including new features, software corrections, and known problems. It also describes any changes to the Switch 2200 system's documentation. (Shipped with your system)

- *SuperStack™ II Switch 2200 Getting Started* (this guide)

  Describes all the procedures necessary for planning your configuration and installing, cabling, powering up, and troubleshooting your Switch 2200 system. (Shipped with your system/Part Number 801-00309-000)

- *SuperStack™ II Switch 2200 Operation Guide*

  Helps you understand network management and administration, bridging, and FDDI technology. It also describes how these concepts are implemented in the Switch 2200 system. (Shipped with your system/Part Number 801-00311-000)

- *SuperStack™ II Switch 2200 Administration Console User Guide*

  Provides information about using the Administration Console and describes the tasks you can perform using the Administration Console. (Shipped with your system/Part Number 801-00310-000)

- *Command Quick Reference for the SuperStack™ II Switch 2200 Administration Console*

  Contains Administration Console Intelligent Switching commands for the Switch 2200. (Folded card shipped with your system/Part No. 801-00314-000)

Related Publications

Depending on how you install and manage your system, several related documents can provide helpful information:

- SNMP Network Manager documents

  The Switch 2200 uses SNMP (Simple Network Management Protocol), which can be accessed by a remote network management facility. 3Com has a number of network management products for a variety of platforms. Contact your supplier for current product information. Each network management facility includes a manual explaining how to manage the units.

  If you are using network management software from another vendor, refer to the sections of the product's documentation that describe how to manage SNMP devices.

- SNMP documents

  3Com recommends this book for an easy-to-read description of SNMP:

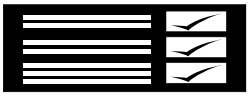
  > Marshall T. Rose. *The Simple Book*. Englewood Cliffs, NJ: Prentice-Hall. ISBN 0-13-812611-9.

  You might also find 3Com's "Introduction to SNMP" Self-Study Guide helpful. (Order from 3Com/Part Number 3CS-350)

- Telnet documents

  To manage the Switch 2200 system over a TCP/IP network using telnet, refer to the documentation supplied with your telnet application.

1 SYSTEM AND SETUP OVERVIEW



This chapter contains an overview of 3Com's SuperStack™ II Switch 2200. It identifies the major features and components of the system.

This chapter also contains the Switch 2200 Setup Roadmap, on page 1-5, which highlights the major tasks required to get your Switch 2200 installed and operating in your network. The roadmap also lists the specific Switch 2200 document containing the information you need for each task.

About the SuperStack™ II Switch 2200 Intelligent Switch

The Switch 2200 is an Ethernet to FDDI switch that incorporates SNMP-compliant network management capabilities. When configured as part of a suitable network, the Switch 2200 can significantly increase LAN workgroup performance. In particular, the Switch 2200 can provide increased client/server performance in both small and large LAN applications.

The Switch 2200 system:

- Switches traffic from Ethernet segments to FDDI
- Switches traffic between Ethernet segments
- Filters FDDI traffic so that only frames destined for a particular Ethernet segment are forwarded to that segment

This powerful switch uses 3Com's new custom asynchronous ASIC technology, which brings high performance and reliability to your network. The Switch 2200 also provides state of the art network interfaces to meet any of your networking needs.

Switch 2200 Solution

Your Switch 2200 allows you to create additional capacity and improve performance without increasing the complexity of your network. Listed here are several solutions provided by your Switch 2200 system.

- Increases bandwidth to the server, either by creating a high-speed downlink to a centralized server or by supporting a local high-speed file server
- Interconnects multiple Ethernet or higher speed LANs
- Switches bandwidth rather than sharing, which provides dedicated 10Mbps Ethernet segments
- Provides parallel communications between users and increases the aggregate bandwidth by allowing information to flow directly from one physical port to another
- Relies on segmentation, which increases bandwidth by dividing your network into smaller segments
- Allows you to stack additional systems to add more switch ports as your network grows

Features of the Switch 2200 System

The Switch 2200 has sixteen shielded 10BASE-T (RJ-45) Ethernet ports and one high-speed FDDI port. The FDDI port, which has both an A port and a B port, is configured as a dual attachment station (DAS).

The Switch 2200 is part of 3Com's SuperStack™ family. You can install the Switch 2200 in a SuperStack™ system, which allows you to combine diverse technologies as your network grows. The Switch 2200 system can also be connected to a redundant power system (RPS) or an uninterruptible power system (UPS) for increased reliability and resilience.

Switch 2200 systems include integrated management to provide fault tolerance and maximum network availability. This management is accessible using

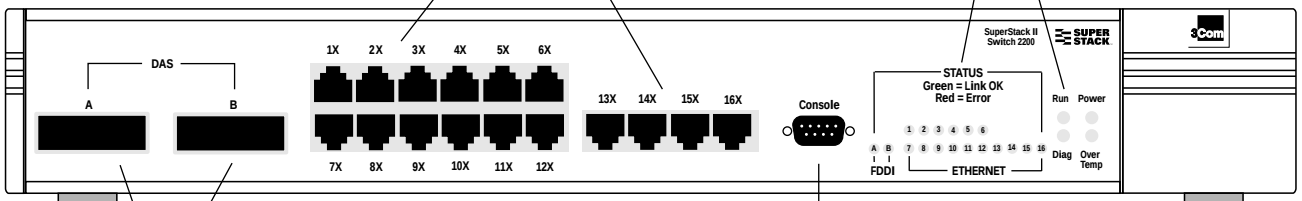
- Switch 2200 system Administration Console
- Transcend® Enterprise Manager for UNIX® and Windows®, 3Com's SNMP-based network management software for LAN switching systems.
- Standard network managers based on SNMP, such as SunNet Manager™, HP OpenView™, or NetView AIX® applications

The following sections identify and describe the major components of the Switch 2200 system.

System Overview — Switch 2200 Front Panel

Ethernet Ports
The Switch 2200 supports 16 10 BASE-T (RJ-45) Ethernet ports.

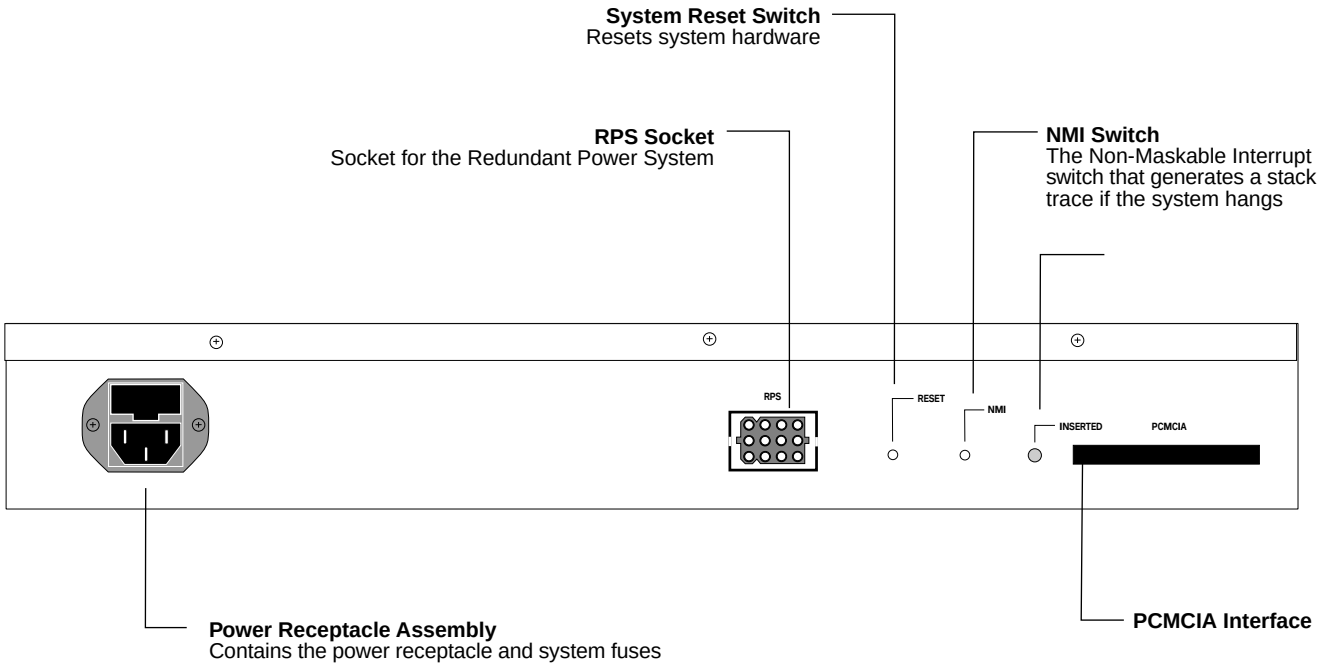
System LEDs
The LEDs provide information about system and port status.



FDDI Ports
The Switch 2200 system is configured as a dual attachment station (DAS). It has an A port and a B port.

Console Port
This port allows you to connect a terminal to the Switch 2200 system for management access.

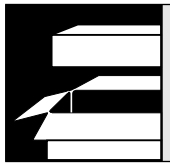
System Overview — Switch 2200 Back Panel



Switch 2200 Roadmap of Setup Tasks

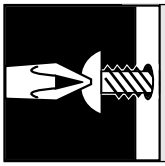
1 Unpacking

See the unpacking instructions



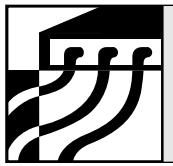
2 Installing the System

See *Getting Started* Chapter 2



3 Cabling

See *Getting Started* Chapter 3



4 Powering Up

See *Getting Started* Chapter 4

5 Configuring for Management

See *Getting Started* Chapter 5

6 Troubleshooting

See *Getting Started* Chapter 6

7 Administration and Operation

See the *Administration Console User* and *Operation Guides*

2 INSTALLING THE SYSTEM

This chapter describes how to install your SuperStack™ II Switch 2200 on a table top, in a free-standing stack with other SuperStack™ II products, or in a distribution rack.

- To install the Switch 2200 system on a table top or in a free-standing stack, read these sections:
  - "Before You Begin" (the next section)
  - "Installing the Switch 2200 System on a Table Top or in a Free-Standing Stack" (page 2-2)
- To install the Switch 2200 system in a distribution rack, read these sections:
  - "Before You Begin" (the next section)
  - "Installing the Switch 2200 System in a Distribution Rack" (page 2-3)

Before You Begin

Before beginning the installation procedures, be sure to:

- Read the appropriate configuration information in Chapter 3: *Cabling*.
  - For strategic information about where to install your system in your Ethernet network, read "Sample Ethernet Configuration" on page 3-2.
  - For strategic information about where to install your system in an FDDI network, read "Sample FDDI Configuration" on page 3-4.
- Move the Switch 2200 system close to where you plan to install it.

Place the system near an easily accessible power outlet. You can only power down the system by removing the power cord from the power source.

- Have a No. 2 Phillips screwdriver available.
- Have the hardware kit readily available. See Table 2-1.
- For rack mounting, have the mounting brackets readily available.

Table 2-1 Switch 2200 Hardware Kit

Qty	Item	To use in...
4	Rubber feet (self-adhesive)	Stacking the system on a table or in a free-standing stack only
2	Mounting brackets	Installing the system in a distribution rack
6	M4 x 8 flathead screws	Installing the distribution rack brackets
4	"G" clips	Installing the system in a distribution rack
4	10/32 x 1/2 Phillips screws	Installing the system in a distribution rack
1	Strain relief, AC power cord	Relieving strain on AC power cord
1	M4 x 8 panhead screw	Installing AC power cord strain relief

Installing the Switch 2200 System on a Table Top or in a Free-Standing Stack

To install the Switch 2200 system on a table top or in a free-standing stack, follow these instructions:

1. Turn the system on its side.
2. Remove the protective covering from the rubber feet.
3. Place a rubber foot onto the base of the system in each of the marked areas at the four corners of the unit.
4. Turn the system onto its feet.

Place the system near an easily accessible power outlet. You can only power down the system by removing the power cord from the power source.

5. If you are installing the system into a free-standing stack, place the system on top of another, ensuring that the rubber feet of the upper unit fit securely in the recesses in the top of the lower unit. See Figure 2-1.
6. Do not not to block the air intake and fan exhaust vents.

CAUTION: *For safety, stack no more than eight SuperStack™ II components in a single free-standing stack.*

You are now ready to cable your system. For instructions, see Chapter 3: *Cabling*.

