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# DECconcentrator™ 500

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## Single-Mode Option Card Installation

Order Number: EK-DEFCN-SM-xxx

**CAUTION**

People installing the cabling system described in this manual should know local building codes, fire codes, and any other applicable codes or regulations. The manufacturers or their distributors and agents will not be responsible for damage due to improperly installed cabling, neglect, misuse, or improper connection of devices to the cabling system.

**CAUTION**

This equipment is in the 1st Class category (information equipment to be used in commercial and/or industrial areas) and conforms to the standards set by the Voluntary Control Council For Interference by Data Processing Equipment and Electronic Office Machines aimed at preventing radio interference in commercial and/or industrial areas. Consequently, when used in a residential area or in an adjacent area thereto, radio interference may be caused in radios and TV receivers etc. Read the instructions for correct handling.

**NOTICE** – Class A Computing Device:

This equipment generates, uses, and may emit radio frequency energy. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference; in which case, measures taken to correct the interference are at the user's expense.

**NOTICE** – Class 1 Laser Device:

The lasers in this equipment are Class 1 devices, compliant with CDRH Rules 21, CFR Subchapter J, Part 1040.10, at date of manufacture. Class 1 laser devices are not considered to be hazardous.

# DECconcentrator™ 500

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## Single-Mode Option Card Installation

December 1991

This manual describes how to install and check the DECconcentrator 500 single-mode option cards.

Supersession/Update Information: This is a revised manual.

**digital**

Order Number: EK-DEFCN-SM-xxx

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# Contents

**Safety**

**Preface**

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## Safety

Warnings and cautions that appear in this manual are defined as follows:

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<b>WARNING</b>	Contains information to prevent personal injury.
<b>CAUTION</b>	Contains information to prevent damage to equipment.
<b>VORSICHT</b>	Enthält Informationen, die beachtet werden müssen, um den Benutzer vor Schaden zu bewahren.
<b>ACHTUNG</b>	Enthält Informationen, die beachtet werden müssen, um die Geräte vor Schaden zu bewahren.
<b>DANGER</b>	Signale les informations destinées à prévenir les accidents corporels.
<b>ATTENTION</b>	Signale les informations destinées à prévenir la détérioration du matériel.
<b>AVISO</b>	Contiene información para evitar daños personales.
<b>PRECAUCIÓN</b>	Contiene información para evitar daños al equipo.

---

The warnings and cautions that must be observed for the hardware described in this manual appear below in English, German, French, and Spanish. The pages on which these safety messages appear are also listed.

---

**CAUTION** 

Use a pointed tool to change switch settings. Never use a pencil; graphite can damage switches. (Page 1-3)

**ACHTUNG**

Verwenden Sie einen spitzen Gegenstand, z.B. einen Kugelschreiber, wenn Sie Schaltereinstellungen ändern wollen. Benutzen Sie dazu keinen Bleistift, da der Graphitabrieb die Schalter beschädigen kann.

**ATTENTION**

Utilisez un outil pointu pour changer le positionnement des commutateurs. N'utilisez jamais un crayon, car le graphite de la mine pourrait endommager les commutateurs.

**PRECAUCIÓN**

Con cualquier herramienta puntiaguda se cambian los parámetros de conexión, pero nunca con lápices porque el grafico daña los interruptores.

---

**WARNING** 

Some fiber optic equipment can emit laser light that can injure your eyes. Never look into an optical fiber or connector port. Always assume the cable is connected to a light source. (Page 1-5)

**VORSICHT**

Schauen Sie niemals direkt in ein Glasfaserkabel oder einen Glasfaseranschluß. Die Laserstrahlen in faser-optischen Geräten können Augenverletzungen verursachen.

**DANGER**

Certains équipements utilisant les fibres optiques peuvent émettre des rayonnements laser dangereux pour les yeux. Ne vous avisez jamais de regarder par l'extrémité d'une fibre optique ou dans l'ouverture d'un connecteur. Considérez toujours que le câble est relié à une source lumineuse.

**AVISO**

Algunos equipos de fibra óptica pueden emitir luz láser que daña los ojos. No se debe mirar en una puerta de conector o fibra óptica. Siempre se debe suponer que el cable está conectado a la luz.



---

**CAUTION** 

Static electricity can damage modules and electronic components. Digital recommends you use a grounded wrist strap and grounded work surface (Digital P/N 29-11762) when you handle any modules or internal parts. Do not remove any option cards from their antistatic bags until instructed to do so in the installation procedure. (Page 2-1)

**ACHTUNG**

Module und elektronische Komponenten können durch elektrostatische Entladungen beschädigt werden. Benutzen Sie immer eine antistatische Gelenkmanschette und eine geerdete Arbeitsunterlage, wenn Sie am offenen Gerät arbeiten. Ein Antistatik-Kit ist in der BRD bei DECdirekt unter der Bestellnummer 29-26246 erhältlich. Entfernen Sie die antistatische Verpackung erst von Erweiterungskarten, wenn Sie in der Installationsanleitung entsprechende Anweisungen sehen.

**ATTENTION**

Les charges excessives d'électricité statique peuvent endommager les modules et les composants électroniques. Digital conseille l'utilisation d'un bracelet de masse et d'un plan de travail mis à la terre (Réf. 29-11762) lors de la manipulation des modules et des composants internes. Si vous possédez des cartes en option, ne les retirez pas de leur housse antistatique avant d'en avoir reçu l'instruction.

**PRECAUCIÓN**

La electricidad estática puede dañar los componentes electrónicos y los módulos. Digital recomienda que se utilicen cintas de pasadores y superficies de trabajo conectadas a tierra (Digital P/N 29-11762) al trabajar con cualquier módulo o parte interna. No sacar de la bolsa ninguna placa de opciones adicional que pudiera tenerse hasta que se indique en el procedimiento de instalación.

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**WARNING** 

To avoid bodily injury or damage to the equipment, do not connect the power cord or any other cable until you are instructed to do so in these procedures.

