

EtherWORKS Switch 6T/2TX

Installation

Part Number: EK-DEL6X-IN. A01

This document describes how to install and operate the EtherWORKS Switch 6T/2TX.

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Preface

About This Manual

This guide is designed for the experienced network installer. It describes how to install and operate Digital's EtherWORKS Switch 6T/2TX (DEL6X) switch (also referred to as the DEL6X or switch).

Conventions

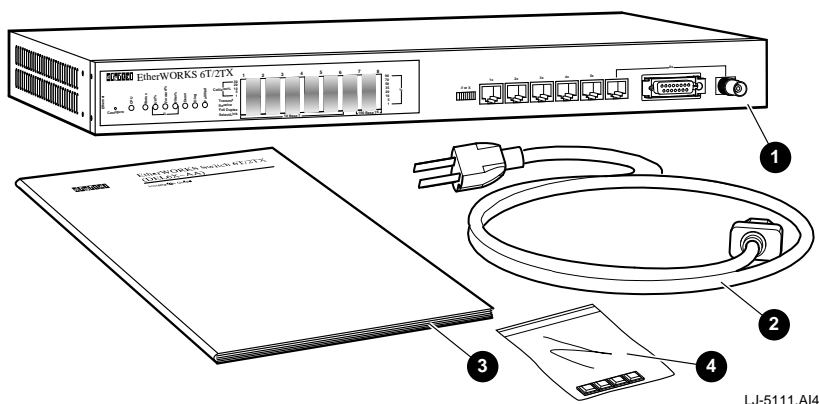
The following conventions are used in this manual:

Convention	Description
Note	Contains information of special importance.
<i>Italics</i>	In examples, indicates a variable. In text, emphasizes a term or indicates a book title.
Monospaced type	Indicates a literal example of system output.

Package Contents

The EtherWORKS Switch 6T/2TX package contains the items in the following list and shown in the following figure:

- The EtherWORKS Switch 6T/2TX ❶
- An ac power cord ❷
- This installation guide ❸
- Four rubber feet ❹



Quick Installation

The EtherWORKS Switch 6T/2TX contains five 8-pin MJ 10 Mb/s Ethernet ports, one multimedia 10 Mb/s port, and two 8-pin MJ 100 Mb/s ports for Fast Ethernet connection. Each 8-pin MJ port supports full- and half-duplex operation. The smart design built into the front display panel and configuration options provides a friendly interface that simplifies installation and network troubleshooting.

Use the following procedure to install the DEL6X:

1. Unpack the DEL6X.
2. Choose a location close to the network device you need to connect, and within easy reach of an electrical outlet.
3. Install the DEL6X on a desktop or mount it in a rack.
4. Connect PCs, servers, or workstations to the 8-pin MJ station ports.
5. Connect to another switch or compatible hub using one of the daisy-chain ports (Port 1 for 10 Mb/s, Port 7 or 8 for 100 Mb/s), or to an Ethernet or fiber-optic trunk using the AUI or BNC backbone port.

You may also use the DEL6X as a collapsed backbone or connect to a collapsed backbone using one of the 10 Mb/s Ethernet ports or 100 Mb/s Fast Ethernet ports. (Refer to Chapter 5 for sample applications.)

6. Set the transmission mode for each port to full- or half-duplex operation.
7. Verify network communications by ensuring the following:
 - You have made all the necessary connections.
 - You can access any connected resources.
 - The DEL6X LEDs are functioning properly.

If you encounter any problems installing the DEL6X, refer to Chapter 3 for a detailed description of installation procedures, or to Appendix A for troubleshooting help.

Overview of Switching Technology

The Ethernet switch allows simultaneous transmission of multiple packets using an internal high-speed data channel. This means that it can partition a network more efficiently than bridges or routers in most environments. Therefore, the Ethernet switch is recognized as one of the most important building blocks for today's networking technology.

The learning function in the switching hub stores the address and corresponding port number of each incoming and outgoing packet in a routing table. This information is subsequently used to filter packets whose destination address is on the same segment as the resource address.

The switch scans the destination address from the packet header, searches the routing table provided for the incoming port, then forwards the packet only if required, often before fully received. This fast forwarding makes the switch attractive for connecting servers directly to the network, thereby increasing throughput and availability. However, the switch is most commonly used to segment existing hubs, which usually improves overall performance. A switching hub can be easily configured in any Ethernet network to significantly boost bandwidth using conventional cabling and adapters.

EtherWORKS Switch 6T/2TX

The DEL6X can boost bandwidth. It provides five 10 Mb/s 8-pin MJ station ports and one 10 Mb/s TP/AUI/BNC combination (combo) port to connect to either a subnetwork, or directly to a PC, server, or key workstation, and two 8-pin 100 Mb/s Fast Ethernet ports for connection to a backbone or server. In addition to partitioning an overloaded network, the DEL6X provides connection between legacy 10Base-T networks and the newer generation 100Base-TX. It can be configured to operate in either full-duplex or half-duplex data transfer mode to support the interconnection requirements of other high-speed devices.

The switching fabric of the DEL6X incorporates a nonblocking crossbar matrix that allows simultaneous transport of multiple packets across the switch (that is, up to eight switching paths can be established at the same time, with each path crossing two ports). The DEL6X performs “on-the-fly” cut-through switching, which sends a packet to the appropriate port according to the destination address scanned from the packet header. This technique reduces the latency of packet transmission to 20 microseconds or less. Compared to approximately 800 microseconds for a bridge or 1800 microseconds for a router, both of which have to store the entire packet before it can be forwarded, the DEL6X can deliver a quantum improvement to network performance.

As a device functioning on the media access control (MAC) layer, the DEL6X is protocol independent, and therefore compatible with IEEE 802.3, IEEE 802.3u, TCP/IP, NetWare, DECnet, and XNS protocols. The DEL6X can be configured as a standalone device to form a work group consisting of two to eight subnetworks or workstations; it can function as a simple twisted-pair LAN; or it can serve as a multiport bridge. With its low port-to-port latency and extremely high-forwarding efficiency, the DEL6X can also be connected to other switches or compatible hubs.

To install the DEL6X, use your current network infrastructure, including wiring and network interface cards (NICs). Afterwards, you can configure and monitor the system using the DEL6X front panel, which includes an extensive array of LEDs for monitoring the unit's overall condition, as well as the status of each port.

Features

The main features of the DEL6X are as follows:

- Five independent 8-pin MJ 10 Mb/s Ethernet ports
- One TP/AUI/BNC combo 10 Mb/s Ethernet port
- Two 8-pin MJ 100 Mb/s Fast Ethernet ports
- Supports cascaded switches using the daisy-chain switch to convert Port 1 (10 Mb/s) or Ports 7 and 8 (100 Mb/s) to a daisy-chain port
- Automatic media detection for the combo port
- Supports both full-duplex and half-duplex operation for all ports
- Total bandwidth of up to 260 Mb/s (when full-duplex mode is used)

- Uses “on the fly” cut-through switching technique to transport packets
- Minimum latency of packet transmission (leading edge to leading edge) of less than 20 microseconds when using cut-through switching
- Supports transparent bridging function
- Operates at maximum packet filtering and forwarding rate
- Provides a 64 KB buffer for each 10 Mb/s port, and a 160K buffer for each 100 Mb/s port
- Routing table contains 4K entries per port to store MAC address for attached network nodes
- Provides address learning function to build the routing information database
- Uses fast hashing scheme to retrieve information from routing table when making routing decisions
- Provides frame filtering and forwarding functions for each port, which are capable of filtering and forwarding 100% of all Ethernet packets at a rate of 14,880 packets per second for the 10 Mb/s ports and 148,800 for the 100 Mb/s ports
- Nonblocking crossbar switching matrix allows concurrent operation of up to eight Ethernet segments
- Microprocessor-based design to monitor network utilization, collisions, link, and port partition status
- A LED indicator panel for monitoring overall switching condition and individual port status
- Port utilization equalizer display
- Automatic polarity detection and correction permits automatic adjustment for wiring errors
- Conforms to the IEEE 802.3 and IEEE 802.3u specifications (10Base-T and 100Base-TX standards)
- Flexible installation for desktop or rack mount

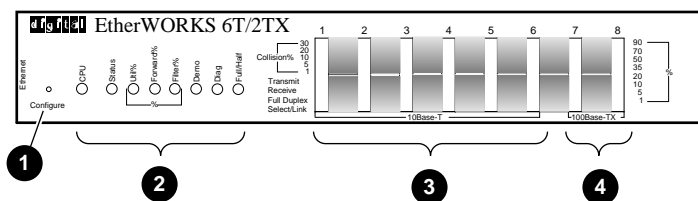
Hardware Description

Overview

This chapter describes the hardware features of the EtherWORKS Switch 6T/2TX. For easier management of the switch, familiarize yourself with the front panel display LEDs, ports, and daisy-chain switches shown in the following illustrations and described in the following sections.