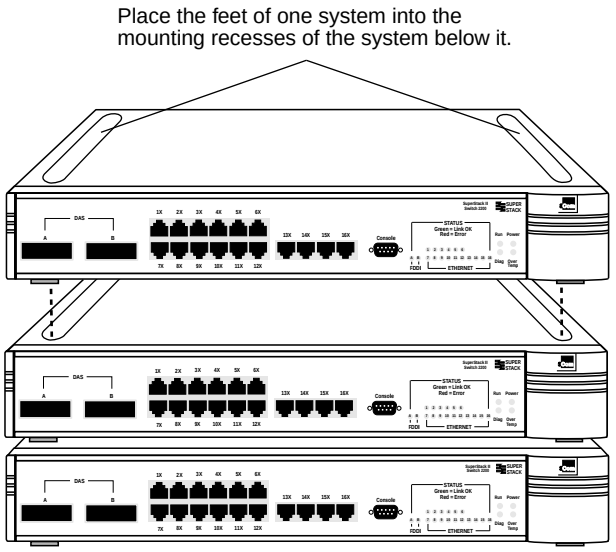


Figure 2-1 Stacking the Switch 2200

Installing the Switch 2200 System in a Distribution Rack

You can mount the Switch 2200 system into a 19-inch distribution rack. This section describes how to prepare the system and distribution rack for installation, and how to mount the system in the rack.

Install your distribution rack near an easily accessible power outlet. You can only power down the system by removing the power cord from the power source.

Preparing the System and Rack

See Appendix B: Site Requirements and Safety Codes *for distribution rack requirements.*

To prepare the system and distribution rack for installing the Switch 2200 system:

1 Attach the mounting brackets to the left and right sides of the system using the M4 x 8 flathead mounting bracket screws. The brackets are marked LEFT and RIGHT for easy identification. See Figure 2-2.

2 Determine whether the distribution rack has threaded holes.

If the holes are not threaded, you need to insert "G" clips into the holes you identify in steps 3 and 4. If the holes are threaded, you do not need to use "G" clips.

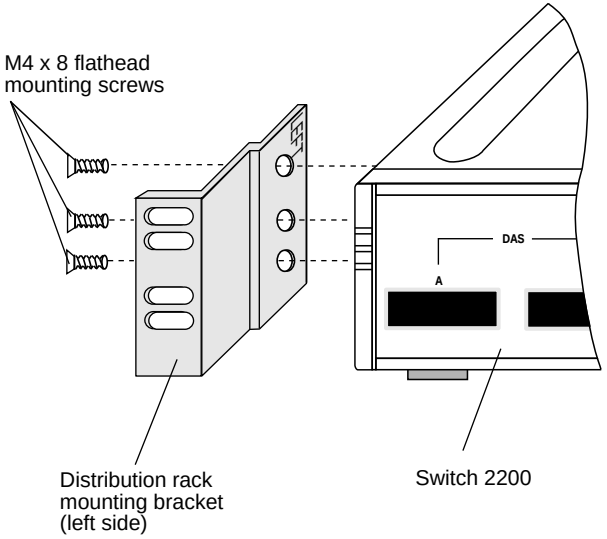


Figure 2-2 Installing System Mounting Brackets

3 Locate the top of a universal mounting hole pattern on either mounting rail of the distribution rack.

In this pattern, the spacing between holes is $^1/_2$ inch, $^5/_8$ inch, $^5/_8$ inch, and $^1/_2$ inch. To find the top of the pattern, locate the midpoint between any two holes that are spaced $^1/_2$ inch apart. Figure 2-3 shows the universal mounting hole pattern.

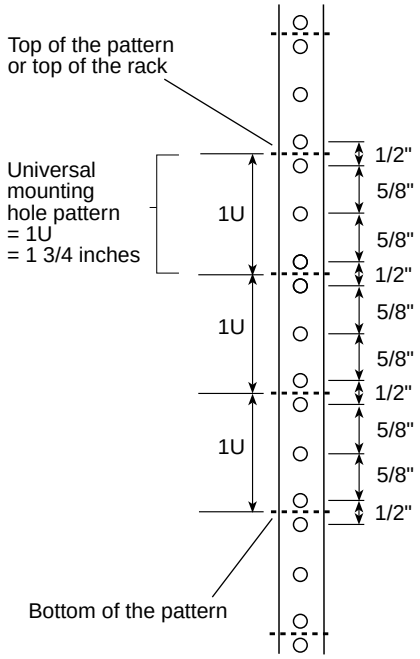


Figure 2-3 Universal Mounting Hole Pattern

4 Determine which holes to use to mount your system.

Two Switch 2200s are designed to mount in any 3U space of the rack (that is, the space occupied by three instances of the universal mounting hole pattern). Figure 2-4 illustrates the position of two Switch 2200s, one attached to holes 1 and 3 and the other attached to holes 6 and 8.

If you are mounting only one Switch 2200, you can mount it in either position.

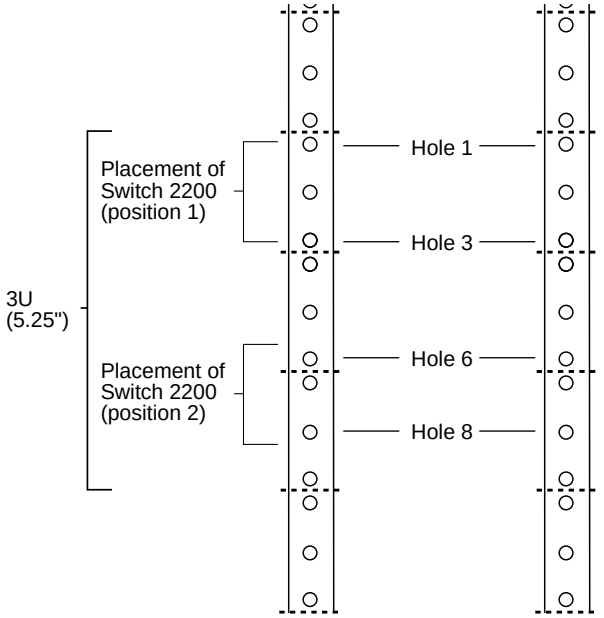


Figure 2-4 Placement of Switch 2200s in a Distribution Rack

5 Repeat the process on the other rail.

Make sure that you select holes that are parallel to each other on the mounting rails.

6 If the mounting rack does not have threaded holes, insert the "G" clips into the holes you identified for mounting and then go to the next section.

If the holes are threaded, you do not need to insert "G" clips. Go to the next section to mount your system.

Mounting the Switch 2200 System into a Distribution Rack

To mount the Switch 2200 system into a distribution rack:

1 Carefully lift the system into place, aligning the appropriate holes in the mounting brackets with the designated holes in the distribution rack. See Figure 2-5.

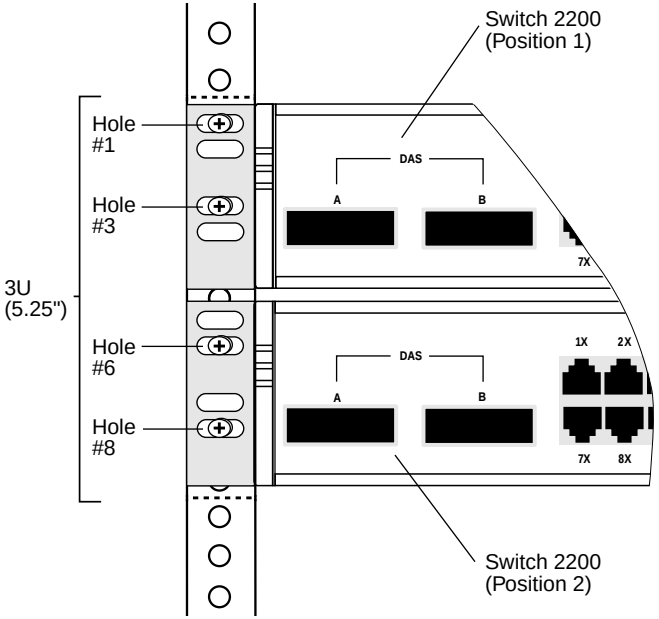


Figure 2-5 Aligning Mounting Bracket and Distribution Rack Holes

2 While holding the system in place, insert the four mounting screws (10/32 x 1/2 Phillips) into the designated mounting holes on both sides of the rack.

3 Tighten the mounting screws. The system is now installed in the distribution rack.

Figure 2-6 shows two Switch 2200 systems installed in a distribution rack.

You are now ready to cable the system. For cabling instructions, see Chapter 3: *Cabling*.

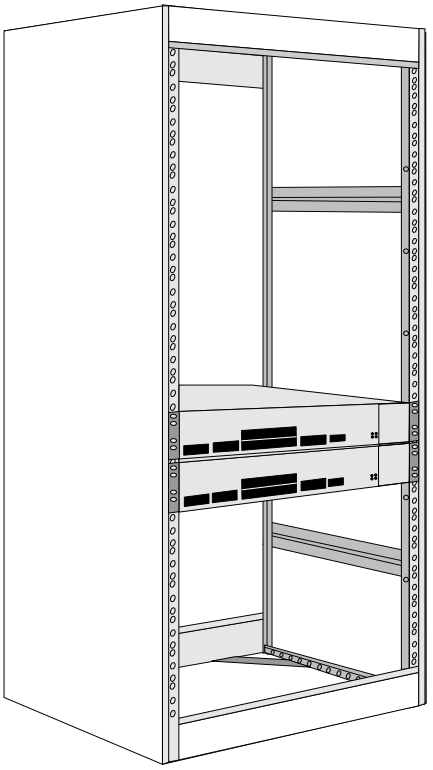


Figure 2-6 Two Switch 2200 Systems Installed in a Distribution Rack

3 CABLING

This chapter describes how to cable your SuperStack™ II Switch 2200 system for connection to the network. It gives an overview of module cabling and describes how to cable:

- Ethernet ports (beginning on page 3-2)
- FDDI ports (beginning on page 3-4)
- System console port (beginning on page 3-6)

The sections on Ethernet and FDDI ports include sample network configurations and instructions for connecting your system to the network.

When all your Ethernet, FDDI, and system network connections are complete, see *Chapter 4:* System Power Up.

If you are staging the system, you do not need to connect it to the network at this point. See Chapter 4: System Power Up *to start your system prior to cabling.*

Overview of Cabling Switch 2200 Ports

The Switch 2200 system is a fixed-configuration LAN switch with sixteen shielded 10BASE-T (RJ-45) Ethernet ports and one FDDI-DAS multi-mode fiber port.

Your Ethernet segments connect to 3Com Corporation's SuperStack™ II Switch 2200 system through the sixteen Ethernet ports on the front panel. The Ethernet ports are configured as MDI-X (Media Dependent Interface cross-over), suitable for direct connection to a workstation or other DTE (Data Terminal Equipment) device, using a normal, straight-through twisted-pair cable.

Your FDDI primary and secondary rings connect to the Switch 2200 system through the FDDI port located on the left side of the front panel. The FDDI port is configured as a DAS (A and B ports).

The Switch 2200 system supports mixed configurations of Ethernet and FDDI. For clarity, Ethernet and FDDI configurations are shown separately in this chapter.

To configure the system for management access through the Ethernet ports, see Chapter 5: Quick Setup for Management Access.

Ethernet Ports

The Switch 2200 has sixteen 10BASE-T ports with RJ-45 connectors. This section contains a sample Ethernet configuration using these ports, information on cabling 10BASE-T (RJ-45) ports, and pin assignments for the RJ-45 connectors.

Sample Ethernet Configuration

The Switch 2200 supports sixteen switched Ethernet connections. Figure 3-1 shows the Switch 2200 with 10BASE-T (RJ-45) connectors attached through unshielded twisted pair (UTP) cable to a PC with a 10BASE-T Network Interface Card (NIC). The Switch 2200 is also attached through UTP cable to a server and to a SuperStack™ II Hub 10 system.