Do not apply power to the unit unless all covers are installed. (Page 3-1)

**VORSICHT**

Schließen Sie das Netzkabel oder andere Kabel erst an, wenn Sie dazu aufgefordert werden. Andernfalls besteht LEBENSGEFAHR! Überdies können die Geräte Schaden nehmen.

Schließen Sie das Gerät erst an das Stromnetz an, wenn alle Abdeckungen ordnungsgemäß angebracht worden sind.

**DANGER**

Afin d'éviter tout risque d'accident corporel ou matériel, NE BRANCHEZ AUCUN cordon d'alimentation ou autre câble sans en avoir reçu l'instruction explicite dans la procédure.

Ne reliez au secteur qu'après l'installation complète de tous les capots.

**AVISO**

Para evitar daños internos al equipo, NO conectar el cable de alimentación ni ningún otro hasta que se indique en estos procedimientos.

---

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**WARNING** 

To avoid bodily injury, use care when connecting the concentrator power cord. Regulations in some countries may require an authorized person to connect the power.

Make sure you connect the power cord to a grounded wall outlet. (Page 3-1)

**VORSICHT**

Netzspannung ist lebensgefährlich. Beachten Sie dies, wenn Sie das Netzkabel anschließen. In einigen Ländern dürfen Elektrogeräte nur von entsprechend ausgebildetem Personal, beispielsweise Elektrikern, angeschlossen werden. Prüfen Sie, ob das in Ihrem Land zutrifft.

Schließen Sie das Netzkabel nur an eine geerdete Steckdose an.

**DANGER**

Afin d'éviter tout risque d'accident corporel, agissez avec la plus grande précaution lors du raccordement du cordon d'alimentation du concentrateur. Assurez-vous que la législation vous autorise bien à effectuer ce branchement.

Assurez-vous que la prise sur laquelle vous raccordez le cordon d'alimentation est effectivement reliée à la terre.

**AVISO**

Para evitar daños generales, es importante tener cuidado a la hora de conectar el cable de alimentación del concentrador. En algunos países existen estipulaciones para que la conexión la tenga que hacer una persona autorizada.

Hay que comprobar que se conecta el cable de alimentación a una toma conectada a tierra.

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**WARNING** 

A safety earth ground wire has been incorporated into this product through the three-wire plug cap of the ac power cord. For continued protection against risk of electric shock, this product must be connected to a three-wire wall receptacle that has its grounding terminal reliably connected to the building's safety earth ground. (Page 3-2)

**VORSICHT**

Das Stromkabel in diesem Gerät ist mit einem Schutzleiter versehen. Um optimale Sicherheit zu gewährleisten, dürfen Sie es nur an eine ordnungsgemäß geerdete Schuko-Steckdose anschließen.

**DANGER**

Cet équipement est mis à la terre au moyen du fil de terre du cordon d'alimentation secteur. Afin d'assurer une protection efficace contre tout risque d'électrocution, cet équipement doit être raccordé à une prise secteur équipée d'un contact de mise à la terre effectivement relié à la terre secteur du bâtiment.

**AVISO**

El producto consta de un cable de tierra en el enchufe trifásico del cable de alimentación. Para evitar el riesgo continuado de descargas eléctricas, este producto debe conectarse en una toma de pared trifásica que tenga un terminal de tierra con una conexión fiable a la toma de tierra del edificio.

---

**CAUTION** 

Make sure that the bend radius of any fiber optic cable is 2.5 centimeters (1 inch) or greater. (Page 3-5)

**ACHTUNG**

Der Biegungsradius von faseroptischen Kabeln muß mindestens 2,5 cm betragen.

**ATTENTION**

Assurez-vous que le rayon de courbure des fibres optiques n'est jamais inférieur à 25 mm.

**PRECAUCIÓN**

Hay que comprobar que el radio de inclinación de cualquier cable óptico de fibra es de es de 2,5 centímetros (1 pulgadas) o mayor.

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## Preface

This manual explains how to install the DECconcentrator 500 single-mode option cards into the DECconcentrator 500 system. The single-mode Network Management Card and the Port Card options provide long-distance links to the Fiber Distributed Data Interface (FDDI) over single-mode fiber.

### Intended Audience

This manual is for:

- The hardware installer
- The system/network manager

The hardware installer and system/network manager should be familiar with fiber optic network technologies, the FDDI ANSI X3T9 standards, and safety procedures.

### Structure of This Guide

This guide has three chapters and six appendixes:

- |                  |  |
|------------------|--|
| <b>Chapter 1</b> | Provides an overview and physical description of the DECconcentrator 500 single-mode Network Management and Port Card options. |
| <b>Chapter 2</b> | Describes how to install the single-mode Network Management Card and the Port Card.  |

<b>Chapter 3</b>	Describes how to verify the installation of the single-mode Network Management Card and Port Card.
<b>Appendix A</b>	Describes single-mode cable plant specifications.
<b>Appendix B</b>	Describes how to test and measure the relative power loss of a single-mode fiber optic cable link.
<b>Appendix C</b>	Contains the DECconcentrator 500 identification list.
<b>Appendix D</b>	Contains vendor information for purchasing patch cables, connector couplers, and inline loss element connectors.
<b>Appendix E</b>	Contains the software microcode upgrade package part numbers.
<b>Appendix F</b>	Lists related documents.

The post-paid Reader's Comments form on the last page of this document requests your evaluation of this document to assist us in preparing future documentation.

