TE100-DX8
TE100-DX16
Ethernet/Fast Ethernet
Dual-Speed Stackable Hub
User's Guide

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ABOUT THIS GUIDE

This guide discusses how to install and use your Ethernet/Fast Ethernet dual-speed stackable hub.

Conventions

As used in this guide, the term *hub*, unless otherwise noted, refers to the eight- or sixteen-port Ethernet/Fast Ethernet dual-speed stackable hub with which this guide was packaged, or to another hub in the same product family.

Overview of the User's Guide

- Chapter 1, *Introduction*. Provides information on Fast Ethernet networks and introduces your hub's features.
- Chapter 2, *Unpacking and Setup*. Helps you get started in setting up the hub.
- Chapter 3, *Understanding Indicators*. Describes all LED indicators on the hub's front panel. Understanding these indicators is essential to effectively using the hub.
- Chapter 4, *Making Connections*. Provides information on connecting to the hub's twisted-pair ports, stacking hubs, and uplinking hubs together.

- Appendix A, *Cables and Connectors*. Provides specifications on the cables and connectors used with the hub.
- Appendix B, *Specifications*. Lists the hub's specifications.

1

INTRODUCTION

This chapter introduces your hub and gives some background information about the technology the hub uses.

Product Description

Your Ethernet/Fast Ethernet dual-speed stackable hub is designed to allow easy integration and migration between 10-Mbps Ethernet and 100-Mbps Fast Ethernet.

The hub can operate with both IEEE 802.3 10BASE-T connections (twisted-pair Ethernet operating at 10 megabits per second) and IEEE 802.3u 100BASE-TX connections (twisted-pair Fast Ethernet operating at 100 megabits per second). All of the twisted-pair ports support NWay auto-negotiation, allowing the hub to automatically detect the speed of a network connection. This means you can connect all of your Ethernet and Fast Ethernet hosts to your hub (or to a stack of hubs in the same product family) without any rewiring required when a host is upgraded from 10 Mbps to 100 Mbps.

Hubs in this family can be purchased with or without a built-in switching circuit to allow communication between network end nodes operating at different speeds. If your hub has a **SW Enable** indicator on its front panel, it has such a switching circuit. On a

hub that does not have such a switching circuit, only end nodes operating at the same speed (10 or 100 Mbps) can communicate with each other (unless the hub is stacked with a hub that *does* have such a switching circuit—see below).

Your hub has eight or sixteen twisted-pair ports and can be stacked together with other hubs in the same product family to a maximum of five hubs in a stack. A stack of five sixteen-port hubs gives a total of eighty Ethernet or Fast Ethernet ports. (Stacking is also referred to as daisy-chaining).

As long as a stack contains at least one hub with a built-in switching circuit, 10-Mbps Ethernet nodes will be able to communicate with 100-Mbps Fast Ethernet nodes and vice versa, regardless of which hub in the stack any node is attached to. Note that if two or more hubs in a stack have switching circuits built in, only one hub's switching circuit will be enabled; any other switching circuits in the stack will automatically be disabled, and only one hub's **SW Enable** indicator will shine. This is to allow intercommunication without the danger of a signal loop forming.

Because it conforms to the standards for both Ethernet and Class II Fast Ethernet repeaters, your hub (or a stack of hubs in the same product family) can also be "uplinked" together with a similarly conformant hub or hub stack to expand the network still further. The uplink connection will carry both 10- and 100-Mbps network signals.

Product Features

The list below highlights your hub's features and specifications:

- Compatible with the IEEE 802.3 10BASE-T Ethernet and 802.3u 100BASE-TX Fast Ethernet industry standards for

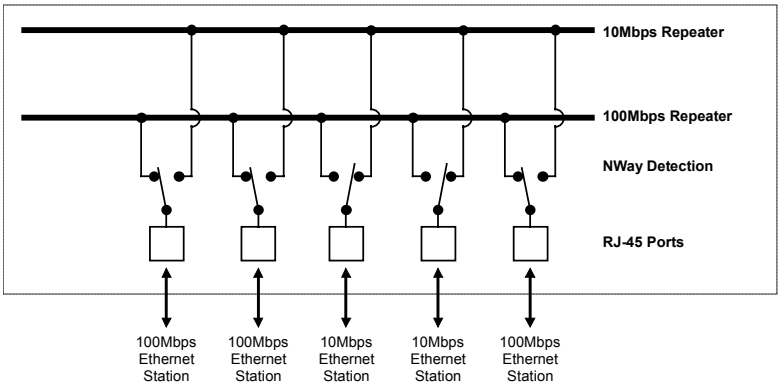
interoperability with other Ethernet and Fast Ethernet network devices.