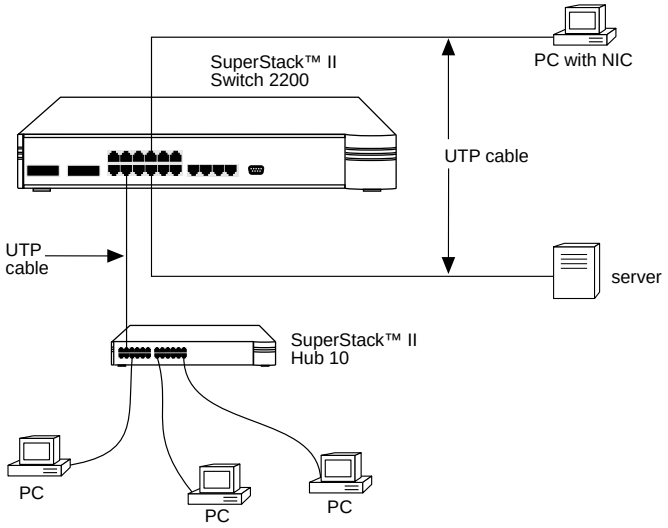


Figure 3-1 Sample Ethernet Configuration with 10BASE-T (RJ-45)

Cabling 10BASE-T (RJ-45) Ports

The Switch 2200 system's sixteen Ethernet ports are shielded RJ-45 data sockets. Shielded or unshielded data cables with shielded or unshielded jacks can be connected to these data sockets.

For 10BASE-T Ethernet cable, follow the media specifications in IEEE 802.3i, Type 10BASE-T. Other cable types may be supported by media adaptors.

Ethernet standards are published by the IEEE Computer Society Press, Technical Service Center, 10662 Los Vaqueros Circle, P.O. Box 3014, Los Alamitos, CA 90720-1264.

The Ethernet ports are numbered from 1X to 16X. They are configured as MDI-X, for direct connection to a workstation or other DTE, using straight-through twisted-pair wiring. To connect a Switch 2200 system to a 10BASE-T repeater, use a crossover cable or set the port on the connected device to MDI and use a straight-through cable.

Follow these guidelines when cabling 10BASE-T connectors:

- Use two twisted-pair wires for each link.
- Use twisted-pair wire that is 22-26 AWG (0.5 millimeter) in diameter.
- Use twisted-pair wire with an impedance between 85 and 115 Ohms.
- Be sure that the length of the twisted-pair link from the system to any potential workstation location is 100 meters (328 feet) or less.

To cable the 10BASE-T (RJ-45) ports:

1. For each port, plug the male RJ-45 connector on the 10BASE-T cable into the selected port until it clicks into place.
2. Attach the other end of the 10BASE-T cable to an MDI port on a workstation, repeater, or concentrator.
3. Repeat steps 1 and 2 for the remaining ports.

Figure 3-2 shows the cabling of a 10BASE-T (RJ-45) port.

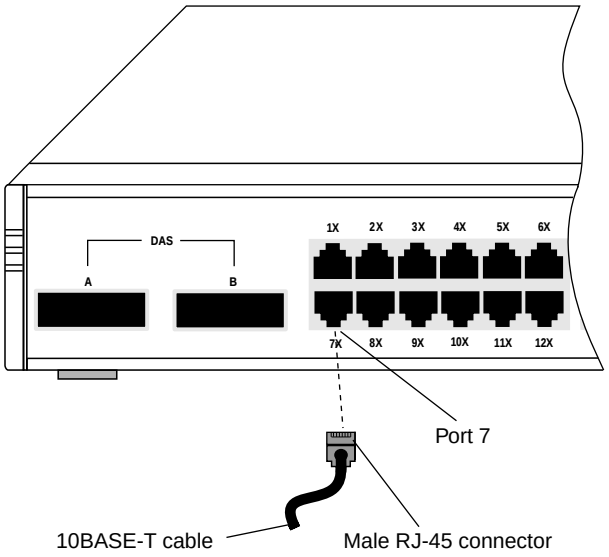


Figure 3-2 Cabling a 10BASE-T (RJ-45) Port

10BASE-T (RJ-45) Connector Pin Assignments

Table 3-1 provides the pin assignments for the RJ-45 connectors.

Table 3-1 10BASE-T (RJ-45) Pin Assignments

Pin No.	Signal	Description
1	RX+	Receive +
2	RX–	Receive –
3	TX+	Transmit +
4		Not used
5		Not used
6	TX–	Transmit –
7		Not used
8		Not used

FDDI Ports

The Switch 2200 has a single high-speed FDDI port. This section contains a sample FDDI configuration and information on cabling the FDDI port.

Sample FDDI Configuration

The Switch 2200 (A/B) FDDI port is a MIC-style fiber port supporting multi-mode fiber cable.

The FDDI configuration in Figure 3-3 shows four Switch 2200 systems attached to a dual ring as DASs. The connections are made by way of the A port (red) and the B port (blue) on each Switch 2200 system. DASs can be attached to the dual rings, as shown.

The Switch 2200 has one FDDI port that serves as both an A port and a B port.

See your *SuperStack™ II Switch 2200 Operation Guide* for more information about FDDI station configurations.

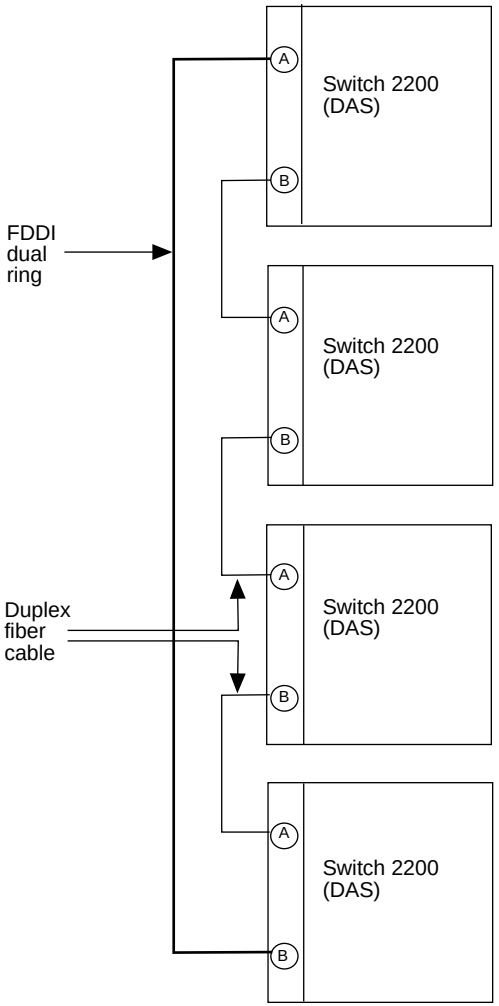


Figure 3-3 Sample Configurations for Switch 2200 System-to-FDDI Connections

Cabling FDDI Ports

When planning your installation, thoroughly inspect your present cabling to determine if it conforms to national standards.

For ANSI FDDI Standards, see publication 212-354-3300, published by American National Standards Institute, 1430 Broadway, New York, NY 10018. See Appendix C: Complying with Multi-Mode Fiber Standards *for further information.*

To cable the FDDI DAS ports:

1. Remove the protectors from the Switch 2200 DAS connectors (A and B) and from the cables you are attaching.
2. Connect one MIC connector to the Switch 2200 A port (red).
3. Be sure that the opposite end of the FDDI cable is attached to a B port of the adjacent upstream or downstream station.
4. Connect the other MIC connector to the Switch 2200 B port (blue).
5. Be sure that the opposite end of the FDDI cable is attached to an A port of the adjacent upstream or downstream station.

The A and B ports may also be connected to any two Master ports on an FDDI LAN concentrator.

Figure 3-4 shows the cabling of the FDDI DAS port.

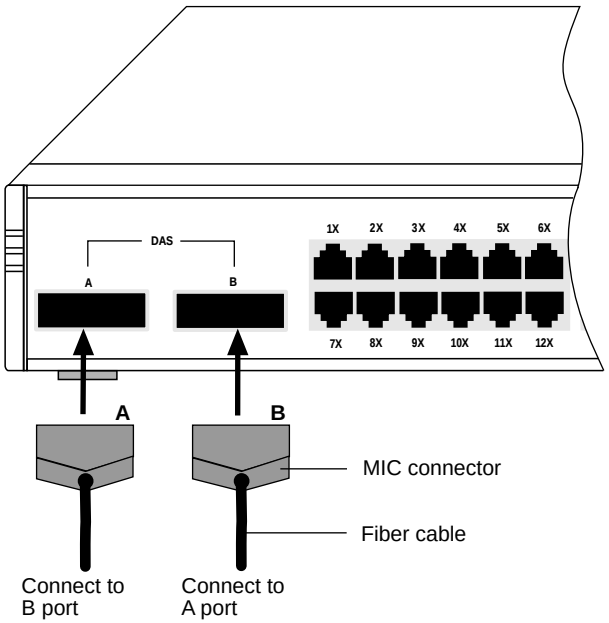


Figure 3-4 Cabling the FDDI DAS Port

Cabling the Console Port

For local administration of the Switch 2200, the Console port provides an RS-232 connection to a local terminal or workstation running a terminal emulation program. The console port located on the front panel has a male 9-pin D-type connector.

To cable the console port:

1 Attach the female DB-9 cable connector to the console port's male connector.

To prevent the cable from being loosened, use the retaining screws.

2 Attach the other end of the serial cable to your terminal.

Figure 3-5 shows the cabling of the console port.

You can also remotely access the system through any Ethernet port using telnet or rlogin. See the *SuperStack™ II Switch 2200 Administration User Guide*.

To use the Administration Console to configure the system for management access through the Console port, see Chapter 5: Quick Setup for Management Access.

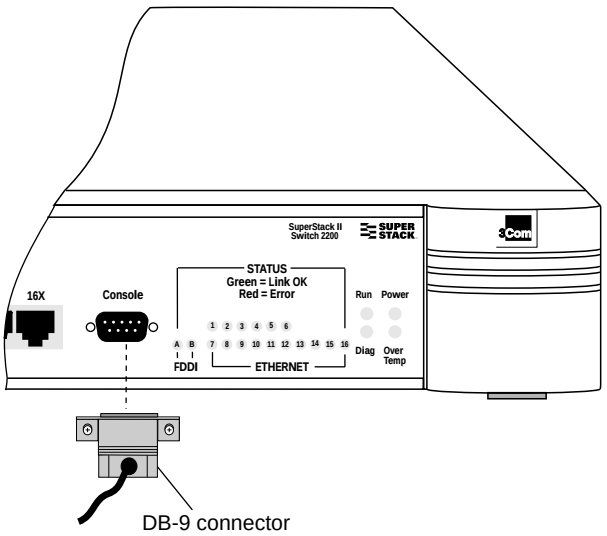


Figure 3-5 Cabling the Console Port

Console Port Pin Assignments

Table 3-2 shows the pin assignments for the Console port.

Table 3-2 Console Port Pin Assignments

Pin No.	Signal	Description
1		Not Used
2	RDA	Received Data
3	TDA	Transmitted Data
4		Not Used
5		Signal Ground
6		Not Used
7		Not Used
8		Not Used
9		Not Used

4 SYSTEM POWER UP

This chapter contains:

- Information on power options for the SuperStack™ II Switch 2200
- Instructions for powering up the Switch 2200 system
- A description of power-up diagnostics
- A list of items to check after system power up

For information on troubleshooting the system during power up, see Chapter 6: *Troubleshooting the System*.

Power Options for the Switch 2200

The instructions in this chapter are for powering up your Switch 2200 system through an AC power cord connected to a power outlet. You can also power a Switch 2200 system using a redundant power system (RPS), an uninterruptible power system (UPS), or a –48V DC converter.

Using a Redundant Power System

To protect against internal power failures, you can connect a 3Com Redundant Power System (RPS) to the Switch 2200 system. The RPS connector is located on the rear panel of the Switch 2200 system. Connect only a 3Com Redundant Power System (3C565047A) to this connector. For details, follow the installation instructions accompanying the redundant power system.

Using an Uninterruptible Power System

To avoid power interruption from brownouts, blackouts, surges, and spikes, connect an uninterruptible power system (UPS) to the Switch 2200 system. Connect only a 3Com Uninterruptible Power System (3C16010 for the United States version, 3C16011 for the European/International version, or 3C16012 for the Japanese version). To install the uninterruptible power system, follow the instructions accompanying the UPS.

Using a DC Voltage Converter

In an environment where AC power is unavailable, you can connect the Switch 2200 system to a –48V DC converter. Use only a 3Com DC Voltage Converter (3C8960A for the converter with 6 outputs; 3C8930A for the converter with 3 outputs). See the instructions accompanying the converter for information on using this product with the Switch 2200 system.