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## Single-Mode Option Cards

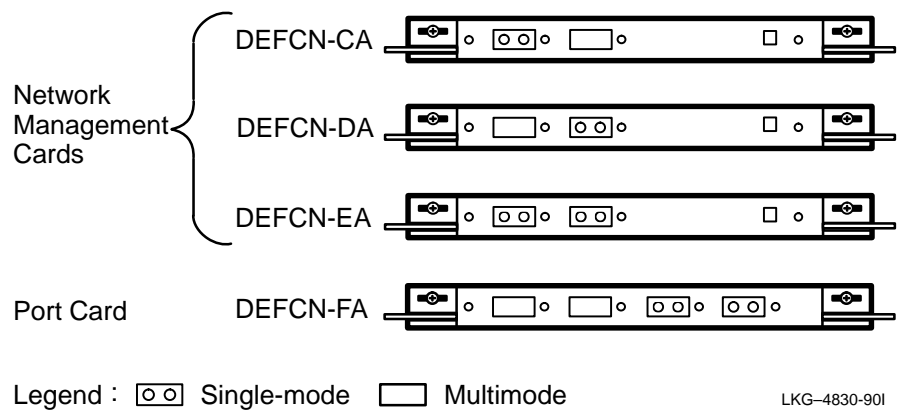
This chapter provides an overview and physical description of the single-mode option cards. Single-mode option cards allow devices that are connected to single-mode fiber to participate in the FDDI network.

### 1.1 Single-Mode Option Cards

Figure 1-1 identifies the three single-mode Network Management Cards and the single-mode Port Card.

**Figure 1-1: Single-Mode Option Cards**

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### 1.1.1 Network Management Cards

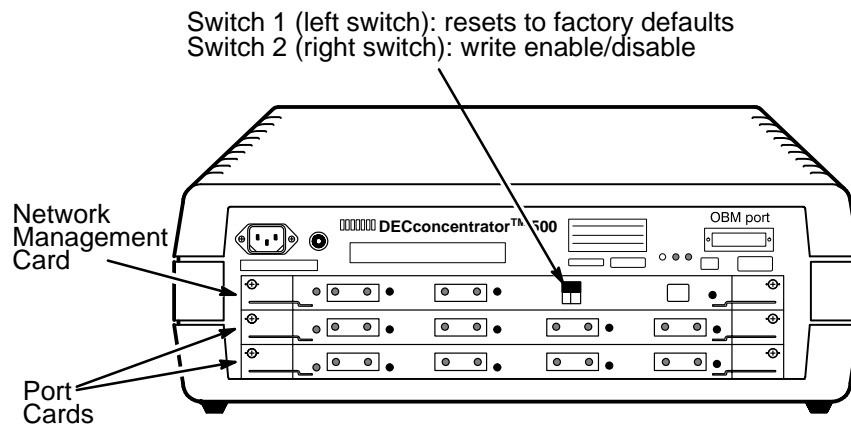
The Network Management Card has two ports and two switches on the front panel (see Figure 1–2). It is available in three versions:

- DEFCN-CA — Port A is single-mode and port B is multimode.
- DEFCN-DA — Port A is multimode and port B is single-mode.
- DEFCN-EA — Port A and port B are single-mode.

#### NOTE

The Network Management Card must be installed in the top slot of the DECconcentrator 500.

**Figure 1–2: Single-Mode Network Management Card Switches**

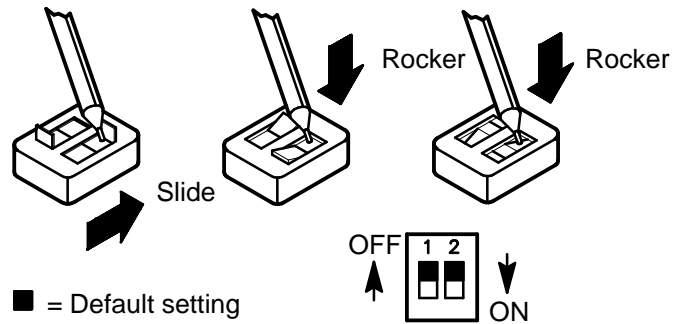


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The switches are used for initialization after option card installation. Each of the switches is a dual-position switch. Figure 1–3 shows the three types of switches that may be on the card. Refer to Table 1–1 for the Network Management Card switch settings.



**Figure 1–3: Types of Network Management Card Switches**



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**CAUTION**

Use a pointed tool to change the switch settings. Never use a pencil; graphite can damage the switches.

**Table 1–1: Network Management Card Switch Settings**

Switch	Default Setting	Function
1 (resets to default)	OFF	<p>When set to OFF at power up or restart, no action occurs.</p> <p>When set to ON at power up or restart, this switch resets any system parameters that have been altered through remote management to the default settings.</p> <p>To reset after the concentrator is installed and operational:</p> <ol style="list-style-type: none"> <li>1. Set the switch to ON.</li> <li>2. Turn the power on and wait for self-test to complete.</li> <li>3. Set the switch to OFF.</li> </ol>
2 (write enable/disable)	OFF	<p>When set to ON, enables write access including downline upgrade.</p>

### 1.1.2 Port Card

A single-mode Port Card has four ports and no switches.

#### NOTE

If there is no Network Management Card, you must install the single-mode Port Card in the top slot to ensure that the safety labels are visible.

The Port Card has one version:

- DEFCN-FA — Two single-mode M ports and two multimode M ports:
  - The two single-mode ports connect single attachment stations with single-mode fiber to the network.
  - The two multimode ports connect single attachment stations with multimode fiber to the FDDI network.

## 1.2 Laser Safety Information

#### WARNING

Some fiber optic equipment can emit laser light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that the cable is connected to a light source.

The DECconcentrator single-mode option cards use laser sources. The laser sources conform to the Class 1 safety regulations of the Center for Diseases and Radiological Health (CDRH) of the United States Department of Health and Human Services, Public Health Service, and the Food and Drug Administration. Class 1 laser devices are not considered to be hazardous.

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## Installing the Option Card

This chapter explains the following:

- Checking the shipment contents
- Disconnecting the power and data cables
- Removing a blank panel or a previously installed option card
- Installing the option card

### CAUTION

Static electricity can damage modules and electronic components. Digital recommends you use a grounded wrist strap and a grounded work surface (Digital P/N 29-11762) when you handle modules or internal parts. Do not remove any option cards you may have from their antistatic bags until instructed to do so in the installation procedure.