- Ethernet connections support Category 3 or better twisted-pair cables.
- Fast Ethernet connections support both shielded twisted-pair and Category 5 unshielded twisted-pair cables.
- Fast Ethernet connections support a maximum distance of 100 meters from end-station to hub, and a total network diameter of 205 meters.
- Eight or sixteen NWay ports per hub for connecting stations to the network.
- Hubs with built-in switching circuitry (shown by the presence of a **SW Enable** indicator on the front panel) automatically transfer packets between Ethernet and Fast Ethernet connections, allowing communication between end nodes operating at different speeds.
- LED indicators for power, 10-Mbps collision, 100-Mbps collision, connection speed, port status, and (on hubs with built-in switching circuitry only) switching circuitry status.
- Auto-partitioning for network protection.
- Data collision detection and handling.
- Preamble regeneration and signal retiming.
- Daisy-chaining ports for interconnecting up to five hubs to form one logical hub.
- **Uplink** jack for easy linking of two hubs or hub stacks (or of a hub to a stack) to further expand the network.
- Optional brackets for mounting in a standard 19-inch equipment rack.
- Internal auto-adjusting power supply (100 to 240V, 50 or 60HZ).

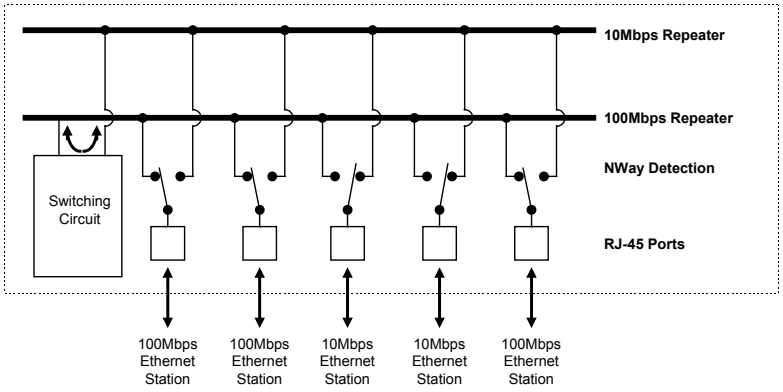
Dual-Speed Ethernet Hub Technology Overview

Dual-speed Ethernet hubs have been developed to make it simpler to plan networks containing both 10-Mbps Ethernet and 100-Mbps Fast Ethernet technologies, especially when network hosts are being gradually migrated to new Fast Ethernet connections.

A dual-speed hub is actually two repeaters in one housing. The 10-Mbps repeater receives Ethernet transmissions from any of its ports, and retransmits them to all other ports operating at 10 Mbps. Similarly, the 100-Mbps repeater retransmits Fast Ethernet transmissions from ports operating at 100 Mbps to all other ports operating at the same speed.



If there is a switching circuit in the hub (or in any hub in a stack), the switching circuit will serve as a bridge between the two repeaters.



100BASE-TX Technology Overview

Introduction to 100-Mbps Fast Ethernet

Computers today have become increasingly powerful, with the capability to accommodate very sophisticated uses such as multimedia applications, video-conferencing, and CAD/CAM. To utilize these technologically advanced applications more efficiently, there is also a growing demand for faster networks that can handle heavy network traffic.

Recognizing this need for greater bandwidth and lower latency, a variety of technologies such as FDDI, ATM, and Fast Ethernet (100 Mbps) have been adopted by many vendors. Fast Ethernet technology stands out as the most inexpensive and smoothest migration path for existing 10-Mbps Ethernet users in part because it doesn't require a protocol translation when sharing data with 10-Mbps Ethernet.

Fast Ethernet is a relatively new standard specified by the IEEE 802.3 LAN committee. It is an extension of the 10-Mbps Ethernet standard with the ability to transmit and receive data at 100 Mbps, while maintaining the CSMA/CD Ethernet protocol. Since Fast Ethernet is compatible with all 10-Mbps Ethernet environments, it provides a straightforward upgrade without wasting the company's existing investment in hardware, software, and trained personnel.