Power Up

CAUTION: *Do not plug the AC power cord and a redundant power system into the system simultaneously.*

To view error messages while the system is running power up diagnostics, connect a terminal, a workstation, or a PC with terminal emulation to the system's Console port.

See Chapter 3: *Cabling* and Chapter 5: *Quick Setup for Management Access* for information about cabling and configuring the Console port.

If you are using a redundant power system (RPS), follow the installation instructions provided with the RPS rather than the instructions provided here.

To get your Switch 2200 powered up and ready to operate, follow these steps:

1. Be sure that the power outlet is near the system and easily accessible. You can only turn the system off by removing the power cord from the power source.
2. Plug the power cord into the system. See Figure 4-1 for the location of the power receptacle on the back panel.
3. Install the strain relief cable clamp and screw to prevent the power cord from accidentially loosening.
4. Plug the other end of the power cord into a power outlet. The system powers up.

CAUTION: *For safety precaution, ensure that you can easily unplug the AC power cord from the chassis with the strain relief in place. If you cannot, adjust the power cord within the strain relief.*

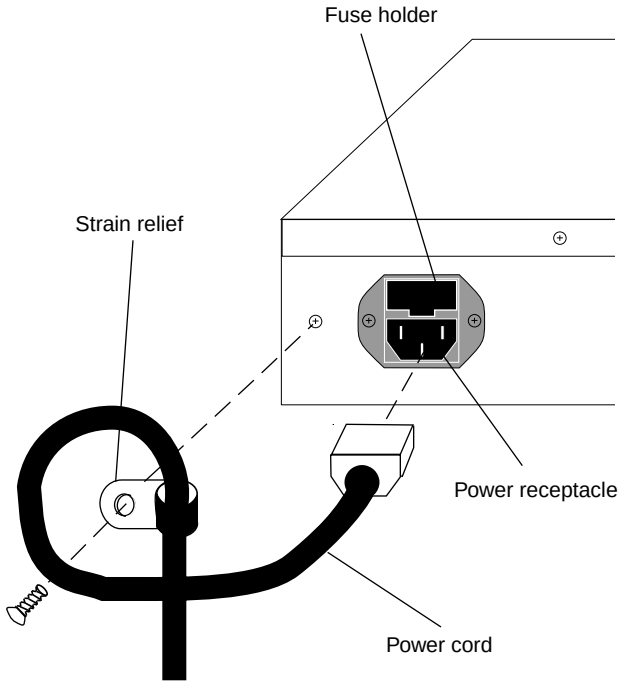


Figure 4-1 Switch 2200 Power Receptacle Assembly

Power-up Diagnostics

The Switch 2200 system automatically runs diagnostic software at power up. This software verifies that the system fully works before running it on the network.

If any component fails during power-up diagnostics, the system either fails to power up or it keeps faulty ports off-line. When the system comes up, check to see which ports, if any, have failed diagnostics by looking at the system configuration in the Switch 2200 Administration Console. See Chapter 4 of the *SuperStack™ II Switch 2200 Administration Console User Guide*.

During power up, the system status LEDs provide information on components in the Switch 2200 system. The system and port status LEDs and the information they provide are shown in the illustration "System and Port Status LEDs" on page 4-4.

You can view messages displayed during power-up diagnostics if you connect a terminal, workstation, or PC that has terminal emulation to the system's Console port.

System Diagnostics — LED Activity

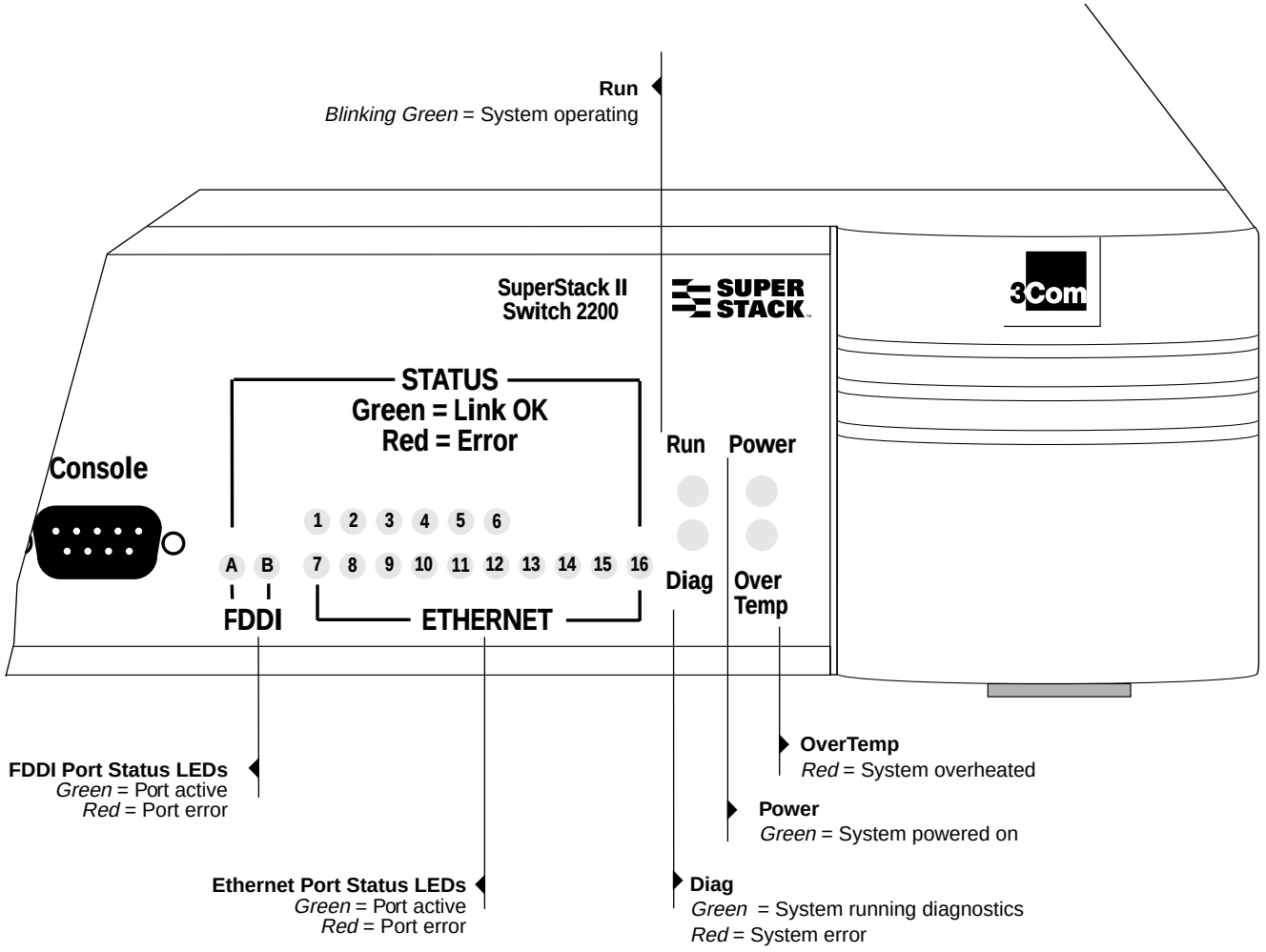
When you first power up the system, the system **Power** LED lights green, indicating that the system is powered on. When the system diagnostics are successfully completed, the **Run** LED blinks, indicating that the system is operational. If the **Diag** LED is red, the system has failed at power up. See Chapter 6: *Troubleshooting the System* for troubleshooting information.

Port Diagnostics — LED Activity

When diagnostics are running on an FDDI or Ethernet port, its port status LED is off. When the diagnostics are successfully completed, the **Ethernet** and **FDDI** LEDs turn green for those ports that are cabled.

When a port has a fault condition, the corresponding **Ethernet** or **FDDI** LED turns red.

System and Port Status LEDs



System Checks

After the system has successfully completed the power-up diagnostics, check the items in Table 4-1 to verify that the system is operating correctly. If you discover any abnormal conditions, see Chapter 6: *Troubleshooting the System*.

Table 4-1 System Power-Up Checklist

Check	Why?
Power-up error messages	If there is a problem during power-up, the messages are displayed in the Administration Console connection through the Console port.
Normal LED activity	When the power-up diagnostics are running, the LEDs light in a certain pattern as described in the section "Power-up Diagnostics" on page 4-3. After properly cabling the system and successfully completing the power-up diagnostics, you should observe the following normal LED activity: **Power** LED = green **Run** LED = blinking green **FDDI** port status LEDs = green **Ethernet** port status LEDs = green If an LED does not light or lights a color different from the one indicated here, see Chapter 6: *Troubleshooting the System* for information about finding the cause of the problem.

The Next Step: Software Configuration

Your Switch 2200 system is shipped from the factory with IEEE 802.1d bridging enabled, allowing the system to run immediately on your network as soon as it is installed. To configure your system for your particular networking environment (including customized filtering and SNMP set up), you must first establish management access. See the procedures in Chapter 5: *Quick Setup for Management Access*.

5 QUICK SETUP FOR MANAGEMENT ACCESS

This chapter provides easy instructions for configuring the SuperStack™ II Switch 2200 system for management access. When you decide how you want to manage your system, follow the configuration instructions for your preferred type of management access.

About Switch 2200 System Management

You can use several applications to configure and manage your Switch 2200 system:

- Switch 2200 Administration Console
- 3Com's Transcend® Enterprise Manager for UNIX® or Windows® software
- Other SNMP-based network management applications

The Switch 2200 Administration Console is a character-oriented, menu-driven user interface for performing system administration. You can access the Administration Console out-of-band using the Console port or in-band using the network ports through the IP network protocol. For more detailed information, see the *SuperStack™ II Switch 2200 Administration Console User Guide*.

For more complete network management, use an external SNMP-based application such as Transcend Enterprise Manager for UNIX or Windows or another network management application. You can access the Switch 2200 system with an external management application using IP.

For more detailed descriptions of these applications, see the *SuperStack™ II Switch 2200 Operation Guide*, Part I: *Management and Administration*.

How Do You Want to Manage the System?

You can manage your system locally through a terminal connection or through the network with an IP connection. Table 5-1 describes the access mechanisms.

Table 5-1 Management Access Mechanisms

Access Mechanism	Allows you to...	Using...
Terminal	Connect directly to the Administration Console and stay attached across system reboots	Console port
IP	Access the Administration Console with the rlogin or telnet commands. Or use an external SNMP management application to communicate with the Switch 2200 SNMP agent	FDDI or Ethernet port assigned to an IP interface

These mechanisms are described more fully in the next sections.

Terminal Connection

Direct access through the Console port is often preferred because it allows you to remain on the system during system boots. A Macintosh or PC attachment can use any terminal emulation program for connecting to the Console port. A workstation attachment under UNIX can use the emulator TIP. For more details, see the documentation that accompanies your terminal emulation program.

IP Interface

An IP interface is the connection between the Switch 2200 system and a subnet. It allows you to manage the system through the Ethernet and FDDI ports.

With an IP interface, you can use the rlogin or telnet commands to access the Administration Console using TCP/IP from a host computer. You can also use an IP interface to manage the system with an external management application.

Initial Management Access

Initially, you must access the system through the Console port using a terminal. These are the default settings for this port:

- 9600 baud
- 8 bits
- 1 stop bit
- No parity

When you access the Administration Console using the Console port, you receive this prompt:

```
Select access level (read, write, administer):
```

1. At the prompt, enter:

   `administer`

2. At the password prompt, press [Return].

   The Administration Console top-level menu appears as shown here.

```
Menu options:
-----------------------------------------------------
system        - Administer system-level functions
ethernet      - Administer Ethernet ports
fddi          - Administer FDDI resources
bridge        - Administer bridging
ip            - Administer IP
snmp          - Administer SNMP
analyzer      - Administer Roving Analysis
script        - Run a script of console commands
logout        - Logout of the Administration Console

Type ? for help.
-----------------------------------------------------
Select a menu option:
```

Use this menu to change the Console port baud rate for the terminal or to configure your system for another management access mechanism.

Setting the Console Port Baud Rate

To set the baud rate of the Console port from the Administration Console:

1. From the top level of the Administration Console at the `Select menu option` prompt, enter:

   `system`

2. At the `system` menu, enter:

   `consoleSpeed`

3. At the prompt, enter the baud rate for the Console port. The system supports these baud rates: 19200, 9600, 4800, 2400, 1200, and 300.