### NOTE

The only tool required for installation is a Phillips-head screwdriver.

If you experience any problems with the installation, refer to the problem-solving section of the *DECconcentrator 500 Installation* manual. Observe all cautions when you install an option card.

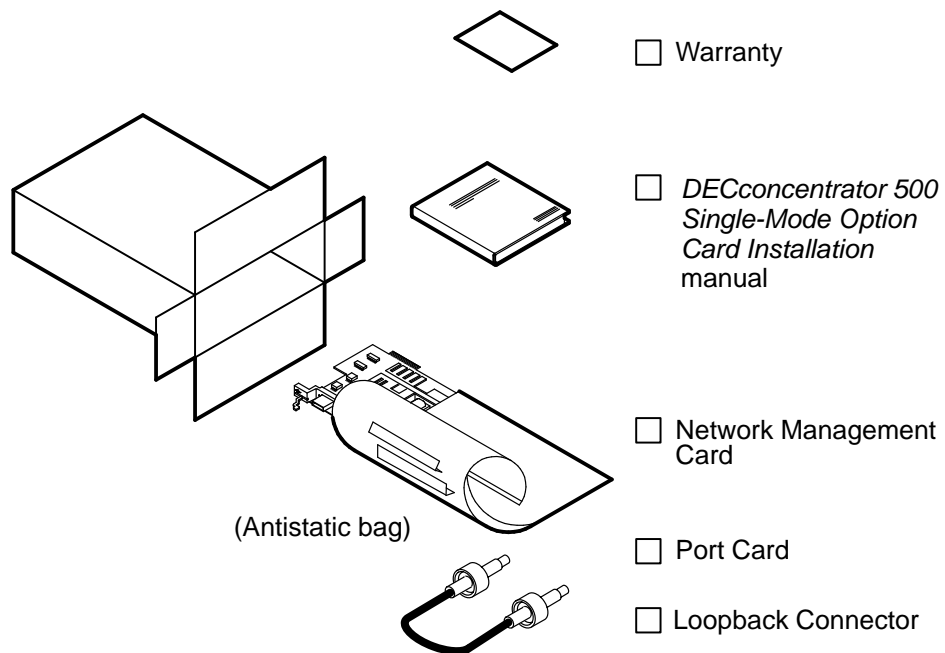
## 2.1 Checking the Shipment Contents

Refer to Figure 2–1 to check the contents of your shipment. Do not remove an option card from its antistatic bag until instructed to do so.

- In case of damage, contact your shipping agent and Digital sales representative.
- In case of missing parts, contact your Digital sales representative.

**Figure 2–1: Checking the Contents of Your Shipment**

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## 2.2 Disconnecting the Power and Cables

### NOTE

Adding an option card disrupts network traffic. Digital recommends that you add an option card when you know that there will be little or no use of the network.

Remove the power and data cables from the DECconcentrator 500 as follows:

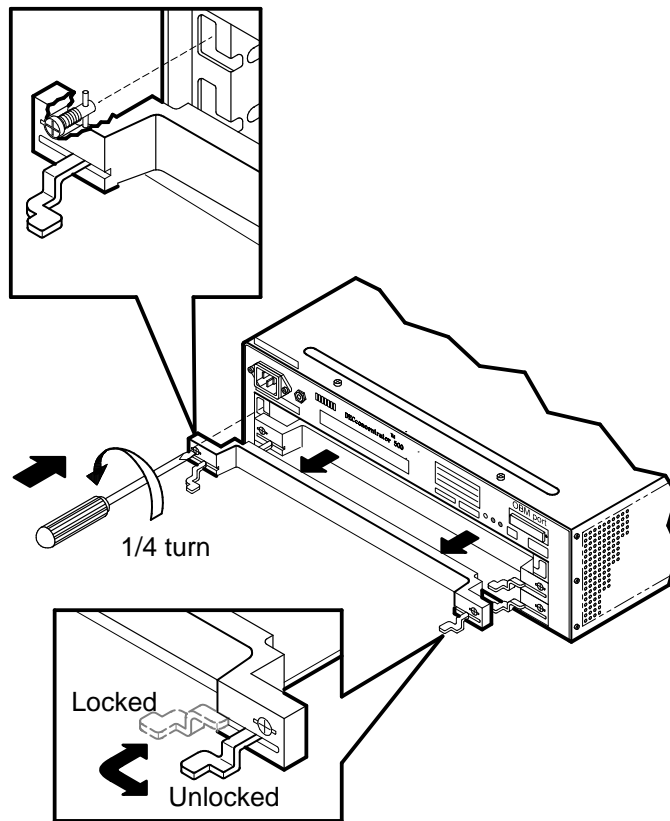
1. Disconnect the power cord from the power source.
2. Disconnect any fiber optic cable from the unit that prevents access to the slot where the option card is to be installed. Note the cable orientation and port location for each cable you remove.

## 2.3 Removing a Blank Panel or a Previously Installed Option Card

To remove a blank panel or a previously installed option card, do the following:

1. Place the antistatic wrist strap around your wrist and attach the other end of the strap to the concentrator chassis.
2. Use a Phillips-head screwdriver to push-in and turn the two captive screws counterclockwise one-quarter turn.
3. Unlock the locking levers (see Figure 2-2). Remove the blank panel or option card.

**Figure 2-2: Removing a Blank Panel or a Previously Installed Option Card**



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## 2.4 Installing an Option Card

If you are reinstalling a Network Management Card, notify the system/network manager that you are resetting the switches to the default setting.

### NOTE

Always install the Network Management Card in the top slot of the DECconcentrator 500.

If you are installing only Port Cards, install the single-mode Port Card in the top slot to ensure that the safety labels are visible.