Cables and Connectors

Category 5 unshielded twisted-pair (UTP) and shielded twisted-pair (STP) cables are both supported. Category 5 UTP cables use the same RJ-45 connector used with 10BASE-T, wired in the same manner.

Topology

A Fast Ethernet workgroup is configured in a star topology and is built around a maximum of two repeaters. Each workgroup forms a separate LAN (also known as a collision domain), and these workgroups can be easily interconnected through switches, bridges, or routers to form one LAN large enough to encompass a high-rise building or campus environment. Recent innovations in LAN hub technology such as stackable hubs, coupled with the decreasing cost of switches, bridges, and routers, allow the design of low-cost, efficient Fast Ethernet workgroups and enterprise LANs.

The following factors strongly influence the architecture of Fast Ethernet networks:

- The EIA/TIA 568 Wiring Standard imposes a 100 meter limit on horizontal runs of twisted-pair cables; that is, connections from the wiring closet to the end-station.

- Fast Ethernet's increased operational speed reduces the maximum distance between all elements of the LAN (see below).

Network Diameter

Network diameter, which is the distance between two end-stations in the same collision domain, is the primary difference between traditional Ethernet and Fast Ethernet. Due to the increased speed in Fast Ethernet and adherence to the EIA/TIA 568 wiring rules, the network diameter of a Fast Ethernet collision domain is limited to 205 meters; in contrast, the maximum 10BASE-T Ethernet collision domain diameter can be up to 500 meters.

Hub Types

Unlike 10BASE-T hubs, which are all functionally identical, Fast Ethernet hubs are divided into two distinct types: Class I and Class II. A Class I hub repeats all incoming signals on one port to the other ports by first translating them to digital signals and then retranslating them back to line signals. These translations are necessary when connecting various network media to the same collision domain, such as when combining two-wire-pair 100BASE-TX media with four-wire-pair 100BASE-T4 media. Only one Class I hub can exist within a collision domain; thus, one hub of this type cannot be directly uplinked to another. A Class II repeater, on the other hand, immediately repeats all incoming line signals on one port to the other ports; no translations are performed. This type of hub connects identical media within the same collision domain; for example, TX to TX. At most, two Class II hubs can exist within the same collision domain.

As mentioned earlier, stackable Class II hubs can be used to increase the number of available nodes in a collision domain. An entire hub stack counts as a single repeater. Hubs in this series are Class II devices.

2

UNPACKING AND SETUP

This chapter provides information on the unpacking and initial installation of your hub stack.

Unpacking

Open the shipping carton of your hub and carefully unpack the contents. The carton should contain the following items:

- One Ethernet/Fast Ethernet dual-speed stackable hub
- One AC power cord, suitable for your area's electrical power connections
- One daisy-chaining cable
- Four rubber feet to be used for cushioning
- This *User's Guide*

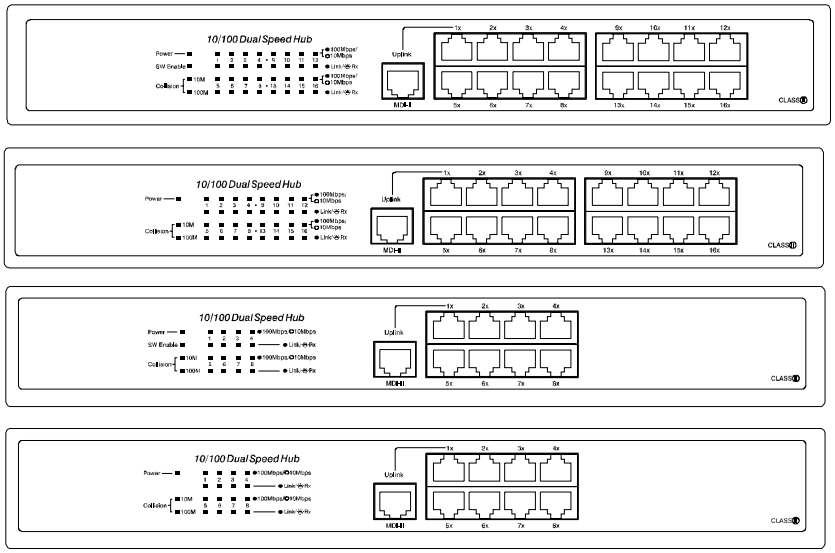
Inspect the hub and all accompanying items. If any item is damaged or missing, report the problem immediately to your network equipment dealer.