   After changing the baud rate, you see this message:

   ```
   Changing the baud rate may cause a loss of
   communication since you are currently connected
   via the serial port.

   Are you sure you want to change the baud rate?
   (y/n):
   ```

4. Enter **y** (for yes) or **n** (for no) at the prompt.

   If you enter **y**, the baud rate is changed immediately. At this time, you lose the ability to communicate on the Console port unless you adjust the baud rate of your terminal or terminal emulator (Sun *tip*) appropriately. If you respond **n**, the baud rate does not change and you are returned to the previous menu.

IP Interface Configuration

These instructions include information on defining an IP interface through which you can manage your Switch 2200 system. An IP interface contains the following parameters:

- **IP address**

  This address, which is specific to your network, is used for managing the system. The IP address defines both the number of the network to which the interface is attached and its host number on that network.

- **Subnet mask**

  A subnet mask, a 32-bit number, uses the same format and representation as IP addresses. The subnet mask determines which bits in the IP address are interpreted as the network number, which as the subnet number, and which as the host number. Each IP address corresponding to a **1** in the subnet mask is in the network and subnet part of the address. Each IP address bit corresponding to a **0** is in the host part of the IP address.

- **Broadcast address**

  The Switch 2200 system uses this IP address when it broadcasts packets to other stations on the same subnet. In particular, this address is used for sending RIP updates. By default, the Switch 2200 system uses a directed broadcast (all **1**s in the host field).

- **Cost**

  Each interface has an associated cost. This value, between 1 and 15, is used when calculating route metrics.

- **Ports**

  A single interface can contain several bridge ports. All of the ports corresponding to one interface share the same IP address, subnet mask, broadcast address, and cost. The Switch 2200 system contains one FDDI port (configured as a DAS with an A and a B port) and sixteen Ethernet ports. The port to which your management workstation is attached must be included in the interface.

  See Table 5-2 for recommended settings of the interface parameters.

Table 5-2 IP Settings for Quick Setup

Parameter	Recommended Setting
IP address	IP address of the interface. User-definable.
Subnet mask	Subnet mask of the subnet to which you are connecting the interface.
Broadcast address	Directed – all **1**s in the host field
Cost	1
Ports	all

To set the interface parameters:

1. From the top level of the Administration Console, enter:

   `ip`

2. At the `ip` menu, enter:

   `interface`

3. At the `interface` menu, enter:

   `define`

4. Enter the IP address of the interface.

5. Enter the subnet mask of the subnet to which the interface is to be connected.

6. Enter the default broadcast address setting of the interface by pressing [Return].

7. Enter the default cost setting of the interface by pressing [Return].

8. Enter the ports you want to include in the interface. Initially assign `all` ports to the interface.

   For more detailed instructions on assigning interface parameters, see the *SuperStack™ II Switch 2200 Administration Console User Guide*.

You can now communicate with the Switch 2200 system from a remote management station.

6 TROUBLESHOOTING THE SYSTEM

This chapter explains how to troubleshoot certain problems with the SuperStack™ II Switch 2200 system. It covers how to:

- Identify and correct system problems
- Perform related tasks, such as replacing fuses or cleaning fiber optic ports and connectors

If you experience system problems that are not addressed in this chapter, contact 3Com Technical Support or your service representative. Before you call, gather the following information and have it available:

- System serial number
- Maintenance agreement or warranty information
- Software revision number
- Brief description of the problem

For additional information, see Appendix D: Technical Support.

Diagnosing Problems

By observing system diagnostics, you can identify and correct problems that might occur at system power up.

Power Failures

If the system does not respond during power up, see the troubleshooting suggestions in Table 6-1.

Abnormal LED Activity

The Switch 2200 system contains several status LEDs that indicate system or port problems. See Table 6-2 or Table 6-3 for troubleshooting suggestions in the event of abnormal LED activity.

Table 6-1 Troubleshooting Power Failures

Symptom	Possible Sources of the Problem	Try this. . .
System does not power up	■ System is not receiving power ■ Power supply malfunction ■ Blown fuse	**1** Verify that the building's power outlet has power. **2** Check that the power cord is firmly plugged into the system and either the building's power outlet, the redundant power system, or the uninterruptible power system. **3** If you are using an RPS or a UPS, check that it is firmly plugged into the building's power outlet. **4** Check the system fuses and replace any blown fuses. (See the section "Checking the Switch 2200 System Fuses" on page 6-4.) **5** If the system still does not operate, contact 3Com Technical Support or your service representative.

Table 6-2 Troubleshooting Abnormal **System Status LED** Activity

LED Status	Possible Sources of the Problem	Try this...
Run LED does not light	Diagnostic software is not running	Call 3Com Technical Support or your service representative.
Diag LED lights red	System failure	**1** Shut down the Switch 2200 system by disconnecting the power plug. **2** Call 3Com Technical Support or your service representative.
Over Temp LED lights red	System temperature is too high ■ Wiring closet is too hot ■ System vents are blocked ■ System fans are not operating ■ System processor has failed ■ Thermal sensor is faulty	**1** Shut down the Switch 2200 system by disconnecting the power plug. **2** Verify that the room temperature meets the system's specifications. See Appendix A: *System Specifications*. If the temperature is too high, lower the room's thermostat and wait until the temperature meets the specifications. **3** Verify that nothing blocks the airflow from the system's vents. **4** Restart the system. If the **OverTemp** LED still lights, either the room temperature is still too high or the system processor is faulty. Shut down the Switch 2200 system by disconnecting the power plug and contact 3Com Technical Support or your service representative.

Table 6-3 Troubleshooting Abnormal **Port Status LED** Activity

LED Status	Possible Sources of the Problem	Try this...
FDDI or **Ethernet** LED lights red	System does not recognize a connection to the Ethernet or FDDI port. ■ Cabling is not fully attached to the port ■ Cabling to the port is dirty (on FDDI ports) ■ Cabling to the port is faulty	**1** Verify that all cables are firmly plugged into both the system's affected port and the attached device. **2** Verify that the cables are clean. See the section "Cleaning Dirty Fiber Optic Ports and Connectors" on page 6-5. **3** Test for faulty cables. When the problem is corrected, the **FDDI** or **Ethernet** LED lights green. If the **FDDI** or **Ethernet** LED remains red, contact 3Com Technical Support or your service representative.

Related Maintenance Procedures

During system troubleshooting, you might have to perform minor maintenance procedures, described in this section, to correct the problem. For other assistance, contact 3Com Technical Support as discussed in Appendix D.

Checking the Switch 2200 System Fuses

If your Switch 2200 system does not power up, check the system fuses.

The fuses are located inside the AC power receptacle assembly on the back panel of the chassis. The fuses are mounted in a removable fuseholder.

WARNING: *Before beginning this procedure, unplug the system from the power source to prevent electric shock, system damage, or both.*

You need a small, flat-blade screwdriver to complete this procedure.

Removing and Replacing the Fuse

To remove the fuses, follow these steps:

1. Remove the power cord from the AC power receptacle assembly.
2. Release the fuse holder by gently levering the screwdriver under the fuse holder catch. See Figure 6-1.

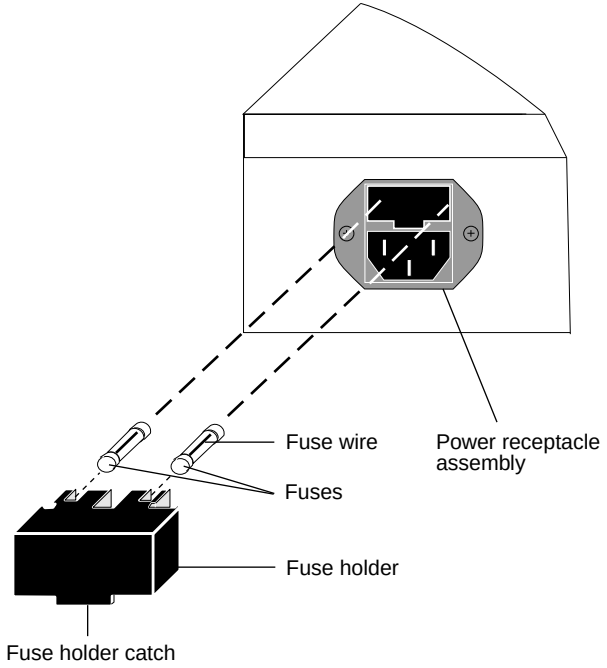


Figure 6-1 Accessing the AC Power Fuses

3. Pull the fuse holder from the AC power receptacle assembly.
4. Pull the fuses out of the fuse holder and inspect the wire.
5. If the wire is broken, install a new 3.15 amp fuse into the fuse holder.

CAUTION: *To protect against the risk of fire, replace fuses with fuses of the same type and rating.*

6 Insert the fuse holder into the power receptacle until it clicks.

7 Plug the appropriate end of the power cord into the system's power receptacle, reattach strain relief if necessary, and the other end into the building's power outlet, redundant power system, or uninterruptible power system.

Cleaning Dirty Fiber Optic Ports and Connectors

Fiber optic transceivers are sensitive optical devices that you must handle carefully. If dirt collects on the fiber optic lens, you might notice that the FDDI LED does not light or lights red. You might also notice degradation in port performance, indicated by an increase in the Link Error Rate (LER) count for that port.

To prevent dust from collecting on the fiber optic lens, keep the dust covers on the ports at all times when not in use. To clean a fiber optic lens, take these steps:

1 Remove any accumulated dust or debris from the port or connector by blowing across all surfaces with a canned air duster.

Compressed gas is recommended, such as Chemtronics' Ultrajet® or the Triangle Tool Group's Liqui-Tool™ Dust-A-Way. Do not use commercial compressed air or "house air" because of the risk of oil contamination.

2 Reconnect the cable to the port to check whether the dusting has corrected the problem.

If the LED still does not light, or if it lights red, continue with steps 3 and 4.

3 Gently wipe the ports with a lint-free, nonabrasive, nonadhesive swab. Microswabs™ by Texwipe™ are recommended.

4 Gently wipe the connectors with a lint-free, nonabrasive wipe or pad. Texwipe™ pads are recommended.

Avoid touching any surface after cleaning the connectors. Keep all unused ports covered.

A SYSTEM SPECIFICATIONS

Table A-1 System Specifications for the SuperStack™ II Switch 2200 Stackable Switch

Specification	
Physical Dimensions	2.5 inches (H) x 17.32 inches (W) x 14.75 inches (D) [6.3 cm (H) x 44 cm (W) x 36.8 cm (D)]
	Weight: 13 lbs (4.5 kg)
Environmental Requirements	
Operating Temperature	32˚ to 104˚ F (0˚ to 40˚ C)
Operating Humidity	10 to 95% relative humidity, non-condensing
Storage Temperature	–22˚ to 149˚ F (–30˚ to 65˚ C)
Storage Humidity	95% maximum relative humidity, non-condensing
Safety	
Agency Certifications	UL 1950, CSA 22.2 No. 950, TUV EN60950
	UK General Approval Statement The SuperStack™ II Switch 2200 is manufactured to the international Safety Standard EN60950 and is approved in the UK under the General Approval Number NS/G/12345/J/100003 for indirect connection to the public telecommunication network.
Designed to Comply with...	IEC 950
AC Protection	250VAC, 3.15 amp fuse (Quantity 2)
Electromagnetic Emissions (Agency Certification)	Meets FCC part 15, Subparagraph J, Class A limits, and CISPR Class A limits. EMC Council Directive 89/336/EEC, Class A limits and Class B limits with cat.5 shielded cable
Heat Dissipation	115 watts maximum (393 BTU/hour maximum)
Power Supply	
Receptacles	15 amp service receptacles, type N5/15 or NEMA 5-15R (United States and Canada only)
AC Line Frequency	47 to 63 Hz
Input Voltage Options	90 to 264 VAC
Current Rating	100 VAC at 2.0 amps (maximum)/240 VAC at 1.0 amps (maximum)

Table A-2 Standards Supported by the SuperStack™ II Switch 2200

Standard Type	RFC Supported
SNMP	■ SNMP protocol (RFC 1157) ■ MIB II (RFC 1213) ■ SNMP/FDDI MIB (RFC 1285) ■ Ethernet MIB (RFC 1284) ■ Bridge MIB (RFC 1286)
FDDI	ANSI X3T9.5 FDDI, including revision 7.3 SMT
Software Installation	ftp (RFC 959)
Terminal Emulation	■ telnet (RFC 854) ■ rlogin (RFC 1282)
Protocols Used for Administration	■ UDP (RFC 768) ■ IP (RFC 791) ■ ICMP (RFC 792) ■ TCP (RFC 793) ■ ARP (RFC 826)

Table A-3 LED Indicators on the SuperStack™ II Switch 2200

LED	Description
System Status	■ **Power:** (Green) — System is powered on ■ **Run:** (Blinking Green) — System is operating ■ **Diag:** (Green) — System is running diagnostics (Red) — System failed at power up ■ **Over Temp:** (Red) — System has overheated ■ **Inserted:** (Green) — PCMCIA card is inserted in system
Port Status	■ **FDDI:** (Green) — Associated port is active (Red) — Associated port has an error **Ethernet:** (Green) — Associated port is active (Red) — Associated port has an error

B SITE REQUIREMENTS AND SAFETY CODES

You took careful steps to plan and prepare your site for new or additional SuperStack™ II Switch 2200 stackable switch systems. For your reference, this appendix summarizes the criteria your site should meet for the Switch 2200 to operate safely and effectively.