Indicator Panel

The front panel on the DEL6X (shown in the following figure) provides a simple interface for configuring or monitoring the switch. It includes a **Configure** button **1**, power and display mode LEDs **2**, 10Base-T statistical display mode LEDs **3**, and 100Base-TX statistical display mode LEDs **4**.



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Configure Button

The Configure button, located on the left of the front panel (❶ in the following figure), is used to select the following configuration functions:

- Port status (displays status of ports during normal operation)
- System performance (displays relative bandwidth utilization rate, forwarding ratio, or filtering ratio for each port)
- Demonstration (verifies that all LEDs are functioning properly)
- Diagnostics (tests the status of various system components)
- Full- and half-duplex mode (sets port communication to full-duplex or half-duplex operations)

To set system performance or diagnostic mode, use the following procedures:

Note

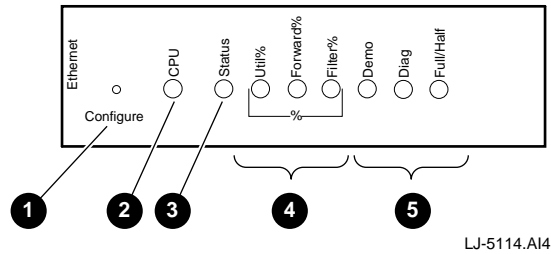
The term “long press” means to press the Configure button for more than 2 seconds, then release it. The term “short press” means to press the Configure button, then immediately release it. If the Configure button is not pressed within 10 seconds, the system returns to normal operation.

1. **To start the configuration**, use a long press on the Configure button. The LEDs will light to show the selected configuration function. (Refer to the related sections in this chapter and in Chapter 4 for complete details.)
2. **To scan through the configuration functions**, use a short press on the Configure button. (Refer to Chapter 4 for information on how to select full- and half-duplex communications.)
3. **To accept and implement the current settings**, use a long press on the Configure button.

LEDs

The LEDs shown in the following figure indicate:

- The unit is receiving power and the CPU is running ❷
- The current display mode ❸
- The statistical display for system performance ❹
- The demonstration, diagnostics, and full- and half-duplex display modes ❺



CPU LED (Power)

The CPU LED indicates the conditions described in the following table:

LED Activity	Condition	Indication
Blinking light	ON	Unit is receiving power, CPU is running
No light	OFF	Power is disconnected, no power received

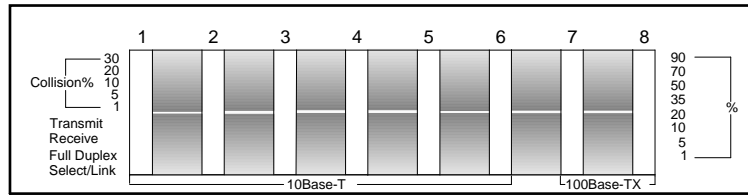
Port Status Display Mode (Status)

The port status display LED (❸ in the previous figure) shows the port status for the DEL6X.

When this LED lights (see the following table), the port status display LEDs (shown in the next figure) provide the information described in the following sections:

LED Activity	Condition	Indication
Steady light	ON	Port status display mode is active
No light	OFF	Port status display is inactive

Hardware Description



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Collision Ratio (Collision%)

Collisions occur when two or more devices connected to a DEL6X attempt to transmit data simultaneously on the network. When a collision occurs, the devices pause, then retransmit after a pseudo-random wait period. Because wait periods differ among devices, successive collisions become increasingly improbable.

The collision LEDs assist the network manager in monitoring the percentage of packet collisions occurring relative to the total packets transmitted by each port. The collision LEDs are labeled by row to indicate the percentage of collisions encountered by the corresponding port. When collisions reach a level marked on the LED display, the corresponding LED lights. For example, if packet collision reaches 1%, the LED labeled 1% will light. However, if collisions go beyond 30%, the LED labeled 30% and all the other LEDs before it (1, 5, 10, and 20) also light in rapid succession (see the previous figure and the following table).

Label%	Color
30%	Red
20%	Amber
10%	Amber
5%	Green
1%	Green

Transmit Status

The following table describes the Transmit status LEDs when outgoing traffic exits the port:

LED Activity	Condition	Indication
Blinking light	ON	Port is transmitting packets; frequency of blinking is proportional to the traffic passing through the port
No light	OFF	No packets are being transmitted from this port

Receive Status

The following table describes the Receive status LEDs when incoming traffic enters the port:

LED Activity	Condition	Indication
Blinking light	ON	Port is receiving packets; frequency of blinking is proportional to the traffic passing through the port
No light	OFF	No packets are being received on this port

Select/Link Status

The following table describes the Select/Link status LEDs during a valid network connection associated with the port:

LED Activity	Condition	Indication
Steady light	ON	Valid link has been established on this port
No light	OFF	No valid link has been established on this port

Note

If the Select/Link LED does not light when a device is connected to its corresponding port, make sure that both the DEL6X and the connected device are powered on. For devices connected to the DEL6X using twisted-pair cable, make sure that the cable length does not exceed 100 meters. Use standard, straight-through cables. Do not use crossover or other specialized cables.

Statistical Display for System Performance

The statistical display LEDs (shown in the previous figure) indicate a functional value for each port, depending on the selected display mode. (Refer to the previous **Configure Button** section for information on setting the display mode.) These LEDs are described in the following table and sections:

Label (%)	Color
90%	Red
70%	Amber
50%	Amber
35%	Green
20%	Green
10%	Green
5%	Green
1%	Green

Port Utilization Rate (Util%)

These LEDs show the percentage of valid data transmitted over the complete network bandwidth (updated every 0.5 seconds). There are eight LEDs representing the percentage of network utilization. The corresponding LEDs light to show that the utilization of LAN bandwidth has reached this percentage (see the following table). When active, these LEDs function similar to a stereo system's equalizer display.

For example, if network utilization reaches 1%, the LED labeled 1% will light. However, if network utilization rises above 1% (for example, 35%), the LED labeled 35% and all the other LEDs before it (1, 5, 10, and 20) will also light in rapid succession. These LEDs monitor the share of valid network frames handled by each port within a 10 Mb/s or 100 Mb/s bandwidth, depending on the port. The LEDs provide a quick way to monitor the current traffic load relative to the network's capacity.

LED Activity	Condition	Indication
Steady light	ON	Port utilization display mode is active
No light	OFF	Port utilization display mode is inactive

Port Forwarding Ratio (Forward%)

These LEDs show the percentage of packets that must be forwarded by bridging hardware to the other port on the DEL6X, that is, another LAN segment or connected workstation (see the following table). When viewing these LEDs, remember that under normal conditions, the DEL6X forwards all Ethernet packets that must be transferred among the connected LAN segments at full line speed.