Identifying External Components

This section identifies all the major external components of the hub. Both the front and rear panels are shown, followed by a description of each panel feature. The indicator panel is described in detail in the next chapter.

Front Panel

The figure below shows the front panels of all hubs in the product family that includes your hub. The two at the top are sixteen-port units, the first with a built-in switching circuit and the second without such a circuit; the two at the bottom are eight-port units, the first with and the second without a built-in switching circuit. Identify your own hub's front panel in the figure before going on.



- **LED Indicator Panel**

  Refer to the next chapter, *Understanding Indicators*, for detailed information about each of the hub's LED indicators.

- **Twisted-pair Jacks**

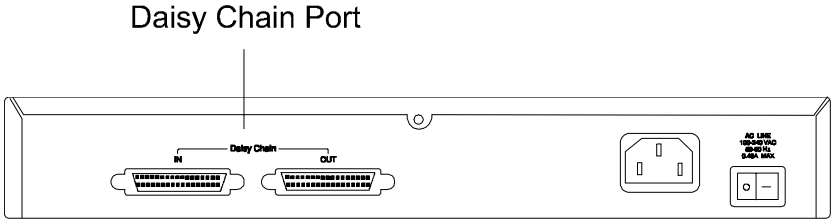
  Use these jacks to connect stations to the hub. These are MDI-**X** (Medium-Dependent Interface, Cross-wired) jacks, which means you can use ordinary straight-through twisted-pair cables to connect user machines and servers to the hub through them. If you need to connect another device with an MDI-**X** jack, such as another hub or an Ethernet switch, you should use a crossover cable, or make the connection using the **Uplink** jack (described below). For more information about crossover connections, see the section entitled *Crossover Cables* on page 28.

- **Uplink Jack**

  The **Uplink** jack is an MDI-**II** jack, which means you can connect the hub (or a hub stack) to a device with an MDI-**X** port using an ordinary straight-through cable, making a crossover cable unnecessary.

  The port 1 **1X** jack and the **Uplink** jack are really the same port, except that their pinouts are different. **Do not use both the port 1 1X jack and the Uplink jack at the same time.**

Rear Panel



- **Daisy Chain IN Port**

  When stacking your hub with one to four other hubs in the same series, this port should be connected to the Daisy Chain OUT port of the previous hub in the stack (usually placed immediately above it). A stack of five hubs can be created in this way. The first and last hubs in the stack use only one of the daisy-chaining ports, while the others use both.

- **Daisy Chain OUT Port**

  This port works in conjunction with the Daisy Chain IN port (see above). Connect this port to the Daisy Chain IN port of the next hub in the stack (usually placed immediately below it), using the enclosed daisy-chaining cable.

- **Fan**

  Provides air circulation and heat dissipation.

- **AC Power Connector**

  For the power cord.

Installing the Hub

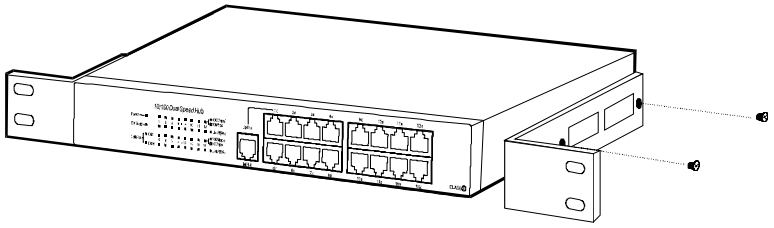
Installation

The site where you install the hub stack may greatly affect its performance. When installing, consider the following pointers:

- Install the hub stack in a fairly cool and dry place. See Appendix B, *Specifications*, for the acceptable temperature and humidity operating ranges.
- Install the hub stack in a site free from strong electromagnetic field generators (such as motors), vibration, dust, and direct exposure to sunlight.
- Leave at least 10 cm of space at the front and rear of the hub for ventilation.
- Install the hub on a sturdy, level surface that can support its weight. When installing the hub stack on a level surface, attach the rubber feet to the bottom of each device. The rubber feet cushion the hub and protect the hub case from scratches.

Rack Mounting

The hub can be mounted in an EIA standard-size, 19-inch rack, which can be placed in a wiring closet with other equipment. For information about the ETH-700I Rack Mounting Brackets, consult your computer hardware dealer. If you already possess the brackets, attach the mounting brackets at the hub's front panel (one on each side), and secure them with the provided screws.