The topics covered in this appendix include:

- General safety requirements
- Wiring closet recommendations
- Distribution rack requirements, if you mount one or more Switch 2200 systems in a distribution rack
- Sources for building and electrical codes

General Safety Requirements

For safe operation, your site must meet these general safety requirements:

- All environmental requirements listed in Appendix A and in "Wiring Closet Recommendations." Pay special attention to temperature and humidity.
- All building and electrical codes for your city and country. Refer to relevant "Building Codes" on page B-4.
- All grounding requirements listed in "Wiring Closet Recommendations" and "Distribution Rack Requirements."

Wiring Closet Recommendations

The cabling system plan used at your facility probably covers most wiring closet concerns. 3Com also recommends that you check these items:

- Verify that your wiring closet meets all requirements mentioned in your *facility cabling plan*.
- Verify that your wiring closet and your facility meet *all state, local, and country building and wiring codes.*
- Be sure that your system is *easily accessible* for installation and service.
- Provide *adequate overhead lighting* for easy maintenance.
- Be sure that all wiring closet doors have locks to *prevent unauthorized access.*
- Assign *wiring closet identification numbers* using architectural location codes or some type of floor-grid matrix.
- Select a *vinyl floor covering* for your wiring closet. Concrete floors accumulate dust; carpets can cause static electricity.
- Be sure that the wiring closet *floor is flat and level*. If you are using distribution racks and the floor is not level, bolt the racks to the floor to prevent them from tipping over.
- Be sure that each wiring closet has a *suitable ground*. Ground all metal racks, enclosures, boxes, and raceways in the closet.
- Use AC power, 15-amp service receptacles, type N5/15 or NEMA 5-15R for 120VAC and the other *system specifications shown in Appendix A.*

- Be especially sure to meet all *system environmental requirements* in Appendix A, such as ambient temperature and humidity.
- Be sure that the *ventilation* in the wiring closet is adequate to maintain a temperature below 104˚ F (40˚ C).
- Install a *reliable air conditioning and ventilation system* if you plan to have two or more Switch 2200 systems in a single wiring closet.
- During nonbusiness hours, *guard against the ventilation being shut down* while a Switch 2200 system remains powered up; otherwise, the equipment might overheat.

Distribution Rack Requirements

If you plan to mount your SuperStack™ II Switch 2200 systems in a distribution rack, your rack should meet the basic mechanical and space requirements described in this section.

Protective Grounding for the Rack

Proper distribution rack grounding ensures that voltages induced into wiring by lightning or other disturbances are directed to ground. Normally, you use a distribution rack grounding kit and a ground conductor that is carried back to earth or to another suitable building ground. To order the grounding kit, contact your sales representative.

Space Requirements for the Rack

Provide enough space in front of and behind the system so that you can service it easily. Allow a minimum of 30 inches (76 centimeters) between the rack and any wall behind or in front of it. Extra room on each side is optional. See Figure B-1.

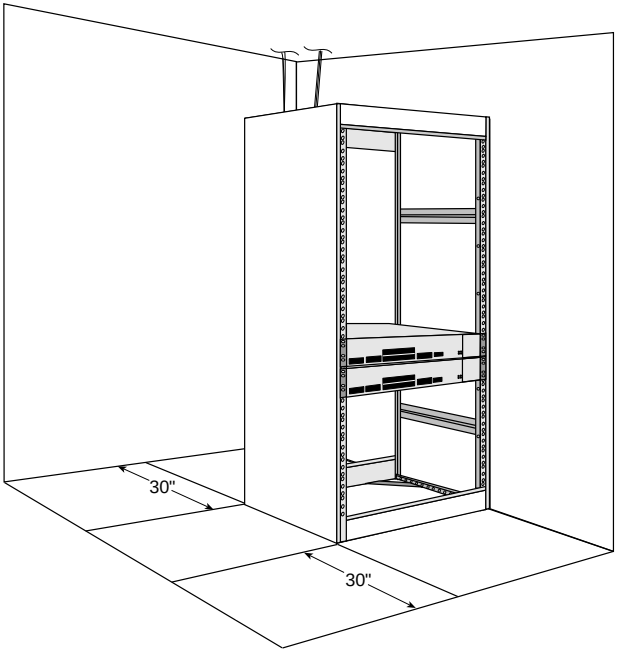


Figure B-1 Recommended Service Access

Mechanical Requirements for the Rack

Racks should comply with the standards and requirements mentioned in your cabling system plan and should also conform to certain conventional standards:

- In the United States, use EIA Standard RS-310C: *Racks, Panels, and Associated Equipment*.
- In countries other than the United States, use IEC Standard 297: *Dimensions of Panels and Racks*.

In addition, 3Com recommends that your distribution rack meet these requirements:

- Use an open style, 19-inch rack. The rack styles shown in Figure B-2 facilitate easy maintenance and provide excellent ventilation.
- Use a rack that has the universal mounting rail hole pattern identified in IEC Standard 297. See page 2-3 for a description of the universal mounting hole pattern.
- Use a rack that is made of steel.
- Install equipment in the lower half of the distribution rack to avoid making the rack top heavy.
- Use a rack that supports approximately 600 lbs. (272 kgs.).
- Use a rack that has adequate electrical grounding, for instance, with a distribution rack grounding kit.
- Verify that the floor under the rack is level within $^{3}/_{16}$ inch (5 millimeters). Use a floor-leveling cement compound if necessary or bolt the racks to the floor.
- Attach the rack to the wiring closet floor with $^{3}/_{8}$ inch (9.5 millimeter) lag screws or equivalent hardware.
- Brace open distribution racks if the channel thickness is less than $^{1}/_{4}$ inch (6.4 millimeters).

Building and Electrical Codes

Follow all appropriate building codes and authorities on electrical codes when planning your site and installing your cable for the Switch 2200 system.

Specific building and electrical codes vary depending on your location. The following lists are provided as resources to help you find additional information.

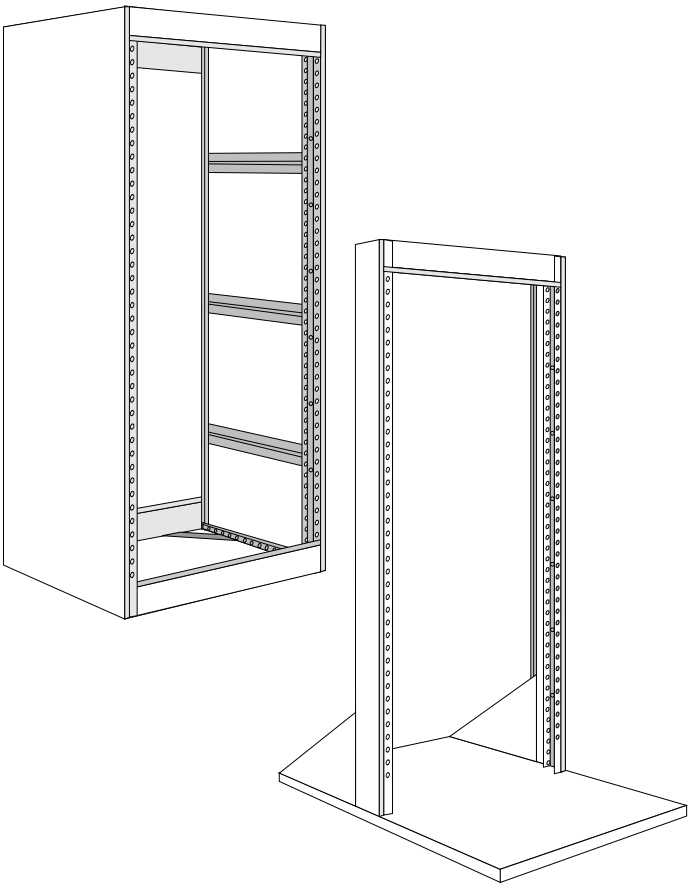


Figure B-2 Recommended Rack Styles

Building Codes

Major building codes:

- Uniform Building Code

  International Conference of Building Officials (ICBO)
  5360 South Workman Mill Road
  Whittier CA 90601

- BOCA Basic Building Code

  Building Officials and Code Administrators
  (BOCA) International, Inc.
  4051 West Flossmoor Road
  Country Club Hills IL 60478

- Standard Building Code (SBC)

  Southern Building Code Congress International, Inc.
  900 Montclair Road
  Birmingham AL 35213

Electrical Codes

Authorities on electrical codes:

- National Electrical Code (NEC) Classification (USA only) — a recognized authority on safe electrical wiring. Federal, state, and local governments use NEC standards to establish their own laws, ordinances, and codes on wiring specifications. The NEC classification is published by

  National Fire Protection Association (NFPA)
  1 Batterymarch Park
  Quincy MA 02269

- Underwriters' Laboratory (UL) Listing (USA only) — an independent research and testing laboratory. UL evaluates the performance and capability of electrical wiring and equipment to determine whether they meet certain safety standards when properly used. Acceptance is usually indicated by the words "UL Approved" or "UL Listed."

  UL
  333 Pfingsten Road
  Northbrook IL 60062-2096

- National Electrical Manufacturing Association (NEMA) (USA only) — an organization of electrical product manufacturers. Members develop consensus standards for cables, wiring, and electrical components.

  NEMA
  1300 North 17th Street, Suite 1847
  Rosslyn VA 22209

- Electronic Industries Association (EIA) (USA only) — a trade association that develops technical standards, disseminates marketing data, and maintains contact with government agencies in matters relating to electronics and related industries.

  EIA
  2500 Wilson Boulevard
  Arlington VA 22201

C COMPLYING WITH MULTI-MODE FIBER STANDARDS

This appendix describes multi-mode FDDI fiber standards that your cable plant must meet. When planning your installation, thoroughly inspect your present cabling to determine if it meets the specifications in the cabling system plan and standards used at your site.

In addition to adhering to your local standards, all cable must conform to the American National Standard FDDI Physical Layer Medium Dependent (PMD) standard, ISO.166-1990, American National Standards Institute, which defines the Physical Medium Dependent (PMD) layer of the FDDI network. Currently, there are two approved PMD standards:

- Multi-mode Fiber (MMF-PMD), which is defined in ANSI standard X.3-166-1992
- Single Mode Fiber (SMF-PMD), which is defined in ANSI standard X.3-184-198x.

For the Switch 2200, 3Com supports multi-mode fiber (MMF-PMD) 62.5/125 µm only.

The MMF-PMD standards define the requirements for an FDDI cable plant to support an interstation distance of up to 1.25 miles (2 kilometers) of multi-mode fiber. Your FDDI cable plant is defined as all fiber optic components between any two communicating FDDI stations and their associated "station-to-network" connectors at each end.

To determine whether your cable plant complies with the MMF-PMD standard, take these steps:

- Compare the specifications of the fiber you are using to standard specifications, as described in the next section.
- If unlike fibers are mated in the cable plant, calculate insertion losses to see whether they exceed the maximum attenuation value allowed for a link, as described on page C-3.
- Verify that the fiber's modal bandwidth is within an acceptable range for the length of the link, as described on page C-4.

Comparing Fiber to Specifications

Compare the specifications of the fiber you are using to those in the following tables. If the fiber does not meet the specifications, use a different fiber or contact 3Com's Technical Support.

Table C-1 describes the standard set forth in MMF-PMD. Table C-2 describes 62.5/125 cable, commonly sold as "FDDI Spec," which meets all the requirements of the MMF-PMD standard.