LED Activity	Condition	Indication
Steady light	ON	Port forward display mode is active
No light	OFF	Port forward display mode is inactive

Port Filtering Ratio (Filter%)

These LEDs show the percentage of packets that must be filtered from the DEL6X by bridging hardware because the destination address is on the same segment connected to the receiving port. When viewing these LEDs, remember that under normal conditions, the DEL6X filters all Ethernet packets that belong to the local LAN segments at full line speed (see the following table).

LED Activity	Condition	Indication
Steady light	ON	Port filtering display mode is active
No light	OFF	Port filtering display mode is inactive

Demonstration Display Mode (Demo)

When this function is enabled (see the following table), the system cycles through all the DEL6X LEDs to verify that the LEDs are functioning. The LEDs will continue to light until the Demo function is disabled.

LED Activity	Condition	Indication
Steady light	ON	Demonstration function is enabled
No light	OFF	Demonstration function is inactive

Diagnostics Display Mode (DIAG)

When this function is enabled, the diagnostic display mode indicates that the system is in diagnostic mode. (Refer to the previous **Configure Button** section for information on setting the display mode.)

After powerup, the DEL6X automatically performs a self-diagnostic test. This test is done in two stages: the first stage is the system diagnostic test; the second stage is the port diagnostic test. If a problem is detected, the current diagnostic process (system or port test) will continue until completed. If the test does not complete successfully, the corresponding LEDs (described in the following table and sections) will flash after test completion to indicate which component failed the test.

Note

Enabling the Diagnostic function activates tests similar to the one performed upon powerup. After successfully completing diagnostics, the system returns to normal operation.

System Diagnostic Test

The following table describes the system-level failures and corresponding LEDs. If a problem is detected, failure indications will appear in Row 9.

LED (Column, Row)	Color	Component Tested
1, 9	Red	System ROM
2, 9	Red	System RAM
3, 9	Red	System EEPROM

Port Diagnostic Test

The port diagnostic test checks all ports. If a problem is detected, the LEDs in the corresponding column (indicating the malfunctioning port) and row (indicating the failed component) will light as shown in the following table:

LED (Row)	Color	Diagnostic Test Status
5	Green	Failed Output Queue RAM Test
6	Green	Failed Input Queue RAM Test
7	Amber	Failed Routing Table Test
8	Amber	Failed Port IC Test

Full- and Half-Duplex Communication Setting (Full/Half)

The communication mode can be set to either full-duplex or half-duplex operation. The LED for the corresponding port in the LED row labeled Full-Duplex should be set as indicated in the following table. The LED row labeled Select is used in conjunction with the Full/Half LED to specify the current port to configure. (Refer to Chapter 4 for information on setting the communication mode.)

LED Activity	Condition	Indication
Steady light	ON	Port is set for full-duplex operation
No light	OFF	Port is set for half-duplex operation

The DEL6X supports full-duplex mode for all ports except the BNC port. If you use full-duplex for the AUI port when connecting to a fiber-optic backbone, be sure that your external transceiver (for example, a MAU) supports full-duplex operation.

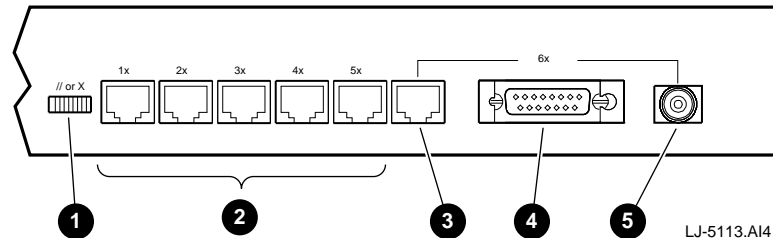
Full-duplex operation applies only to point-to-point access (for example, when attaching the DEL6X to a PC, workstation, server, or another switch). Repeater hubs use a common collision domain for all communications, and therefore cannot support full-duplex mode. When connecting the DEL6X to a repeater hub, use a standard cascaded connection set for half-duplex communications.

Ethernet Ports

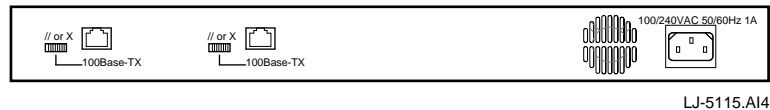
The DEL6X includes five 10 Mb/s Ethernet ports, one combo 10 Mb/s Ethernet port, and two 100 Mb/s Fast Ethernet ports. These ports are shown in the following figures and described in the following sections.

8-Pin MJ Ports

There are six 8-pin MJ 10 Mb/s Ethernet ports available on the front panel (shown in the following figure) and one daisy-chain switch **1**. Five of these ports are dedicated ports **2**. One additional 8-pin MJ port **3** is included as part of the combo TP/AUI/BNC port (**4,5**). You can connect a PC, server, or workstation to any of these ports.



There are also two 8-pin MJ 100 Mb/s Fast Ethernet ports (Ports 7 and 8) located on the back panel (see the following figure). These ports can be used to connect to devices such as a high-speed server or Ethernet backbone.



Refer to the Connecting to Another Network Interconnection Device in Chapter 3 for connection information.

Combo Port 6

The DEL6X provides one 10 Mb/s combo Ethernet port on the front panel (see **3, 4, 5** in a previous figure). This multimedia port supports twisted-pair, AUI, or BNC connections, providing auto-detection of the media type currently used. A physical connection to one of these port types automatically disables the other two types. AUI and BNC port connections are described in the following sections; twisted-pair connections are described in the previous 8-Pin MJ Ports section.

AUI Port

The AUI trunk port on the front panel can be used to expand your network connection to the following:

- Fiber-optic Ethernet cable (10Base-F)
Attach an appropriate transceiver (MAU) directly to the DEL6X AUI port for a fiber-optic connection.
- Thick wire Ethernet cable (10Base5)
Run an AUI drop cable from the 10Base5 transceiver attached to the backbone to the DEL6X AUI port for a thick wire Ethernet connection.

Note

If the AUI port is set to full-duplex mode, be sure your transceiver also supports full-duplex communications.

BNC Port (10Base2)

The DEL6X has a built-in BNC transceiver for connections using ThinWire coaxial cable. The BNC port can link up to 30 switches on one coaxial cable segment. The ThinWire coaxial cable that links the BNC ports may be extended up to 185 meters and have computers or other Ethernet devices attached to it. When connecting two switches using BNC ports, there should be at least 0.5 meters (approximately two feet) of coaxial cable between the two BNC ports. If the DEL6X is at the end of an Ethernet cable, plug and lock the 50-ohm terminators to the T-connector on the BNC port.

Note

The BNC port does not support full-duplex communications. When using a BNC connection, be sure the corresponding port is set to half-duplex mode. (Refer to the Full-/Half-Duplex Mode Selection section in Chapter 4.)

Power Socket

The DEL6X is equipped with a universal full-range power source. The power socket accepts 100 Vac to 240 Vac at 50 or 60 Hz.

Overview

This chapter provides information on the EtherWORKS Switch 6T/2TX preinstallation requirements, how to establish network connections, and how to configure the system. The DEL6X can be installed on any level surface (for example, a table or shelf), or mounted in a standard equipment rack.

Preinstallation Requirements

Before connecting the DEL6X to the network, make sure you provide the right operating environment, including power requirements, sufficient physical space, and proximity to other network devices that are to be connected. Verify the following installation requirements:

- Power requirements of 100 Vac to 240 Vac ($\pm 10\%$) at 50 or 60 Hz (± 3 Hz). The DEL6X power supply automatically adjusts to the input voltage level.
- The DEL6X is located in a cool dry place, with at least 10 cm of space at the front and back of the switch for ventilation.
- The mounting screws, brackets, bolts, and nuts, and the right tools are available if you intend to mount the DEL6X on a rack.
- The network cables and connectors needed for installation are available.
- The DEL6X is installed at the center of the devices you plan to link, and near a power outlet.