To install an option card, do the following:

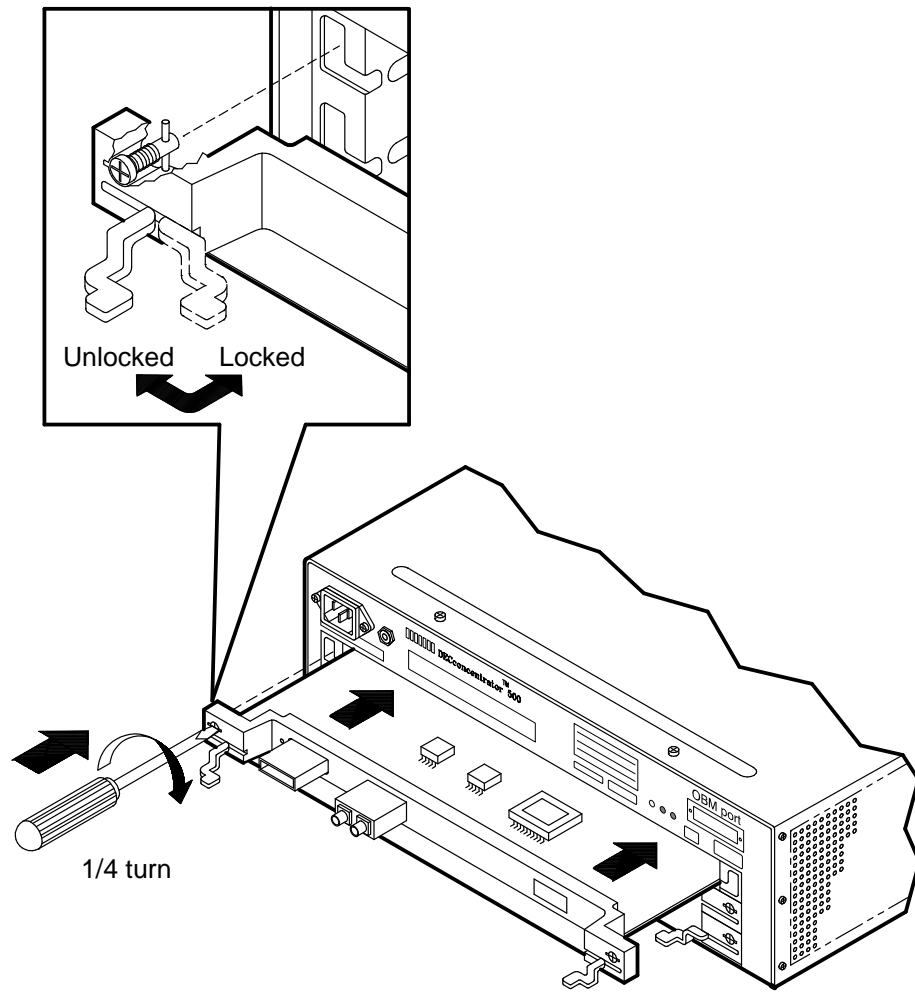
1. Attach the antistatic wrist strap around your wrist and attach the other end of the strap to the concentrator chassis.
2. Carefully remove the option card from its antistatic bag. Make sure that the locking levers on the option card are in the outward (unlocked) position.
3. Slide the option card into the appropriate slot. Make sure that the sides of the option card are seated in the guides of the DECconcentrator 500. Push firmly into place.
4. Lock the option card in place and turn the two captive screws clockwise one-quarter turn (see Figure 2-3).

### NOTE

If the card is a Network Management Card, refer to Figure 1-2 and Table 1-1 for information about the card switches.

5. Remove the antistatic wrist strap from your wrist and from the concentrator.

Figure 2-3: Installing Option Cards



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## Verifying the Installation

This chapter contains the procedures to connect the power and fiber optic cables. It also explains how to verify the operation of the DECconcentrator 500 unit and the ports.

### 3.1 Applying Power

**WARNING** 

To avoid bodily injury or damage to the equipment, do not connect the power cord or any other cable until you are instructed to do so in these procedures.

Do not apply power to the unit unless all covers are installed.

**WARNING** 

To avoid bodily injury, use care when connecting the concentrator power cord. Regulations in some countries may require an authorized person to connect the power.

Make sure you connect the power cord to a grounded wall outlet.

To verify the DECconcentrator 500 option card installation, do the following:

**WARNING** 

A safety earth ground wire has been incorporated into this product through the three-wire plug cap of the ac power cord. For continued protection against risk of electric shock, this product must be connected to a three-wire wall receptacle that has its grounding terminal reliably connected to the building's safety earth ground.

**NOTE**

If you installed a Network Management Card, go to step 1. If you installed a Port Card, go to step 2.

1. Set switch 1 on the Network Management Card to the ON position (refer to Figure 1–3).
2. Plug the power cord into the concentrator first and then into the wall outlet. This applies power to the concentrator and starts the self-test. Refer to the self-test section in the *DECconcentrator 500 Installation* manual.

After the self-test is complete, the port LEDs blink green. If the LEDs are not blinking green, refer to the problem-solving section in the *DECconcentrator 500 Installation* manual.

3. Set switch 1 to OFF (if you installed a Network Management Card).
4. Set switch 2 to ON for network management; otherwise, leave switch 2 set to OFF.

### 3.2 Loopback Testing

The loopback test determines whether the DECconcentrator 500 Network Management Card or Port Card is faulty. This test can also determine whether there is a problem with the cable or the device at the end of the cable. The port LED should be blinking green before you start the loopback test. Steps 1 through 3 describe how to perform the loopback test.