Table C-1 Standard Multi-mode Fiber Specifications

Specification	Description
Core	62.5 µm diameter
Cladding	125 µm diameter nominal
	122 µm minimum
	128 µm maximum
Numerical aperture	0.275
Maximum attenuation	11 dB* (1 dB allowed for reflection and dispersion penalties)
Modal bandwidth	500 MHz • km
Maximum distance between nodes	2 km
Output power (from transmitter)	–20 dB minimum
	–14 dB maximum
Receive power	–32 dB minimum sensitivity
	–14 dB maximum sensitivity

*Maximum attenuation includes cable attenuation and the loss induced by other components such as connectors, splices, and the mating of unlike fiber types. Although some 2 km cable plants have a total attenuation of less than 11.0 dB, the 2 km interstation distance must be maintained to comply with modal bandwidth requirements.

The maximum attenuation value is based on a cable diameter of 62.5, 80, or 100 µm. If you are using fiber with a diameter of 50 µm, the maximum attenuation is 8 dB for links connecting two Switch 2200 systems and 6 dB for links connecting a Switch 2200 system with equipment from another vendor.

Table C-2 Acceptable Alternative Multi-mode Fiber Types

Core (µm)	Cladding (µm)	Numerical Aperture
50	125	0.20
50	125	0.22
85	125	0.28
100	140	0.29

If you are using fiber with a diameter of 50 µm and have 3Com equipment at both ends of the link, substitute 8 dB for the maximum attenuation in Table C-1. If 3Com equipment is only at one end, substitute 6 dB for the maximum attenuation value.

If you are using equipment at the end of a link from a vendor other than 3Com, you must perform a separate loss budget analysis. Contact the vendors of your other equipment for values to use in your analysis.

Calculating Insertion Losses for Unlike Fibers

If unlike fibers are mated in the cable plant, calculate insertion losses to be certain that the cable plant does not exceed the maximum attenuation value listed in Table C-1 on page C-2. To calculate the insertion loss, consider the types of fiber in the cable plant and the connectors or splices used to join them. Compare the result to the maximum attenuation value listed in Table C-1 on page C-2. If your result is greater than the value in the table, use only like fibers in your cable plant.

Refer to Table C-3 for the insertion losses of the fiber-to-fiber connections only, not for power launched from a transmitter. Use Table C-4, which lists the losses for connectors, cables, and splices, if the specifications for these components are not available.

Table C-3 Insertion Losses for Mating Unlike Fiber Types

		Transmitting Fiber Size				
		50 μm	**50 μm**	**62.5 μm**	**85 μm**	**100 μm**
Receiving Fiber Size	Numerical Aperture	0.20	0.22	0.275	0.26	0.29
50 μm	0.20	0.0	0.4	2.2	3.8	5.7
50 μm	0.22	0.0	0.0	1.6	3.2	4.9
62.5 μm	0.275	0.0	0.0	0.0	1.0	2.3
85 μm	0.26	0.0	0.0	0.1	0.0	0.8
100 μm	0.29	0.0	0.0	0.0	0.0	0.0

Table C-4 Typical Losses for Typical Connectors, Cables, and Splices*

Type of Insertion	**Loss**
MIC connector	.6 dB
ST connector (ceramic)	.6 dB
ST connector (plastic)	1.0 dB
ST connector (stainless steel)	.7 dB
62.5/125 cable	1.0 to 3.0 dB maximum per km, depending on cable quality (nominal 2.0 dB)
8/125 cable	.5 dB/km (AT&T Lightguide)
Fusion splice	.1 to .3 dB, depending on type used (use .3 dB)

*A MIC-to-ST adapter connection and an ST-to-ST connection are each considered 1 connector loss.

Example

You plan a link consisting of 1 km of 62.5/125 fiber with a maximum attenuation rating of 1.75 dB/km. It is transmitting into 1 km of 50/125 fiber with a maximum attenuation rating of 3 dB/km. The fibers are joined using a fusion splice rated at 0.3 dB and the link contains one in-line ST connector rated at 0.6 dB. The calculation in Table C-5 arrives at the link loss attenuation value for this linked fiber.

Table C-5 Calculation Example for Link Loss Attenuation Value

Type of loss	Value
Cable loss (62.5 µm)	1 km (1.75 dB/km)
Cable loss(50 µm)	1km (3 dB/km)
Splice loss	0.3 dB
ST connector loss	0.6 dB
Insertion loss for mating unlike fiber types	2.2 dB
Total link attenuation	7.85 dB

The resulting value, 7.85, does not exceed the maximum attenuation value listed in Table C-1, so no adjustments are needed in the types of fibers joined or how they are connected. The link meets all of the specifications of the MMF-PMD.

Verifying Modal Bandwidth

The bandwidth of an optical fiber is the lowest frequency at which the magnitude of the baseband frequency response has decreased by 3 dB compared to the magnitude at zero frequency. Bandwidth for multi-mode fiber is referred to as *modal bandwidth* because it varies based on the modal field (or core diameter) of the fiber. Modal bandwidth is specified in units of MHz • km, which indicates the amount of bandwidth supported by the fiber for a distance of 1 kilometer.

The modal bandwidth specified in Table C-1 on page C-2 is 500 MHz • km, which allows the cable plant to support end-to-end bandwidth of 250 MHz at the maximum 2 km distance. As a check, use the following formula to verify that the bandwidth of your fiber is within an acceptable range:

n MHz • km/x km = y MHz

In this formula, n is the amount of bandwidth available according to the fiber specification. Divide this number by the total length of the fiber (x) in kilometers. The result is the modal bandwidth (y), measured in MHz.

If the result is lower than 250 MHz, the link might increase bit errors. To reduce the likelihood of bit errors, shorten the length of the fiber or use different fiber until the result of the calculation reaches 250 MHz.

Example

Cable with a modal bandwidth of 500 MHz • km has 250 MHz of bandwidth at 2 km:

(500 MHz • km)/2 km = 250 MHz

The same cable has 500 MHz of bandwidth at 1 km. A fiber cable with a bandwidth specification of 200 MHz • km has only 100 MHz of bandwidth at 2 km, which would not support FDDI. In this case, another type of fiber would be required.

D TECHNICAL SUPPORT

3Com provides easy access to technical support information through a variety of services. This appendix describes these services.

Online Technical Services

3Com offers worldwide product support seven days a week, 24 hours a day, through the following online systems:

- 3Com Bulletin Board Service (3ComBBS)
- World Wide Web site
- 3ComForum on CompuServe®
- 3ComFacts℠ automated fax service

3Com Bulletin Board Service

3ComBBS contains patches, software, and drivers for all 3Com products, as well as technical articles. This service is available via modem or ISDN seven days a week, 24 hours a day.

Access by Modem

To reach the service by modem, set your modem to 8 data bits, no parity, and 1 stop bit. Call the telephone number nearest you:

Country	Data Rate	Telephone Number
Australia	up to 14400 bps	(61) (2) 9955 2073
France	up to 14400 bps	(33) (1) 69 86 69 54
Germany	up to 9600 bps up to 9600 bps	(49) (89) 627 32 188 (49) (89) 627 32 189
Hong Kong	up to 14400 bps	(852) 2537 5608
Italy (fee required)	up to 14400 bps	(39) (2) 273 00680
Japan	up to 14400 bps	(81) (3) 3345 7266
Singapore	up to 14400 bps	(65) 534 5693
Taiwan	up to 14400 bps	(886) (2) 377 5840
U.K.	up to 28800 bps	(44) (1442) 278278
U.S.	up to 28800 bps	(1) (408) 980 8204

Access by ISDN

ISDN users can dial-in to 3ComBBS using a digital modem for fast access up to 56 Kbps. To access 3ComBBS using ISDN, dial the following number:

(408) 654 2703

World Wide Web Site

Access the latest networking information on 3Com's World Wide Web site by entering our URL into your Internet browser:

`http://www.3Com.com/`

This service features news and information about 3Com products, customer service and support, 3Com's latest news releases, selected articles from 3TECH™ (3Com's award-winning technical journal), and more.

3ComForum on CompuServe®

3ComForum is a CompuServe-based service containing patches, software, drivers, and technical articles about all 3Com products, as well as a messaging section for peer support. To use 3ComForum, you need a CompuServe account.

To use 3ComForum:

1. Log on to CompuServe.
2. Enter **`go threecom`**
3. Press [Return] to see the 3ComForum Main menu.

3ComFacts Automated Fax Service

3Com Corporation's interactive fax service, 3ComFacts, provides data sheets, technical articles, diagrams, and troubleshooting instructions on 3Com products 24 hours a day, seven days a week.

Call 3ComFacts using your Touch-Tone® telephone at these international access numbers:

Country	Telephone Number
Hong Kong	(852) 2537 5610
U.K.	(44) (1442) 278279
U.S.	(1) (408) 727 7021

Local access numbers are available within the following countries:

Country	Telephone Number
Australia	800 123853
Belgium	0800 71279
Denmark	800 17319
Finland	98 001 4444
France	05 90 81 58
Germany	0130 8180 63
Italy	1678 99085

Country	Telephone Number
Netherlands	06 0228049
Norway	800 11062
Portugal	0505 442607
Russia (Moscow only)	956 0815
Spain	900 964445
Sweden	020 792954
U.K.	0800 626403

Support from Your Network Supplier

If additional assistance is required, contact your network supplier. Many suppliers are authorized 3Com service partners who are qualified to provide a variety of services, including network planning, installation, hardware maintenance, application training, and support services.

When you contact your network supplier for assistance, have the following information ready:

- Diagnostic error messages
- A list of system hardware and software, including revision levels
- Details about recent configuration changes, if applicable

If you are unable to contact your network supplier, see the following section on how to contact 3Com.

Support from 3Com

If you are unable to receive support from your network supplier, technical support contracts are available from 3Com.

In the U.S. and Canada, call **(800) 876-3266** for customer service.

If you are outside the U.S. and Canada, contact your local 3Com sales office to find your authorized service provider. Use one of these numbers:

Country	Telephone Number
Australia (Sydney)	(61) (2) 9937 5000
(Melbourne)	(61) (3) 9653 9515
Belgium*	0800 71429
Brazil	(55) (11) 546 0869
Canada	(905) 882 9964
Denmark*	800 17309
Finland*	0800 113153
France*	05 917959
Germany*	0130 821502
Hong Kong	(852) 2501 1111
Ireland*	1 800 553117
Italy*	1678 79489
Japan	(81) (3) 3345 7251
Mexico	(525) 531 0591
Netherlands*	06 0227788
Norway*	800 13376
Singapore	(65) 538 9368
South Africa	(27) (11) 803 7404
Spain*	900 983125
Sweden*	020 795482
Taiwan	(886) (2) 577 4352
United Arab Emirates	(971) (4) 349049
U.K.*	0800 966197
U.S.	(1) (408) 492 1790

* These numbers are toll-free.

Returning Products for Repair

A product sent directly to 3Com for repair must first be assigned a Return Materials Authorization (RMA) number. A product sent to 3Com without an RMA number will be returned to the sender unopened, at the sender's expense.

To obtain an RMA number, call or fax:

Country	Telephone Number	Fax Number
U.S. and Canada	(800) 876 3266, option 2	(408) 764 7120
Europe	31 30 60 29900, option 5	(44) (1442) 275822
Outside Europe, U.S., and Canada	(1) (408) 492 1790	(1) (408) 764 7290

GLOSSARY

10BASE-T

Refers to IEEE Standard 802.3i, which provides industry specifications for 10Mbps multi-segment baseband networks that use twisted-pair wiring as a medium.

A port

Each DAS contains two ports, one designated A and one designated B. The A port is intended to be connected to the primary ring on the incoming fiber and the secondary ring on the outgoing fiber. A properly formed trunk ring is composed of a set of stations with the A port of one station connected to the B port of the neighboring station. See also *B port.*

Attenuation

The weakening of a transmitted signal as it travels farther from its point of origin. Example: the distortion of a digital signal on a network cable, or reduction in the amplitude of an electric signal without appreciable modification of the waveform. Measured in decibels (dB).

B port

Each DAS contains two ports, one designated A and one designated B. The B port is intended to be connected to the incoming fiber of the secondary ring and the outgoing fiber of the primary ring. A properly formed trunk ring is composed of a set of stations with the A port of one station connected to the B port of the neighboring station. See also *A port*.