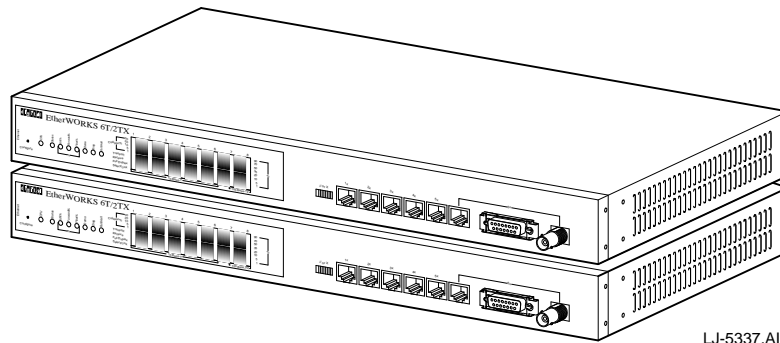
Hardware Installation

The DEL6X is suitable for desktop or rack-mount installation. It can be stacked with other switches using a mounting rack, or stacked directly on top of one another. The following sections describe these methods.

Stacking the DEL6X Without a Rack

To stack the DEL6X on top of another switch (shown in the next figure), use the following procedure:

1. Stick the self-adhesive rubber foot pads (included in the DEL6X package) on each of the four hollow spaces located on the bottom of the first DEL6X.
2. Place the first DEL6X on a firm, flat surface in the area where you want the stack to be installed.
3. Repeat step 1 for additional switches before stacking them. The rubber foot pads cushion the switch against shock/vibrations and provide space between each switch for ventilation.

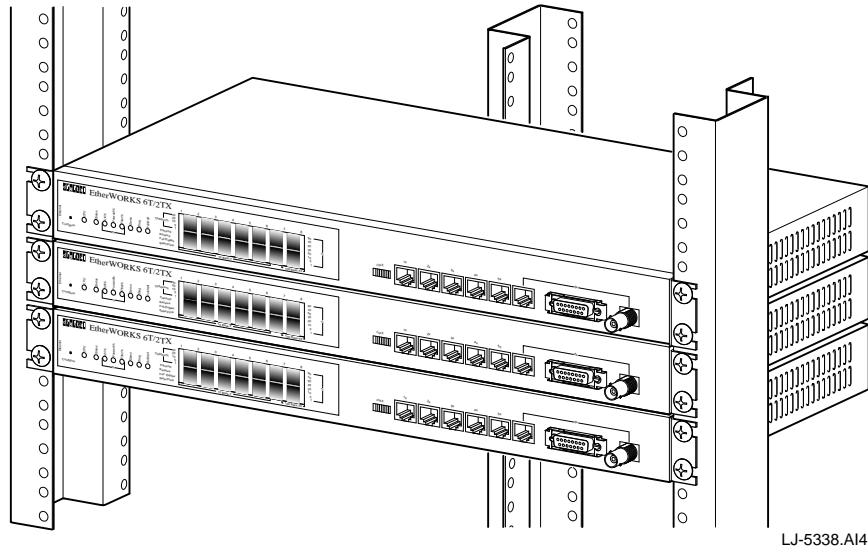


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Mounting the DEL6X in a Rack

To mount the DEL6X in a rack (shown in the next figure), use the following procedure:

1. Confirm that the rack you are using is an EIA standard size 19-inch rack.
2. Mount the DEL6X in the mounting rack using the screws and mounting brackets provided with the switch.



Connecting the DEL6X System

The following sections describe how to connect the DEL6X to a PC, server, workstation, another device, or trunk line.

Connecting to a PC, Server, or Workstation

The DEL6X supports five dedicated 8-pin MJ 10 Mb/s Ethernet ports, one combo 10 Mb/s Ethernet port with TP/AUI/BNC media options, and two 8-pin MJ 100 Mb/s Fast Ethernet ports.

Hardware Installation

To connect the DEL6X to a PC, server, or workstation, use the following procedure:

1. Prepare the systems you wish to network. Make sure they have properly installed 10Base-T or 100Base-TX network interface cards (NICs).
2. Prepare straight-through twisted-pair cables with 8-pin MJ connectors at both ends. Connect one end of the cable to the MJ port on the computer's NIC and the other end to one of the crossover-wired ports (x) on the DEL6X.

Ports 1 through 6 support 10 Mb/s Ethernet connections, while Ports 7 and 8 support 100 Mb/s Fast Ethernet connections. When connecting to Ports 1, 7, or 8, remember to set the Daisy-Chain switch to the crossover-wired (x) port. When inserting an 8-pin MJ plug, be sure the tab on the plug clicks into position to ensure that it is properly seated. Using the DEL6X in a standalone configuration, you can network up to eight end nodes.

Category 5 twisted-pair cable must be used for 100 Mb/s connections. Although Category 3, 4, or 5 cable can be used for 10 Mb/s connections, it is recommended that you use Category 5 cable for these connections to avoid any unnecessary expense or confusion if you subsequently upgrade to Fast Ethernet.

3. Set the communication mode using the **Configure** button to half-duplex or full-duplex operation to match the NIC installed in your computer. Refer to the Full- and Half-Duplex Communication Setting (Full Duplex) section in Chapter 2, and the Full/Half-Duplex Mode Selection section in Chapter 4.

Note

Make sure that the length of any twisted-pair cable does not exceed 100 meters. Digital recommends using BN25G-xx (UTP) or BN26M-xx (ScTP) point-to-point twisted-pair cable for connections. The xx stands for cable length in meters.

You may also connect a PC, server, or workstation to the AUI or BNC ports located on the DEL6X front panel. However, be sure to use a proper transceiver when connecting to these ports.

Connecting to Another Network Interconnection Device

To make a direct connection to another switch, to a compatible repeater or hub, or to a network interconnection device such as a bridge or router, use Port 1 for a 10 Mb/s Ethernet connection, or Port 7 or 8 for a 100 Mb/s Fast Ethernet connection.

Note

To achieve the best performance when cascading switches, isolate your heaviest traffic within the internal pathways provided by the DEL6X (that is, avoid heavy loading on the interswitch links).

To connect the DEL6X to another network interconnection device, use the following procedure:

1. Set the Daisy-Chain switch on the DEL6X to the straight-wired (//) port.
2. Prepare Category 3, 4, or 5 straight-through twisted-pair cables with 8-pin MJ connectors at both ends for the 8-pin MJ 10 Mb/s ports, or Category 5 cable for the 8-pin MJ 100 Mb/s ports.
3. Connect one end of the cable to the appropriate 8-pin MJ port on the DEL6X, and the other end to a standard crossover-wired (x) port on the other device.

As an alternative, you may connect to another compatible device by running straight-through twisted-pair cabling from a station port on the DEL6X to a crossover port on another switch. However, if you connect to another switch using the station ports at both ends of the cable, use crossover cabling.

Note

The IEEE 802.3 standard recommends restricting the number of hubs connected in a stack using twisted-pair cable to 5; IEEE 802.3u provides even stricter recommendations for Fast Ethernet. Therefore, when cascading devices other than the DEL6X, refer to the device's accompanying documentation for restrictions on stack size.

In contrast to repeater hubs, a cascade of switches divides the collision domain. The number of switches that can be cascaded is therefore theoretically unlimited. However, in practice, the length of a cascade may be limited by the timeout requirements of the particular applications running on the network.

Connecting to a Trunk Line

The DEL6X can connect to an Ethernet trunk line using an AUI or BNC connection, if necessary. The DEL6X provides one combo port (Port 6) that automatically detects the current media type.