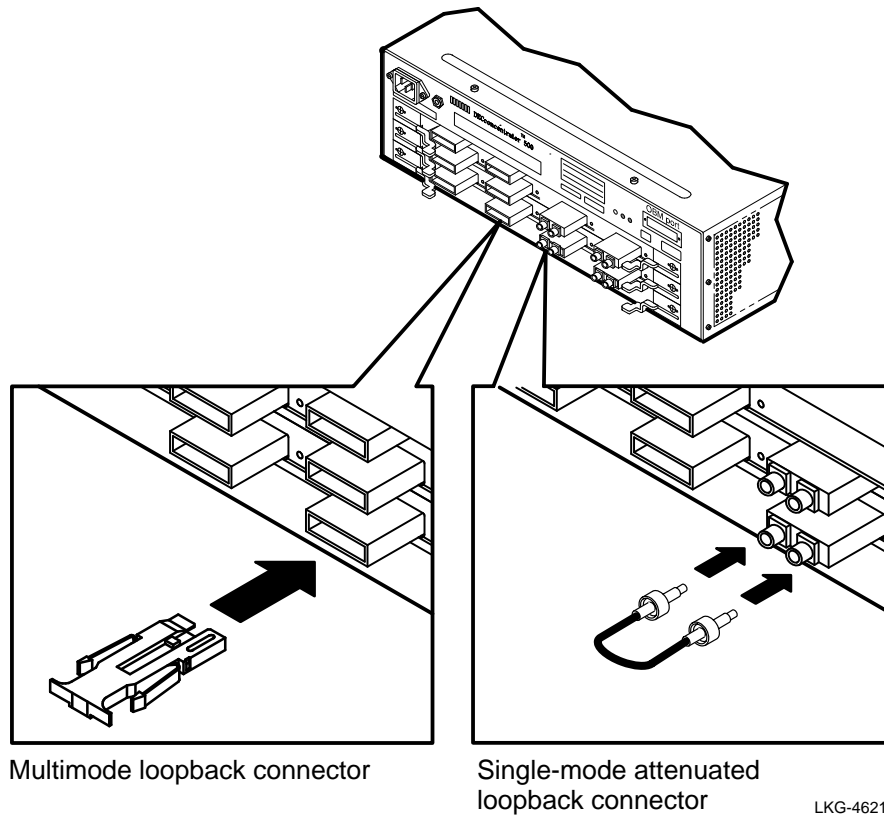
1. Remove the protective cap from the port to be tested.

**NOTE**

To avoid additional optical power loss, do not touch the fiber ends. Always replace protective caps when the fiber is not connected.

2. Connect the loopback connector to the port to be tested. Use the appropriate loopback connector for the port you are testing (see Figure 3–1).

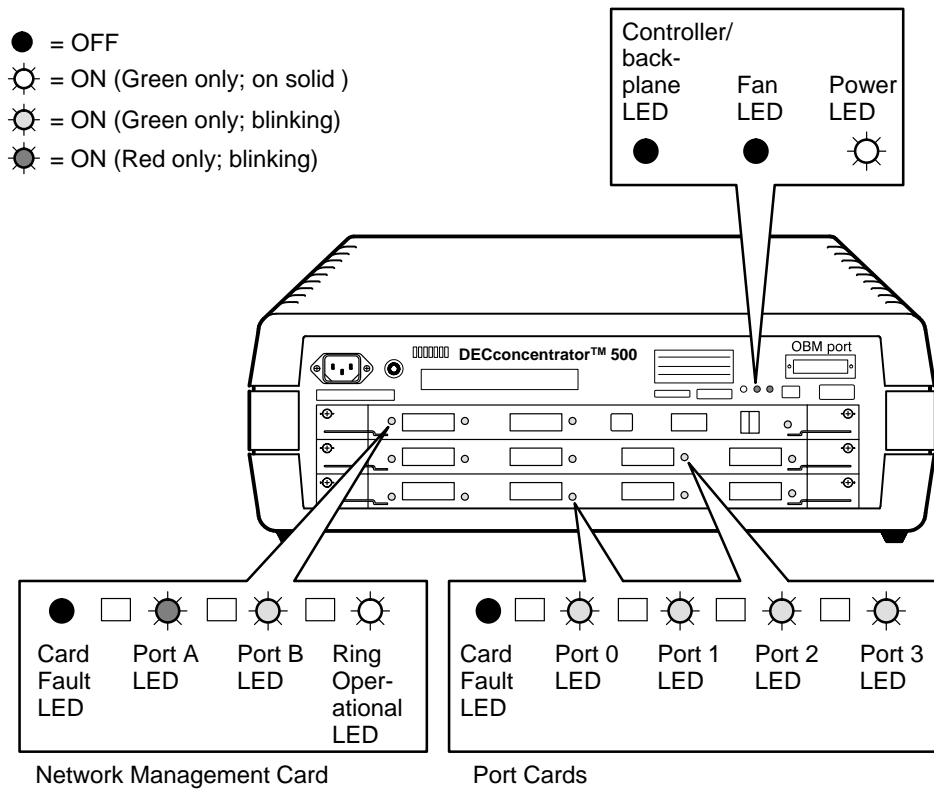
**Figure 3–1: Loopback Connectors**



After loopback connection, the port LED blinks red (see Figure 3–2). This indicates successful completion of the loopback test. If the LEDs do not match Figure 3–2, refer to the problem-solving section in the *DECconcentrator 500 Installation* manual.

3. Remove the loopback connector. The port LED blinks green again.

**Figure 3–2: Port LED Status During Loopback Testing**



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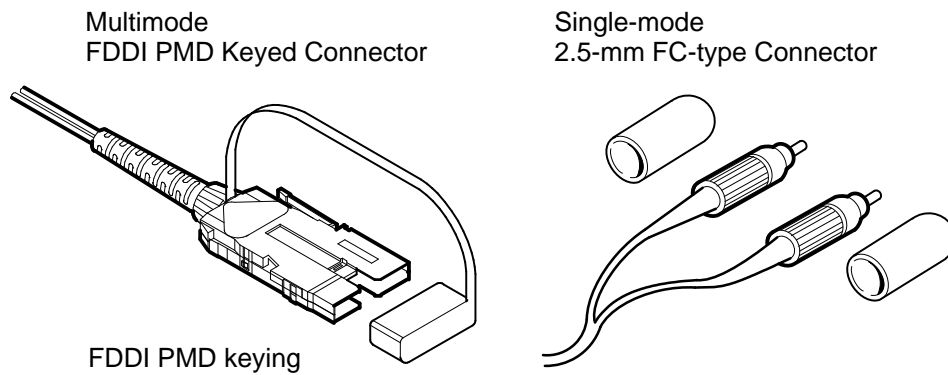
### 3.3 Connecting Fiber Optic Cables

#### NOTE

For single-mode and multimode fiber optic cable specifications, refer to the *FDDI Network Configuration Guidelines* manual.