Then, use screws provided with the equipment rack to mount each hub in the rack. Follow the directions provided by the rack manufacturer.

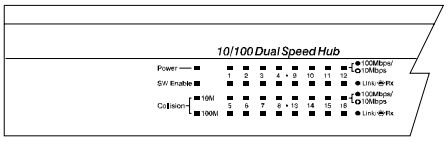
Connecting the Power Supply

Power is supplied to the stackable Fast Ethernet hub through an AC power cord. The AC power input voltage ranges from 100 to 240 VAC. A power cord is included with the device.

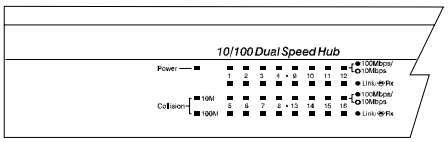
3

UNDERSTANDING INDICATORS

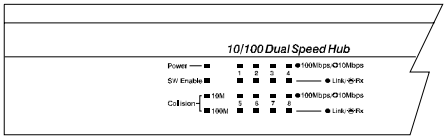
Before connecting network devices to the hub, take a few minutes to look over this section and familiarize yourself with the front panel LED indicators of your dual-speed hub, depicted below.



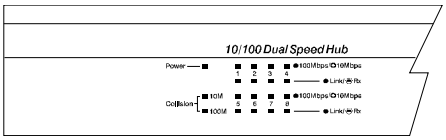
Sixteen-port hub with built-in switching circuit



Sixteen-port hub without switching circuit



Eight-port hub with built-in switching circuit



Eight-port hub without switching circuit

Hub State Indicators

- **Power Indicator**

  This indicator shines green when the hub is receiving power; otherwise, it is off.

- **Collision—10M and Collision—100M Indicators**

  These indicators indicate data collisions on the respective 10-Mbps Ethernet or 100-Mbps Fast Ethernet segments of the hub. (If several hubs are stacked or uplinked together, all of them should detect and indicate the same collision, since collisions span the entire network segment.) Whenever a collision is detected, the respective collision indicator will briefly blink amber.

SW Enable Indicator

The **SW Enable** indicator shows the presence of an active switching circuit in the hub. This indicator is not present on hubs that do not have such a switching circuit.

A switching circuit transfers signals between 10-Mbps and 100-Mbps network segments. If a stack contains more than one hub with a built-in switching circuit, only one hub's **SW Enable** indicator will shine; the other hubs' switching circuits will automatically be disabled to prevent signal loops.

If a hub with a switching circuit is used alone (that is, not in a stack), its **SW Enable** indicator will shine all the time, even if all devices connected to the hub operate at the same speed.

Port Speed Indicators

There is a port speed indicator for each of the hub's twisted-pair ports. A port's speed indicator should shine green when a 100BASE-TX device is connected to the port, and remain dark if the port is unconnected or if a 10BASE-T device is connected.

Port Status Indicators

There is one port status indicator for each of the hub's twisted-pair ports. When a good link to a powered-up but idle device is detected on a port, the port's status indicator shines steadily. When packets are received from the device, the indicator blinks off and on.

If a powered-up device is connected to a port and the port's status indicator is unlit, the most probable cause is a cabling or connection problem (for example, wrong cable type or bad contact) or a device malfunction.

4

MAKING CONNECTIONS

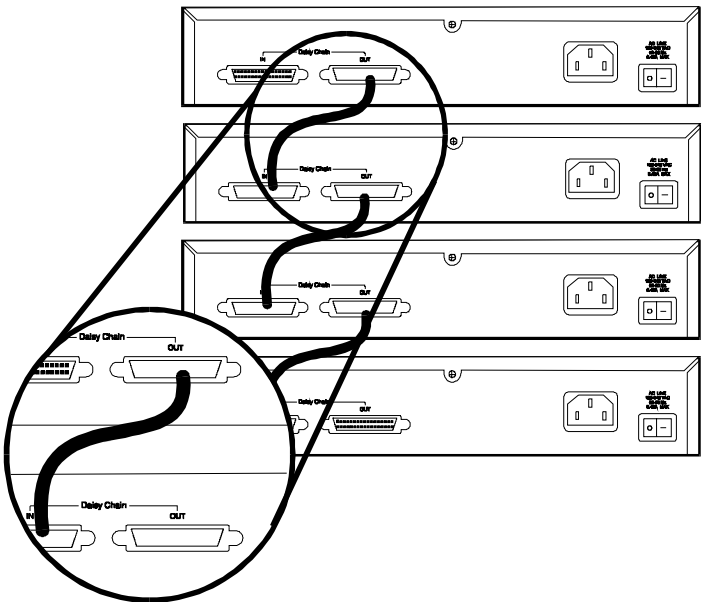
This chapter discusses how to create a stack, connect end nodes, and uplink two hubs (or two stacks, or a hub and a stack) together.