To connect the DEL6X to a trunk line, use the following procedures:

1. For an AUI connection, attach the AUI connector with a 10Base5 transceiver to the thick wire Ethernet trunk. Run an AUI drop cable (with 15-pin D-type connectors on both ends) from the AUI port of the DEL6X to the transceiver. Note that the maximum length of an AUI drop cable is 50 meters.

If you plan to use the AUI port on the DEL6X for connecting to fiber-optic cable, attach the fiber-optic transceiver to the AUI port, then connect the transceiver to the corresponding cable (a 10Base-F trunk).

2. For a BNC connection, plug the BNC T-connector into the BNC port on the DEL6X. Use this port to connect the device to a 10Base2 ThinWire Ethernet trunk. If the unit is at the terminal end of a trunk segment, then connect a 50-ohm terminator to the open end of the T-connector.

Note

If your transceiver provides a signal quality error (SQE) test, disable the test.

Providing Power to the DEL6X

To provide power to the DEL6X, use the following procedure:

1. Powerup the DEL6X by plugging the power cord into the power socket at the back of the switch, then plugging the other end into a power outlet.
2. Check the power LED (labeled CPU) on the front panel to make sure that it is turned on. The DEL6X will automatically select the setting that matches the connected input voltage. Therefore, no additional adjustments are necessary when connecting it to any input voltage within the range marked on the back panel.
3. The DEL6X performs a self-diagnostic test upon powerup. (This test takes about 50 seconds to complete.) For details about the system self-diagnostic test, refer to the Diagnostic Display Mode section in Chapter 2.

Verifying System Operation

Verify that all attached devices have a valid connection. The DEL6X monitors link status for each port. If any device is properly connected to the DEL6X and transmitting a link beat signal, the Link LED lights for the corresponding port.

If the Link LED fails to light when you connect a device to the DEL6X, check the following items:

- Ensure that the twisted-pair cable is properly attached to the DEL6X and the connected device. Verify that the 8-pin RJ plug snaps into place when attached.
- Ensure that the twisted-pair cable is functioning properly by using it for another port and attached device that displays valid indications when connected to the network.
- Check the length of the twisted-pair cable to be sure it does not exceed 100 meters.
- Verify that the computer's adapter is functioning properly by trying it in another computer that has been successfully connected to the network.

If you still cannot resolve the problem, refer to Appendix A.

Setup and Configuration

Overview

This chapter provides information on the EtherWORKS Switch 6T/2TX system setup that includes powerup diagnostics, and using the Configure button to perform diagnostic tests and to set display modes.

Diagnostic Tests

Upon powerup, the DEL6X performs an internal self-diagnostic test of major switch components. If any component fails during the test, the DEL6X will try to complete the diagnostic procedure. Otherwise, the system will hang. For related information, refer to the Diagnostics Display Mode section in Chapter 2.

The components to be tested include the following:

- System ROM
- System RAM
- System EEPROM
- Ports 1 through 8

During normal operation, you can use the Configure button any time you want the system to perform a diagnostic test. When testing begins, the system leaves normal operation. If no problem is encountered by diagnostics, the system automatically returns to normal operation.

Setting the Display Mode

This section describes the information available for each display mode and the corresponding LEDs. The display functions are listed in the sequence selected by the **Configure** button. For a more detailed description of these LEDs, refer to Chapter 2.

A long press on the **Configure** button is used to initiate basic configuration. (The LEDs light to indicate the configuration function.) A short press switches between functions. A second long press implements the current selection.

Port Status Display

Active LED: Status (ON)

This is the default display mode that provides information on system status using the Collision, Transmit, Receive, and Link LEDs.

Bandwidth Utilization

Active LED: Util% (ON)

In this mode, the statistical LEDs (the LED array labeled %) show the percentage of valid data transmitted over the whole network bandwidth.

Packet Forwarding Ratio

Active LED: Forward% (ON)

In this mode, the statistical LEDs show the percentage of packets that are forwarded by bridging hardware to another port on the DEL6X.

Packet Filtering Ratio

Active LED: Filter% (ON)

In this mode, the statistical LEDs show the percentage of packets that are filtered from the DEL6X by bridging hardware because the destination address is on the segment connected to the receiving port (that is, in the same segment with the source address).

Demonstration Function

Active LED: Demo (ON)

Enabling the Demo function will light all LEDs, one at a time. The LEDs will continue to light until the Demo function is disabled (Demo LED is OFF) using the **Configure** button.

Diagnostic Function

Active LED: Diag (ON)

Enabling the Diagnostic function will activate diagnostic tests similar to the one performed upon powerup. After successfully completing diagnostics, the system returns to normal operation. For diagnostic test details, refer to the Diagnostic Tests section in this chapter

Full-/Half-Duplex Mode Selection

Active LED: Full/Half (ON)

This function is used to set the communication mode for selected ports to full-duplex or half-duplex.

1. Use the Configure button to light the Full/Half display mode LED.
2. Use a long press to move to the required port (light the Link LED for the target port).
3. To change the current setting for a port, use a short press (light the full-duplex LED to select full-duplex communications), then use a long press to effect the setting and move on to the next port.
4. When Port 8 is reached, use a long press to terminate duplex mode selection.

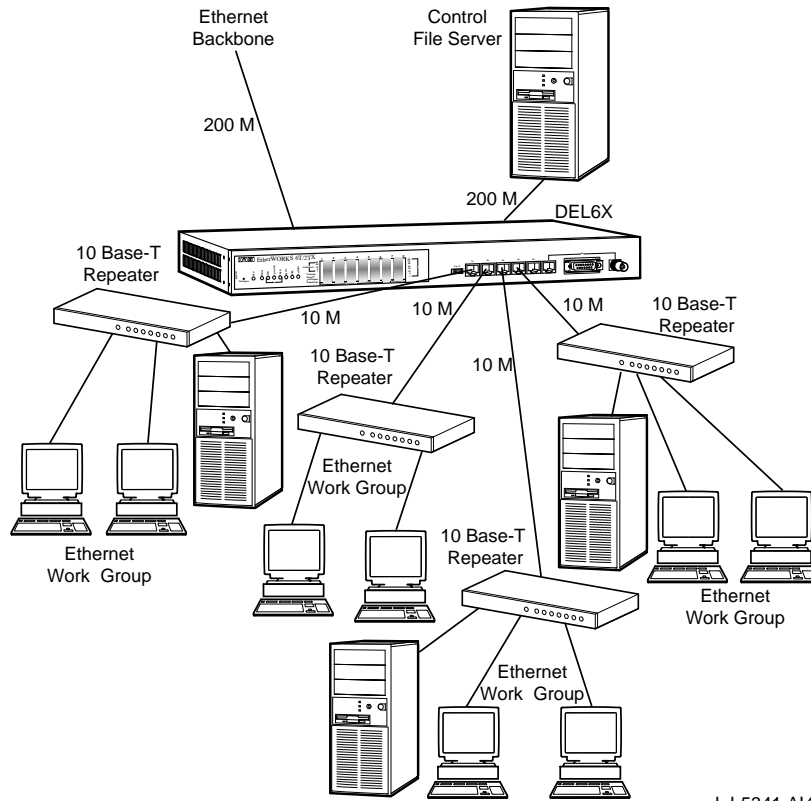
Overview

This chapter describes some of the common applications for the EtherWORKS Switch 6T/2TX. The DEL6X is designed to provide flexibility in configuring your network connections. It can be used as a simple standalone switch; it can be connected to standard repeaters and switches; or it can be connected to other interconnection devices in various configurations.

Multiport Bridge with High-Bandwidth Backbone

Most networks are interconnected with traditional two-port bridges that insert significant latency into normal communications. For traffic that must pass through several bridges to reach its destination, this latency can degrade communications considerably. With six straight-wired 10 Mb/s bridging ports and two internally bridged 100 Mb/s ports, the DEL6X can collapse a complex network into a single, efficient, bridged node, thereby increasing overall bandwidth and throughput.