As shown in Figure 3–3, use keyed connectors with FDDI PMD multimode ports. Use FC/PC-type connectors with single-mode fiber ports.

**Figure 3–3: Types of Connectors**



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#### CAUTION

Make sure that the bend radius of any fiber optic cable is 2.5 centimeters (1 inch) or greater.

Steps 1 through 4 describe how to connect fiber optic cables.

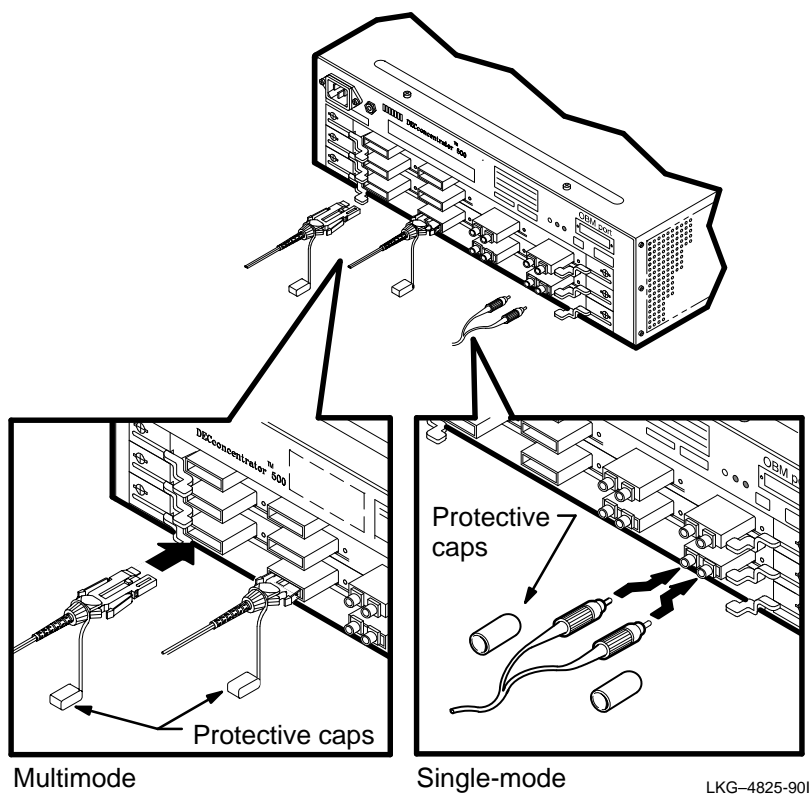
1. Pull the protective cap or rubber boot from the port and fiber optic cable plug.

## NOTE

To avoid additional optical power loss, do not touch the fiber ends. Always replace protective caps when the fiber is not connected.

2. Connect the fiber optic cable to the appropriate connector. Transmit and receive icons are marked on the handle of single-mode ports. Figure 3-4 shows connecting the FDDI keyed connector and the FC/PC-type connector. Make sure that the correct cable plant fiber is attached to the correct transmit and receive connector.

**Figure 3-4: Connecting Keyed FDDI Cables and FC/PC-type Cables**

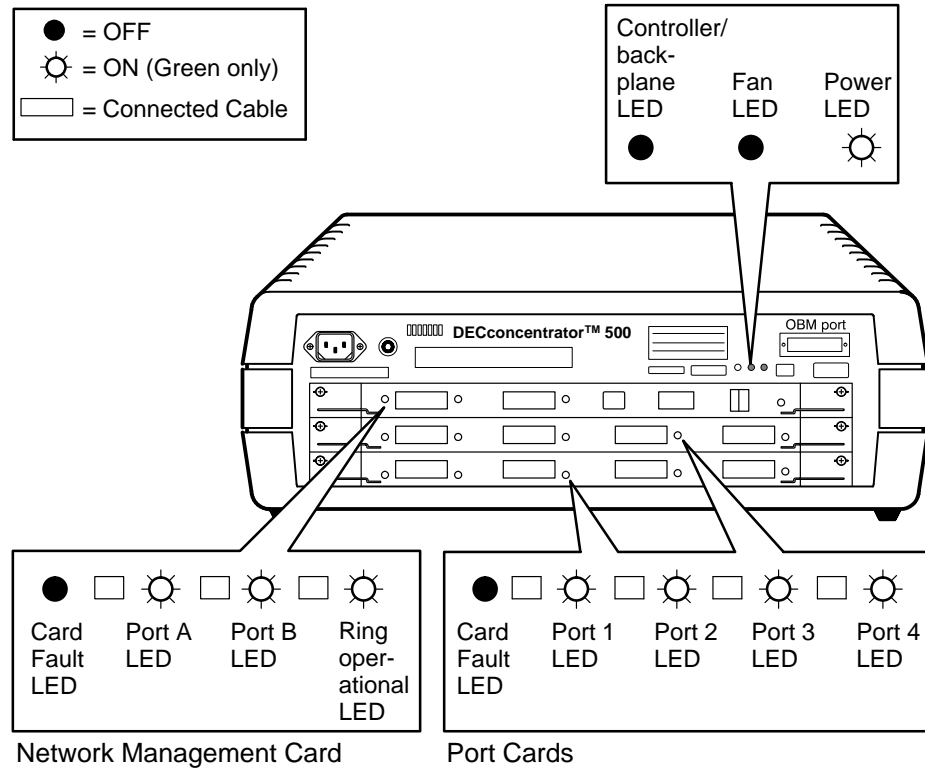


3. Observe the LEDs as you connect the fiber optic cables (Figure 3-5).

## NOTE

Figure 3-5 assumes that all ports are connected to active stations.