Creating a Stack

You can stack as many as five hubs together using the daisy-chaining ports to form one logical hub. In this configuration, the interconnected hubs constitute a single logical unit providing a maximum of 80 twisted-pair ports.

Never connect or disconnect a daisy-chaining cable while the power is on to the hub or to any other hub in the stack. **Always turn off power to the entire stack before adding or removing a hub or hubs.**

Use the supplied daisy-chaining cable to connect the **Daisy Chain OUT** port on the rear panel of one hub to the **Daisy Chain IN** port on the hub below it, as shown in the figure below. Repeat this procedure for each hub to be included in the stack. Note that the first hub's **Daisy Chain IN** port and the last hub's **Daisy Chain OUT** port must be left unconnected.



If any hub in the stack is equipped with a built-in switching circuit, network end nodes operating at different speeds will be able to intercommunicate; otherwise they will not. If more than one hub in the stack has a switching circuit, only one hub's **SW Enable** indicator will light up, and that hub will provide 10-Mbps/100-Mbps intercommunication capability for all end nodes connected to the stack.

Connectivity Rules

Ethernet (10-Mbps) networks have the following connectivity rules:

- The maximum length of a twisted-pair cable segment is 100 meters. Cabling should be Category 3 or better.

- Between any two end-stations in a collision domain, there may be up to five cable segments and four intermediate repeaters (hubs, hub stacks, or other repeaters).
- If there is a path between any two end-stations containing five segments and four repeaters, then at least two of the cable segments must be point-to-point link segments (e.g., 10BASE-T or 10BASE-FL), while the remaining segments may be populated segments (that is, they can be 10BASE-2 or 10BASE-5 segments with end nodes attached).

Fast Ethernet (100-Mbps) networks have the following connectivity rules:

- The maximum length of a twisted-pair segment (that is, the distance between a port on the hub and an addressable network device such as an end-station computer, server, or Fast Ethernet switch) is 100 meters. All cabling should be certified as Category 5 or higher UTP or equivalent (for example, Type 1 STP with RJ-45 plugs).
- The maximum diameter of a collision domain is 205 meters using two Class II hubs (or two hub stacks, or one hub and one stack) uplinked together.
- Between any two end-stations in a collision domain, there may be up to three cable segments and two Class II hubs (or two hub stacks, or one hub and one stack).

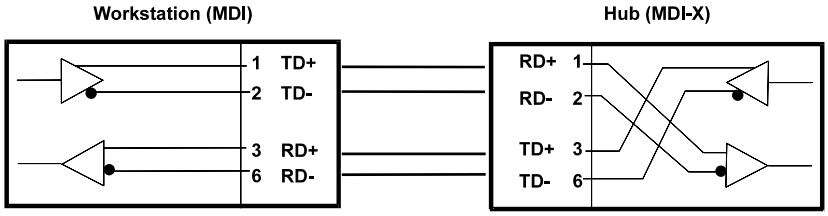
Hub-to-end-node Connections

After the hub is properly installed, it can support up to eight or sixteen end-node connections.

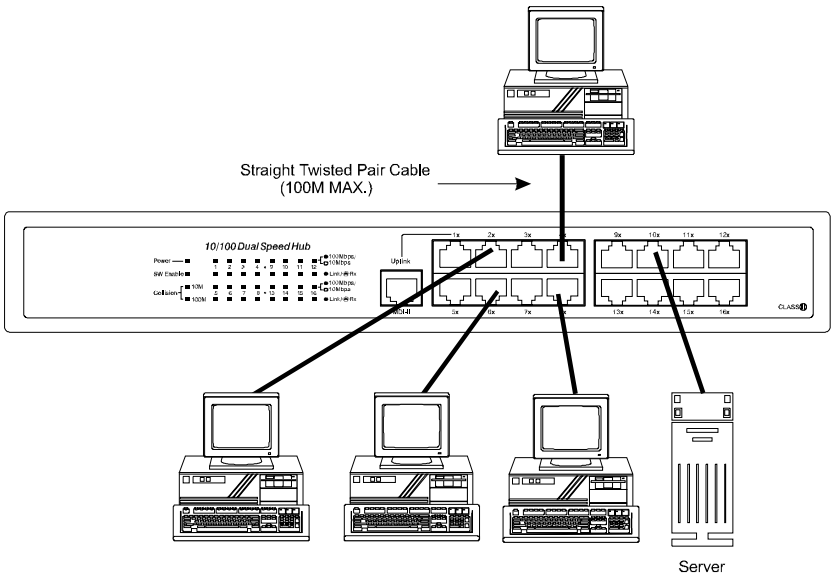
Each Fast Ethernet connection requires either a Category 5 UTP cable or a Type 1 STP cable. These cables can be up to 100 meters long.