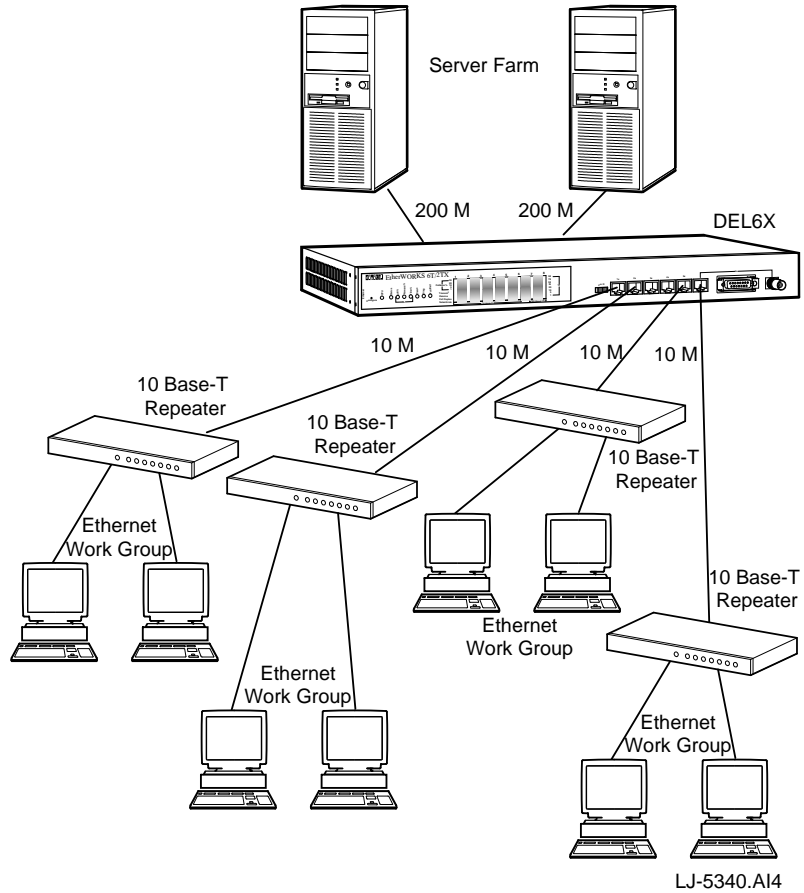
Segments attached to the DEL6X no longer have to cross the backbone, now reaching each other at near zero latency. However, for high-bandwidth applications that must pass data across the network backbone, the 100 Mb/s ports provide a high-speed “fat pipe” for fast access (see the following figure).



LJ-5341.A14

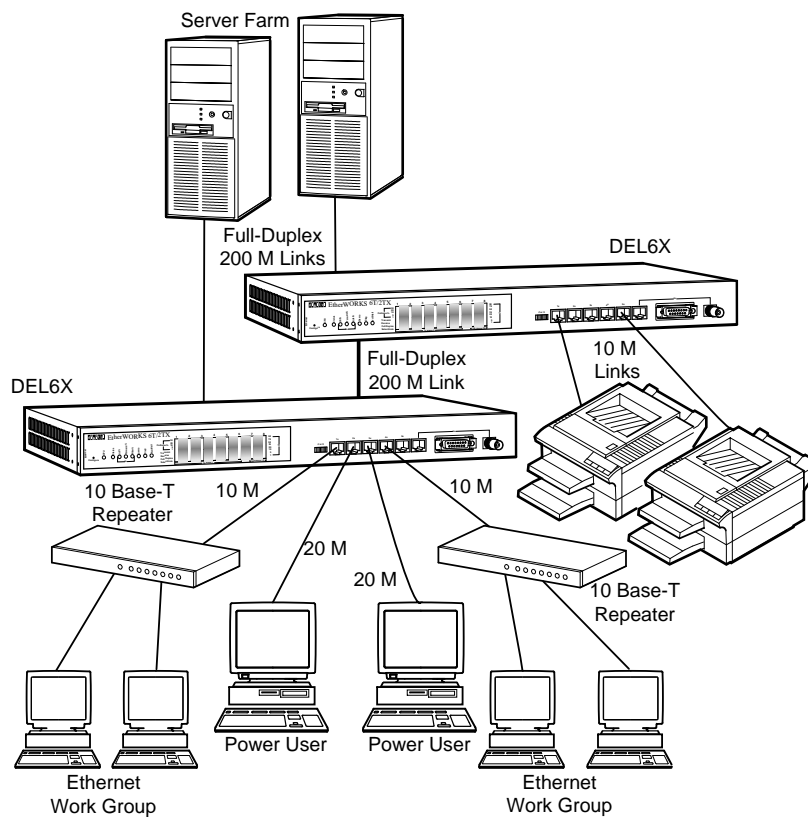
High-Bandwidth File Server

The DEL6X is not only used to boost bandwidth for work groups, but also to enhance network throughput when accessing high-volume file servers. The DEL6X provides parallel communications between the high-speed 100 Mb/s ports and each of the 10 Mb/s station ports. This allows multiple conversations to occur concurrently, which can make key servers (or other heavily used devices) available to more users, and thereby significantly expand overall throughput. The DEL6X also helps you to centralize multiple servers in a single location, easing supervision and maintenance (see the following figure).



High-Speed Link Between Switches

The most common LAN implementations use a combination of standard repeater hubs, bridges, and routers. The bridges and routers quickly become bottlenecks, reducing overall network throughput. Switching to higher speed LANs, such as Token Ring or FDDI, is not a good choice for most people. Besides being very expensive, you have to replace all existing Ethernet cable and adapters, restructure your network, then implement more expensive administration procedures. By using switches instead of bridges and routers to tie together LAN segments, you retain a cohesive LAN structure in which any node can freely communicate with any other node in the network. For network applications that require routers (for example, interconnecting dissimilar network types), attaching switches directly to a router can significantly improve overall Ethernet performance (see the following figure).



LJ-5339.A14

Overview

This chapter provides information about the comprehensive array of LEDs located on the front panel of the DEL6X.

Diagnosing DEL6X LEDs

The LEDs on the DEL6X assist the network manager in identifying potential problems.

The following table describes the common problems you may encounter and possible solutions:

Symptom	Cause	Solution
Link LED does not light (green LED) after making a connection.	Computer's NIC, cable, or DEL6X port is defective.	Check the NIC and cable connections for possible defects. Replace the defective NIC or cable.
Power LED displays a steady green light long after powerup	Power supply, CPU, or cord is defective.	Check the cord and wall outlet. Replace the cord if defective. If the power supply or CPU is defective, see your reseller or Authorized Digital Distributor.

Use the diagnostic procedures described in Chapter 2 to verify that all other system components are functioning properly. If any component fails the diagnostic test, contact your Digital Services Representative.

System Diagnostics

This section describes the system components to be verified.

Installation

Verify that all system components have been properly installed. If one or more components appear to be malfunctioning, test them in an alternate environment where you are sure that all the other components function properly.

Cabling

Verify the DEL6X cabling as follows:

1. Check that you are using the correct cable type. Straight-through cable should be used for all standard twisted-pair connections. Be sure all cable connectors are securely seated in the required ports.
2. When cascading two switches using 8-pin MJ station ports at both ends of the cable (not the daisy-chain port), make sure a crossover cable is used. Crossover cable should only be used if the daisy-chain port is not available on either switch.
3. When using ThinWire Ethernet cables, be sure both ends are terminated with 50-ohm terminators.
4. Make sure all devices are connected to the network. Equipment may have been unintentionally disconnected from the network.