B to M link

One of several detailed connection rules for a specific port relative to other ports. The "B to M (master) port rule" is a tree connection with possible redundancy. With this link, a station must not go to THRU state in Configuration Management (CFM). Port B on one station has precedence for connecting to an M port on a different station (single MAC station).

backbone

The main segment of a campus network, to which department networks are attached.

bandwidth

Data, measured in bits per second, that a channel can transmit. The bandwidth of Ethernet is 10Mbps; the bandwidth of FDDI is 100Mbps.

bridges

Equipment that connects LANs, allowing communication between devices on separate LANs. Bridges are protocol independent but hardware specific, with communication limited to the data link layer and physical layer of the ISO reference model. Bridges connect LANs with different hardware and different protocols.

Example: A device that connects an Ethernet network to an FDDI network. This bridge allows the two networks to send signals to each other.

broadcast packet

A single packet that is sent to all stations in a network. See also *multicast packet.*

bus topology

An architecture distinguished by having all of its nodes connected to a cable.

cabling system plan

A plan for organizing the various cables and accessories necessary for wiring a communication system. It can be used for many currently available communication products. Two examples of cabling system plans are the IBM Cabling System and AT&T Premises Distribution Plan.

campus network

Local area networks that connect other LANs from multiple departments in a single building or campus.

client

A single-user computer that requests application or network services from a server.

client-server

A distributed system model of computing that brings computing power to the desktop, where users ("clients") access resources from servers.

concentrator

An FDDI station having additional PHY/PMD entities beyond those required for its own attachment to an FDDI network. These additional PHY/PMD entities, called M (master) ports, are for the attachment of other FDDI stations (including other concentrators) in a tree topology. See *PHY standard, PMD standard*

CSMA/CD

Carrier Sense Multiple Access with Collision Detection. A network protocol for handling situations in which two or more nodes or stations transmit at the same time, causing a collision.

DAC

Dual-attached concentrator. A concentrator that offers two attachments to the FDDI network, each capable of accommodating a dual, counter-rotating ring. A DAC contains an A-B port pair and at least one M port.

DAS

Dual-attached station. A station that is directly attached to FDDI's dual token rings. A DAS has four fiber attachments, one receive and one transmit fiber for each ring. Rather than an individual user workstation, a DAS is most likely to be the device controlling LAN operation, such as an FDDI concentrator, bridge, router, server, minicomputer, or mainframe. A DAS can be either single MAC or dual MAC. It contains one A-B port pair.

DCE

Data communication equipment. One of two types of hardware connected by an RS-232-C serial connection. See also *DTE*.

DTE

Data terminal equipment. One of two types of hardware connected by an RS-232-C serial connection. See also *DCE*.

dual homing

A method of cabling concentrators and stations that allows an alternate path to the FDDI network. Dual homing creates a more stable ring of concentrators.

dual MAC

A station that has one MAC inserted in each of the dual rings, as in a DAS. To be designated a station, a minimum of one MAC is required. See *DAS*.

duplex fiber cable

A cable composed of two sets of insulated fiber optic conductors twisted together.

EIA RS-232 standard

A set of specifications used throughout the data communications industry to define the interconnection of data terminal equipment (DTE) and data communication equipment (DCE) for the exchange of serial binary data. The standard defines electrical signal characteristics, mechanical interface characteristics, and circuits.

Ethernet

A CSMA/CD, 10Mbps, local area data network, developed by Xerox Corporation. It is one of the most popular baseband LANs in use.

FDDI

Fiber Distributed Data Interface. A high-performance, fiber optic token ring LAN that operates at 100Mbps over distances of up to 200 kilometers with up to 1000 connected stations.

FDDI dual ring

The pair of counter-rotating, logical rings (primary and secondary) common to the FDDI network. This architecture provides a high degree of reliability. In normal operation, only the primary ring carries data. The second or backup ring is used for automatic recovery in case of failure. If a network fault occurs, only the stations on either side of the fault are affected. They detect the fault and automatically bypass it to maintain continuous transmission of data.

FDDI paths

The segments of an FDDI ring that pass through a station. Every FDDI station must contain a primary path. The primary path represents, to the best of the station's knowledge, the segments of the primary ring that pass through the station. In addition, a station may optionally contain a secondary path representing the segments of the secondary ring that pass through the station. A station may contain additional paths representing segments of rings other than the primary and secondary. Such paths are called local paths.

FDDI standard

A standard by the X3T9.5 Committee of the American National Standards Institute (ANSI), that addresses the need for more speed and reliability than is currently available in other standard LANs. Its recent completion is a major factor contributing to the expected acceptance and widespread use of optical fiber as a LAN transmission medium. The standard comprises four parts. See *PMD standard, PHY standard, MAC standard,* and *SMT standard.*

fiber optic cable

A data transmission medium consisting of glass or plastic fibers. Light-emitting diodes send light through the fiber to a detector, which then converts the light back into electrical signals. Fiber optic LANs offer a high degree of protection from eavesdropping, electromagnetic interference, and radioactivity. It is the cable most frequently used with FDDI.

ground

See *protective grounding*.

hostname

A meaningful, easy-to-remember name or title assigned to a machine on the Internet that is associated with the IP address. See *IP address*.

IEEE 802.3

A physical layer standard specifying a LAN with a CSMA/CD access method on a bus topology. Ethernet follows this standard. See *10BASE-T.*

in-band management channel

Network management performed using the same network normally used for data transmission. See also *out-of-band management channel*.

internal paths

See *FDDI dual ring, primary ring, secondary ring*.

Internet Protocol

See *IP address*.

interoperability

The ability of computer equipment from one vendor to communicate and exchange information with dissimilar equipment from other vendors.

IP address

Internet Protocol address. A unique identifier for a machine that is attached to a network made up of two or more interconnected local area or wide area networks.

IP fragmentation

The process of breaking up larger IP frames on one network to a size compatible with the network to which they will be forwarded.

ISO

International Standards Organization. The ISO is a multinational organization that defines computer, communication, and other standards. The ISO defined the OSI seven-layer reference model for computer communications. See also *OSI*.

LAN

Local area network. A data communications network spanning a limited geographical area, such as a single building or campus. It provides communication between computers and peripherals. LANs are distinguished by their small geographical size, high data rate, and low error rate.

LLC

Logical Link Control. The upper sublayer of the data-link layer of the OSI seven-layer reference model. The LLC handles error control, flow control, and frames transmission between stations. The IEEE 802.2 standard is the most widely implemented LLC protocol.

local management

Management of a station by software running on the station.

local paths

See *FDDI paths*.

M port

Master port. Each PHY/PMD pair, designated a port, belongs to one of four types: A, B, M, or S. Concentrator stations (DAS and SAC) contain one or more M ports to provide connection within the concentrator tree.

MAC

Media Access Control layer. A station resource that specifies the lower sublayer of the data-link layer for FDDI. It presents the specifications and services provided for conforming FDDI attachment devices. MAC specifies the access to the medium, including addressing, data checking, and data framing.

master port

See *M port*.

MAU

Medium attachment unit. An IEEE 802.3-compatible Ethernet transceiver used to coupled unshielded twisted-pair wiring to AUI cable. A computer's hardware mechanism through which network transmissions are sent and received. See *IEEE 802.3, twisted pair.*

MIB

Management Information Base. Stores a device's managed characteristics and parameters. MIBs are used by Simple Network Management Protocol (SNMP) and Common Management Information Protocol (CMIP) to contain attributes of their managed systems. The Switch 2200 system contains its own internal MIB.

MIC

Media Interface Connector. A mated connector pair that attaches an FDDI station to a fiber optic cable plant. It consists of two parts: a plug and a receptacle. There are four types of MIC: MIC A, MIC B, MIC S, and MIC M.

multicast packet

A single packet that is copied to a subset of addresses in a network. See also *broadcast packet*.

multiconductor
More than one conductor within a single cable.

multimode fiber
A fiber optic cable that transmits signals by using light-emitting diodes (LEDs). Multimode fiber is used widely to transmit data.

NAC
Null Attachment Concentrator. A system configured so that it has no attachments to the FDDI dual ring. A no-attach station contains no A, B, or S ports.

non-10BASE-T
A device attached to Ethernet that is proprietary or nonstandard. See also *10BASE-T*.

nonvolatile memory
Computer memory that is preserved when a system loses power.

operating system
A program that manages and provides access to system resources.

OSI
A reference model, developed by the ISO, that divides computer communications into seven ordered layers: physical, data-link, network, transport, session, presentation, and application. See also *ISO*.

out-of-band management channel
Network management accomplished through a network or connection other than the one usually used for data transmission. See *in-band management channel*.

PHY standard
Physical Layer standard. The American National Standard (ANSI X3) that specifies the data encoding mechanism and the clock recovery and data framing parameters.

PMD standard
Physical Layer Medium Dependent standard. The American National Standard (ANSI X3) that specifies the lower sublayer of the physical layer for FDDI, including the power levels and characteristics of the optical transmitter and receiver, interface optical signal requirements including jitter, the connector receptacle footprint, the requirements of conforming FDDI optical fiber cable plants, and the permissible bit error rates.

primary ring
One of two counter-rotating, fiber optic rings that serve as the root of an FDDI network. The primary ring normally enters each station on the trunk ring through the A port and exits through the B port. See *FDDI dual ring, secondary ring*.

protective grounding
Connection to the ground, or to a conductor which is grounded, to ensure safety from electric shock.

protocol

A set of rules for communicating between computers. The rules dictate format, timing, sequencing, and error control.

repeater

An FDDI node that serves as a two-way relay of the optical signals in an FDDI network. A repeater does not have any MACs or concentrator functionality.

ring

A series of stations across which information is passed sequentially, each station in turn examining or copying the information, finally returning it to the originating station. The ring has a predictable response time, determined by the number of stations. See also *primary ring, secondary ring, FDDI dual ring*.

router

A device that connects two remote networks by selectively forwarding messages between them. A router differs from a bridge and a gateway in that it selectively forwards information between the networks. Routers may be implemented in pairs, or a router may communicate directly with a computer. See *bridges*.

RPS

Redundant power system.

RS-232 serial port

The port on the system accepting a DB-9 connector. It changes the parallel arrangement of data within computers to the serial (one after the other) form used on data transmissions links. This port can be used for dedicated local management access.

S port

Each PHY/PMD pair, designated a port, belongs to one of four types: A, B, M, or S. A single attachment station (SAS or SAC) has an S port that is intended to be attached to an M port within a concentrator tree. Also called a slave port.

SAC

Single attachment concentrator. A concentrator that offers one attachment to the FDDI network. A SAC has an S port that is intended to be attached to an M port within a concentrator tree.

secondary ring

One of two counter-rotating, fiber optic rings that serve as the root of an FDDI network. The secondary ring normally enters each station on the trunk ring through the B port and exits through the A port. See also *FDDI dual ring, primary ring*.

server

A computer that provides clients with application and network services. Servers are shared by multiple users.

slave port

See *S port*.

SMT

Station Management. A component of the FDDI standard that specifies the control required for proper operation of a station in an FDDI ring.

SNMP

Simple Network Management Protocol. A protocol originally designed to be used in managing TCP/IP internets. SNMP is presently implemented on a wide variety of computers and networking equipment and may be used to manage many aspects of network and end-station operation. See *protocol*.

station

An addressable logical and physical attachment in a ring that is capable of transmitting, receiving, and repeating information. An FDDI station has one or more PHY entities, one or more MAC entities, and only one SMT entity.

station ID

The identifier for an FDDI concentrator or station.

topology

Physical or logical placement of stations on a network in relation to one another in a ring, mesh, star, or bus configuration.

transceiver

See *MAU*.

twisted-pair wire

Two insulated wires wrapped around each other. Each wire is insulated, and the pair is usually covered by an overall casing. This type of wiring is generally used for connecting low-speed data equipment, such as terminals, to host systems.

universal mounting rail hole pattern

The standard spacing pattern between holes in a mounting rack: $^{1}/_{2}$ inch , $^{5}/_{8}$ inch , $^{5}/_{8}$ inch , and $^{1}/_{2}$ inch .

UNIX

A computer operating system developed by AT&T that is capable of multitasking.

UTP

Unshielded twisted pair. Common, phone-grade, twisted-pair wiring with no protective shielding against outside interference. See also *twisted-pair wire*.

wiring closet

A central area used for wiring terminal systems and telephone communication systems, such as line circuits, power supplies, and special control devices. The wiring closet provides a concentration point for routing data communication cables between the controller and the office data terminals.

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