Each Ethernet connection requires a Category 3 or better UTP cable. It is recommended that you use Category 5 cabling for all connections in order to make it easier to transition all stations to 100 Mbps.

You can connect any combination of end-station computers, servers, and other addressable network devices to the twisted-pair ports using straight-through twisted-pair cables. Do *not* use crossover cables. The following figure illustrates the pin assignments for a straight-through cable:



When connecting an end-station computer or a server, the system being connected should have an Ethernet or Fast Ethernet network interface card with a twisted-pair port. The following figure shows typical connections between the hub and end nodes:



Uplink Connection

You can "uplink" two hubs (or two hub stacks, or a hub and a stack) to each other using either (*a*) any two numbered **X**-type jacks or (*b*) a numbered **X**-type jack and an **Uplink** jack. (In the discussion that follows, the word *hub* should be taken to mean a hub, or a stack of hubs, in the same product family as your dual-speed Ethernet/Fast Ethernet stackable hub.)

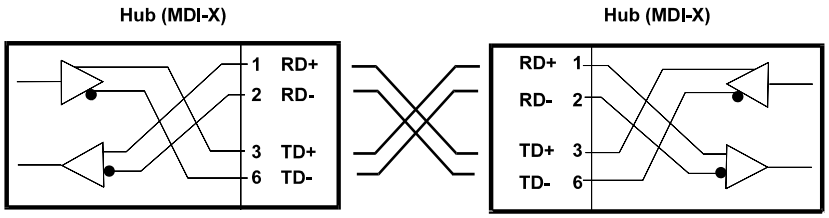
Uplinking hubs using **X**-type jacks requires a crossover twisted-pair cable; uplinking hubs using an **X**-type jack and an **Uplink** jack requires an ordinary straight-through twisted-pair cable. Inside the hub, the **Uplink** and **1X** jacks are wired to the same circuitry (they are just wired to it in different ways), so you must never use the **1X** jack and the **Uplink** jack at the same time.

When you uplink two hubs together, the maximum distance between any two end nodes in a collision domain is 205 meters. If both hubs have maximum-length (100-meter) connections to end nodes (even if there is only one such connection on each hub), the hub-to-hub uplink connection will be limited to 5 meters. However, if the longest hub-to-end-node connection is less than 100 meters, the uplink connection can be longer than 5 meters, provided that the 205-meter total network diameter rule is followed.

The following table describes different methods of linking hubs:

HUB PORT USED	DEVICE	PORT TYPE	CABLE TO USE
Normal	Switch or Hub	Non-Uplink	Crossover (X)
		Uplink	Straight-through (|||)
	Network end node		Straight-through (|||)
Uplink	Switch or Hub	Non-Uplink	Straight-through (|||)
		Uplink	Crossover (X)
	Network end node		Crossover (X)

A crossover cable is a twisted-pair cable in which the wires have been crossed. The figure below shows the pin assignments for an Ethernet or Fast Ethernet crossover cable:



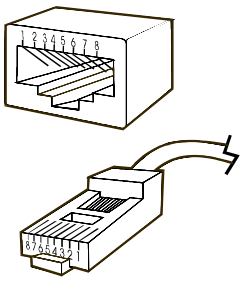
NOTE: *The port 1* **1X** *jack shares its circuitry with the* **Uplink** *jack. If you connect a hub to the* **Uplink** *jack, do not use the port 1* **1X** *jack.*