External Adapters

Verify the following:

1. The network adapter cards installed in the computers are in good working condition.
2. The media transceivers are functioning properly, and the SQE test has been disabled for transceivers attached to the DEL6X.

Configuration

If a problem occurs after altering the network configuration, restore the original connections, then try to isolate the problem by implementing the new changes, one step at a time. Ensure that cable distances, repeater limits, and other physical aspects of the installation do not exceed recommendations.

DEL6X Integrity

Verify the integrity of the DEL6X with a power-on reset. Turn the power to the DEL6X off, then on. If the problem persists and you have completed the previous diagnoses, then contact your Digital Services Representative.

General Information

Overview

This appendix provides the following general EtherWORKS Switch 6T/2TX information:

- Physical characteristics
- Regulatory standards compliance
- Operating environment and power requirements
- Connector pin assignments
- Other Digital network adapter products

Physical Description

The DEL6X switch measures 440 mm (17.3 inches) by 240 mm (9.45 inches) and is 43 mm (1.69 inches) in height.

The DEL6X has five 8-pin MJ 10Base-T ports, one TP/AUI/BNC 10 Mb/s combo port, and two 8-pin MJ 100Base-TX ports.

Conformance

The DEL6X conforms to the following IEEE standards and media-supported specifications:

- IEEE 802.3 10Base-T
- IEEE 802.3u 100Base-TX
- 10Base2
- AUI Class II standards

Operating Environment Specifications

The following table lists the operating environment and power requirements for the DEL6X:

Specification	Rating
Operating temperature (sea level)	0°C to 50°C (standard operating)
Relative humidity	5% to 95% (noncondensing)
Radiated emissions	FCC, CISPR Class A VCCI Class I CE Mark
Safety	UL, CSA, TUV/GS CE Mark
Immunity	IEC 801-2, 3, 4
Power requirements	100 Vac to 240 Vac, 50/60 Hz, 20 W maximum

Bridging Criteria

The following table lists the bridging criteria for the DEL6X:

Criteria	Description
Network bridging function	Filtering, forwarding, and learning
Maximum filtering rate	Full line speed
Maximum forwarding rate	Full line speed
Network latency	Less than 20 microseconds
Address table	4K entries/port
Queue buffer	64 KB/port for 10 Mb/s ports 160 KB/port for 100 Mb/s ports

Acoustical Specifications

The following table lists the acoustical specifications for the DEL6X.

Acoustics—Preliminary declared values per ISO 9296 and ISO 7779:

Product	Sound Power Level L_{wAd} B	Sound Pressure Level L_{pAm} dBA (bystander positions)
	Idle/Operate	Idle/Operate
DEL6X	5.9	44

Current values for specific configurations are available from Digital Equipment Corporation representatives (1 B = 10 dBA).

Schallemissionswerte—Vorläufige Werteangaben nach ISO 9296 und ISO 7779/DIN EN27779:

Produkt	Schalleistungspegel L_{wAd} B	Schalldruckpegel L_{pAm} dBA (Zuschauerpositionen)
	Leerlauf/Betrieb	Leerlauf/Betrieb
DEL6X	5,9	44

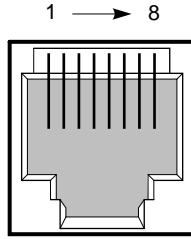
Aktuelle Werte für spezielle Ausrüstungsstufen sind über die Digital Equipment Vertretungen erhältlich (1 B = 10 dBA).

Connector Pin Assignments

This section describes the DEL6X connector pin assignments.

8-Pin MJ Port

The DEL6X twisted-pair network connector pin signals are shown in the following figure and explained in the following table:



LJ-4797.A14

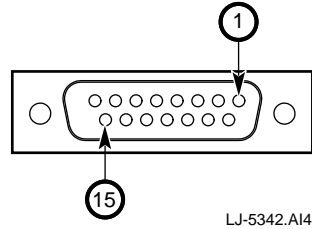
Pin	Ports 1 Through 8 ¹	Daisy-Chain Ports 1, 7, and 8 ²
1	Input Receive Data+	Output Transmit Data+
2	Input Receive Data-	Output Transmit Data-
3	Output Transmit Data+	Input Receive Data+
6	Output Transmit Data-	Input Receive Data-
4,5,7,8	Not used	Not used

1 Applies to Ports 1, 7, and 8 when the daisy-chain switch is set to crossover-wired (x) port.

2 Applies to Ports 1, 7, and 8 when the daisy-chain switch is set to straight-wired (/) port.

AUI Port

The DEL6X AUI network connector pin signals are shown in the following figure and explained in the following table:



Pin	Assignment
1	Collision In shield
2	Collision In+
3	Data Out+
4	Data In shield
5	Data In+
6	DC power common
9	Collision In-
10	Data Out-
11	Data Out shield
12	Data In-
13	DC power+
14	Power shield
7, 8, 15	No connection

Other Digital Network Adapter Products

The EtherWORKS Switch 6T/2TX is part of a complete family of low-cost network switches, adapters, and boot ROMs developed by Digital Equipment Corporation. Other products include the following:

DE45X-AR Remote Boot ROM

This option ROM is installed on an EtherWORKS Turbo PCI 10 adapter (either DE450-CA or DE450-TA) in a DOS-based system. The installed ROM can be configured and tested using the EZWORKS Installation utility. The DE45X-AR remote boot ROM enables your computer to perform a remote boot using the MOP or RPL protocols.

Digital offers the following remote boot ROMs to be used with the EZWORKS Turbo PCI 10 adapter:

- DE45D-AR, 28-pin remote boot ROM
- DE45F-AR, 32-pin upgradable FLASH remote boot ROM

DE20M-AR Remote Boot ROM

This option ROM is installed on an EtherWORKS 3 Turbo adapter (either DE204 or DE205) in a DOS-based system. The installed ROM can be configured and tested using the EZWORKS Installation utility. This remote boot ROM enables your computer to perform a remote boot using the MOP or RPL protocols.

EtherWORKS Switch 2TTX (DEL2X)

This switch provides two 10/100 Mb/s 8-pin MJ ports (set at full- or half-duplex mode) to connect to either a subnetwork, or directly to a PC, server, or workstation. In addition to partitioning an overloaded network, the DEL2X provides connection between legacy 10Base-T networks and the newer generation 100Base-TX. The DEL2X is protocol independent, and therefore compatible with IEEE 802.3, IEEE 802.3u, TCP/IP, NetWare, DECnet, and XNS protocols. Where traditional 100Base-TX networks restrict the maximum distance between end nodes to 205 meters, the DEL2X divides your network into smaller and more manageable segments, each linked to the larger network with a switch. This enables unlimited maximum distance for communications between end nodes.

EtherWORKS Hub 8TX (DELXR) Repeater

This 8-port Class II 100Base-TX repeater complies with the IEEE 802.3u standard. The Hub 8TX is used for 100 Mb/s Ethernet networks. It can link two to eight PCs or workstations using Category 5 unshielded or screened twisted-pair (UTP or ScTP) cables to form a simple Fast Ethernet LAN. The Hub 8TX also contains a daisy-chain port to connect to another compatible repeater or switch using twisted-pair cable. The Hub 8TX is ready to run with all network operating systems and protocols. A Lifetime Warranty is included.

Fast EtherWORKS PCI 10/100 Adapter

This 32-bit dual-speed adapter uses a single connector for either a 10 Mb/s or a 100 Mb/s IEEE 802.3 Ethernet network connection. The adapter automatically senses and adjusts to either speed. The Fast EtherWORKS PCI 10/100 adapter is software configurable to operate in full-duplex mode, increasing aggregate bandwidth up to 20 Mb/s and 200 Mb/s. Easy installation of this adapter is ensured by using the EZWORKS Installation utility. The adapter supports IEEE 802.3u autonegotiation (DE500-AA) and IEEE 802.3 autosening (DE500-XA) functions. In addition, the DE500-AA model provides optional boot ROM support (FLASH or OTP) up to 128 KB. The device drivers for the Fast EtherWORKS 10/100 adapter include NetWare, Windows for Workgroups, Windows NT, Windows 95, PATHWORKS, LAN Manager, LAN Server, Banyan Vines client, SCO OpenServer, UnixWare, Digital UNIX, and OpenVMS. The adapter supports twisted-pair connections. A Lifetime Warranty is included.

EtherWORKS Turbo PCI 10 Adapter

This 32-bit, low-cost 10 Mb/s PCI Ethernet adapter features DMA bus master design with a fast cut-through FIFO buffer (2 x 256B FIFOs). Easy installation of this adapter is ensured by using the EZWORKS Installation utility. The adapter provides optional remote boot ROM interface for RPL, MOP, and other future protocols. The device drivers for the EtherWORKS Turbo PCI 10 adapter include NetWare, Windows for Workgroups, Windows NT, PATHWORKS, LAN Manager, LAN Server, Banyan Vines client, SCO OpenServer, UnixWare, Digital UNIX, and OpenVMS. The DE450-TA adapter supports twisted-pair connections and the DE450-CA adapter supports twisted-pair, ThinWire, and AUI connections. A Lifetime Warranty is included.

EtherWORKS 3 Turbo Adapter

This high-performance, 16-bit ISA adapter is designed to meet client/server needs. The low-cost adapter features 128 KB of on-board buffer RAM that is dynamically allocated for optimal transmit/receive performance. The device drivers for the EtherWORKS 3 Turbo adapter include NetWare, Windows for Workgroups, Windows NT, Windows 95, PATHWORKS, LAN Manager, LAN Server, Banyan Vines client, Packet Driver, SCO OpenServer, UnixWare, Digital UNIX, and OpenVMS. The DE204-AB supports twisted-pair connection and the DE204-AC supports ThinWire, twisted-pair, and AUI connections. A Lifetime Warranty is included.

EtherWORKS Turbo EISA Adapter

This 32-bit Ethernet adapter maximizes throughput without compromising CPU time or network performance. Ideal for intensive server-based applications, this adapter features a fast cut-through FIFO buffer (2x 256B FIFOs). The EtherWORKS Turbo EISA adapter supports full-duplex operation of 20 Mb/s. The device drivers for this adapter include NetWare, Windows for Workgroups, PATHWORKS, LAN Manager, LAN Server, Banyan Vines client, Packet Driver, SCO OpenServer, UnixWare, Digital UNIX, and OpenVMS. The adapter supports ThinWire, twisted-pair, and AUI connections. A Lifetime Warranty is included.

EtherWORKS PCMCIA Turbo Adapter

This credit card sized adapter is designed to link laptop and notebook systems to 10 Mb/s Ethernet networks quickly and affordably. This adapter for PCMCIA-compliant (Type II) PCs features a highly integrated single-chip design, easy installation, hot-swapping capabilities, and card and socket services. The device drivers for the EtherWORKS PCMCIA Turbo adapter include NetWare, Windows for Workgroups, PATHWORKS, LAN Manager, LAN Server, Banyan Vines client, Packet Driver, SCO OpenServer, UnixWare, Digital UNIX, and OpenVMS.

DEC FDDIcontroller/PCI Adapter

As the first PCI FDDI adapter in the industry, this custom high-performance, low-cost 32-bit adapter features an on-board CPU for SMT processing, DMA chip, and 1 MB buffer. Full-duplex capability extends bandwidth to 200 Mb/s. The device drivers for the DEC FDDIcontroller/PCI adapter include NetWare, Windows for Workgroups, Windows NT, Windows 95, PATHWORKS, LAN Manager, LAN Server, Banyan Vines client, SCO OpenServer, UnixWare, Digital UNIX, and OpenVMS. This adapter can be used with PCI-based Alpha, Intel, MIPS, and PowerPC systems. Four models are offered: UTP SAS and DAS (DEFPA-UB, DEFPA-MB), and MMF SAS and DAS (DEFPA-AB, DEFPA-DB). A Lifetime Warranty is included.

DEC FDDIcontroller/EISA Adapter

This custom high-performance, low-cost 32-bit adapter features an on-board CPU for SMT processing, DMA chip, and 1 MB buffer. Full-duplex capability extends bandwidth to 200 Mb/s. The device drivers for the DEC FDDIcontroller/EISA adapter include NetWare, Windows for Workgroups, Windows NT, Windows 95, PATHWORKS, LAN Manager, LAN Server, Banyan Vines client, SCO OpenServer, UnixWare, Digital UNIX, and OpenVMS. This adapter can be used with Alpha, Intel, MIPS, and PowerPC systems. Four models are offered: UTP SAS and DAS (DEFEA-UA, DEFEA-MA), and MMF SAS and DAS (DEFEA-AB, DEFEA-DA). A Lifetime Warranty is included.

Ordering Information

To order these products, contact an Authorized Digital Distributor or Digital sales representative. For more information, call 800-457-8211 in the U.S. and Canada, 508-692-2562 in other locations, or your local sales office.

Glossary

8-pin MJ connector

Most common terminator for twisted-pair wiring.

10Base2

IEEE specifications for running 10 Mb/s Ethernet using ThinWire coaxial cable. A cable segment can be up to 185 meters long and have a maximum of 30 nodes.

10Base5

IEEE specifications for running 10 Mb/s Ethernet using thick wire coaxial cable. A cable segment can be up to 500 meters long and have a maximum of 100 nodes.

10Base-T

IEEE specifications for 10 Mb/s Ethernet using unshielded or screened twisted-pair cable (UTP or 100-ohm ScTP). The maximum length of cable for a point-to-point connection is 100 meters.

100Base-TX

IEEE specifications for 100 Mb/s Ethernet using unshielded or screened twisted-pair cable (UTP or 100-ohm ScTP). The maximum length of cable for a point-to-point connection is 100 meters.

Attachment Unit Interface (AUI)

A 15-pin interface specified by the IEEE 802.3 standard for connecting a PC, server, workstation, or other device to a thick wire Ethernet backbone. This port can be connected to a variety of Ethernet media (including BNC or fiber-optic) using an Ethernet transceiver or Media Access Unit (MAU).

Glossary

BNC

An interface specified by the IEEE 802.3 standard for connecting a PC, server, or workstation.

bus topology

A network topological arrangement where only one path exists between any two nodes and data transmitted by any node is concurrently available to all other nodes on the same transmission medium.

configuration

The way to set up a computer, server, or local area network.

connection

A logical binding between two or more users of an interconnection service.

daisy-chain

A serial connection of devices with or without a faceplate. On the DEL6X, the straight-wired port (/) on Port 1 and Port 2 can be used to connect to other switches or compatible hubs in a daisy-chain configuration.

Ethernet

A network communication system developed and standardized by Digital, Intel, and Xerox, using baseband transmission, CSMA/CD access, logical bus topology, and coaxial cable. The successor IEEE 802.3 standard provides for integration into the OSI model and extends the physical layer and media with repeaters and implementations that operate on fiber optics, broadband, and twisted-pair.

IEEE 802.3 standard

Standard for the physical and electrical connections in local area networks (LANs) developed by the IEEE. The IEEE 802.3u standard covers these same issues for 100 Mb/s networks.

LED

Light-emitting diode. A semiconductor device used as an indicator or control light in electronic hardware. On the front panel of the DEL6X, LEDs are used to monitor a switch or network condition.

local area network (LAN)

A group of interconnected computers and support devices.

screened twisted-pair (ScTP)

A 100-ohm screened twisted-pair cable.

unshielded twisted-pair (UTP)

Cable composed of two insulated wires twisted together to reduce electrical interference; used in common telephone cord.