A

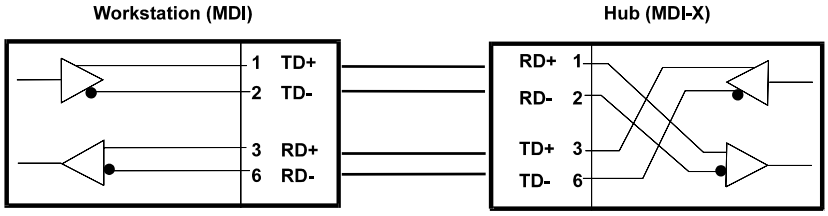
CABLES AND CONNECTORS

100BASE-TX Fast Ethernet Cables and Connectors

- Cable characteristics: Category 5 unshielded twisted-pair or EIA/TIA-568 compliant, 100-ohm shielded twisted-pair data cable with 0.4 to 0.6 mm (22 to 26 AWG) wires in two or four twisted pairs (only two pairs—that is, four wires—are used for 100BASE-TX).
- Maximum segment length: 100 meters
- Maximum network diameter: 205 meters
- Connectors: RJ-45



Straight Twisted Pair Cable Pinouts		
Contact	**MDI-X Signal**	**MDI-II Signal**
1	RD+ (receive)	TD+ (transmit)
2	RD- (receive)	TD- (transmit)
3	TD+ (transmit)	RD+ (receive)
4	Not used	Not used
5	Not used	Not used
6	TD- (transmit)	RD- (receive)
7	Not used	Not used
8	Not used	Not used

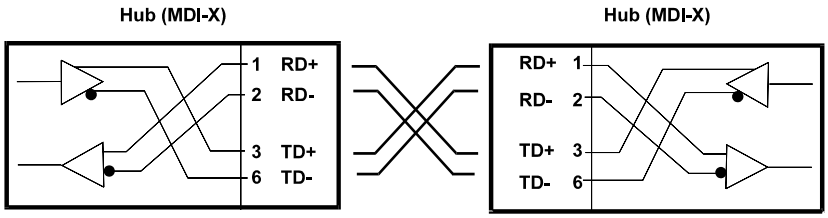


Crossover Cables

When making an uplink connection between one hub and another (or between a hub and a switch or bridge) using **X**-type jacks at both ends, you must use a crossover cable. In a crossover cable, two pairs of wires are switched at one end. Carry out the following steps to create a crossover twisted-pair cable:

1. Leave one end of the cable as-is, with the wiring on the RJ-45 connector unchanged. The wiring needs to be modified at one end only.

2. At the other end of the cable, connect wires 1 and 2 to contacts 3 and 6, respectively. Likewise, connect wires 3 and 6 to contacts 1 and 2. Refer to the following diagram:



B

SPECIFICATIONS

General

Standards: IEEE 802.3 10BASE-T Ethernet repeater, IEEE 802.3u 100BASE-TX Fast Ethernet repeater (Class II); ANSI X3T9.5 twisted-pair transceiver

Topology: Star

Protocol: CSMA/CD

Network Data Transfer Rate: Fast Ethernet, 100 Mbps; Ethernet, 10 Mbps

Number of Ports: 8 or 16, all dual-speed (10/100 Mbps)

Network Media: Ethernet: Category 3 or better UTP cable, maximum length 100 meters; Fast Ethernet: Category 5 UTP/STP, 100-ohm twisted-pair (maximum length 100 meters) for hub-to-station links; Cat 5 UTP, 100-ohm UTP/STP (maximum length 5 meters) for hub-to-hub linking

Daisy-chain Specifications

Number of Daisy-chained Hubs: Maximum five hubs per stack

Daisy-chain Connectors: Two D-type receptacles

Daisy-chain Cable: Proprietary cable with integral D-type connectors (included)

LED Indicators

Hub Status: Power, 10 Mbps collision, 100 Mbps collision. Hubs with built-in switching circuit have **SW Enable** indicator.

Port Status (per port): Speed (10/100 Mbps), connection status

Environmental and Physical

Power Supply: 100 to 240 VAC, 50 or 60 Hz internal universal power supply

Power Consumption: 8-port hubs: maximum 13.5 watts
16-port hubs: maximum 24 watts

Dimensions (W × H × D): 324 × 44.5 × 231 mm
(12.76 × 1.75 × 9.1 inches)

Weight: 2.6 kg (5.73 lb.)

Operating Temperature: -10 to 55°C

Storage Temperature: -25 to 55°C

Humidity: 5% to 95% (non-condensing)

DC Fan: 40 × 40 × 10 mm

Emissions: FCC Class A, CE, VCCI Class A

Safety: UL, CSA, CE Mark