**Figure 3-5: LEDs — Fully Configured and Cabled DECconcentrator 500**



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If the LEDs for single-mode ports do not indicate proper DECconcentrator 500 operation, interchange the transmit and receive single-mode fiber optic cable connectors. If the interchange does not work, refer to the problem-solving section of the *DECconcentrator 500 Installation* manual.

4. For each cable connected to the concentrator, add the cable identification number to the DECconcentrator 500 Identification List in Appendix C.

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## Specifications for Single-Mode Fiber Optic Cable

This appendix describes the specifications required for the single-mode fiber optic cable.

### NOTE

Verify that the installation site meets the physical, environmental, power, and cabling requirements for the DECconcentrator 500. Check the cable plant log book entry for the cable plant certification. If the cable plant is not certified, refer to Appendix B for instructions on how to check the cable plant or contact your Digital customer service representative.

### A.1 Fiber Optic System Requirements

The single-mode option cards use a 1300-nm optical system with low-power laser transmitters operating with single-mode fiber. Digital recommends using standard telecommunications grade dispersion unshifted single-mode fibers (EIA/TIA 492BAAA). The fiber must conform to Digital general specification 1710003-GS.

The optical system used in the single-mode option cards require:

- A cable plant with a minimum of 12 decibels (dB) of loss and a maximum of 22 dB of loss
- Cable plant loss data to be measured at a nominal wavelength of 1300 nm



### **A.1.1 Connecting the Cable Plant**

The cable plant is connected to the single-mode fiber option cards with FC/PC-type connectors. Patch cables can be used to connect the termination of the single-mode fiber cable plant to the single-mode fiber option cards. The patch cables can be used to translate different connector types. Refer to the *FDDI Network Configuration Guidelines* manual for additional cable plant information.

### **A.1.2 Special Cable Plant Considerations**

Considerations apply to cable plants with less than 12 dB of loss and cable plants longer than 10 km (6.2 mi) . For control of system loss, Digital recommends the use of high-quality, low-loss (< 0.6 dB) connectors and high return-loss (>20 dB) connectors. Refer to section A.3.2 for additional information on cable plant back-reflection.

The connectors are available from many fiber optic suppliers (see Appendix D).

## **A.2 Patch Cable Requirements**

Single-mode patch cables are used to connect the option cards to the single-mode fiber cable plant. One end of the patch cable is connected to the FC/PC-type connector. The other end of the patch cable is fitted with the appropriate connector type that matches the existing cable plant.

The single-mode fiber in the patch cables must conform to EIA/TIA 492BAAA and have a cutoff wavelength of 1240 nm or less. If the fiber-cutoff wavelength data is unavailable, the patch cable must be at least 2 m (6.6 ft) long and have two 7.6-cm (3-in) diameter loops in it.

You can purchase single-mode patch cables from many vendors. See Appendix D for a partial listing of the vendors.

### A.3 Inline Loss Elements

Inline loss elements are required for cables with less than 12 dB of loss. The following specifications apply over the operational wavelength range of the DEC-concentrator optical system (1278 to 1342 nm):

- In single-mode cable plants with 0 to 6 dB of loss, the installer must include an inline loss element with 12 to 16 dB of loss.
- In single-mode cable plants with 6 to 12 dB of loss, the installer must include an inline loss element of 6 to 10 dB.

You can purchase inline loss elements from many vendors. See Appendix D for a partial listing of the vendors.

#### A.3.1 Cable Plant Concerns

If the cable is longer than 10 km (6.2 mi), a penalty is added to the loss budget as shown in the following example:

$$\text{Loss penalty} = (0.06 \text{ dB/km}) \bullet \text{cable length}$$

$$\text{Total loss} = \text{measured cable loss} + \text{loss penalty}$$

The total loss must be less than 22 dB.

This penalty reserves a portion of the power budget to correct the potential mismatch between the DECconcentrator 500 single-mode fiber optical system operating wavelength and the wavelength used to measure the installed loss of the single-mode fiber cable. A loss-test wavelength range of 1275 to 1325 nm can cause an underestimation of the cable attenuation of 0.06 dB/km. Refer to Appendix B for information on how to measure the cable plant loss. This measurement includes the loss penalty.

### **A.3.2 Cable Plant Back-Reflection**

Optical cable plant back-reflection is the return of optical power to the system transmitter. Back-reflection is caused by connectors, splices and inline loss elements. Back-reflection is a ratio, in decibels, of reflected optical power to optical power incident in the cable plant.

High levels of back-reflection may degrade the performance of the single-mode fiber optical system. Back-reflection can be controlled by using properly designed cable plant components. Digital recommends using components with low optical return loss (nonair gap). Cable plant components must comply with the FDDI single-mode fiber PMD required minimum of 20-dB optical return loss.

#### **NOTE**

When planning to upgrade to a higher bit-rate system, consider specifying an optical-return loss of 30 dB or greater.

---

## **Single-Mode Relative Power Loss Test**

This appendix explains how to measure the relative power loss of a single-mode fiber optic cable link. This test uses the 1300-nm single-mode relative power loss test kit.

The test involves:

- Launching a premeasured quantity of optical power into the cable being tested
- Measuring the power at the opposite end of the cable with an optical power meter.

The difference between the launched power and received power is a measure of the optical loss in the cable link.

The wavelength and launch characteristics of the optical test source must simulate the system source as closely as possible. For example, if the wavelength of the optical test source differs by 50-nm from the system source, the measured loss differs from the actual system loss by as much as 0.06 dB per kilometer. For a 40-km (24-mi) link, this introduces an error of 2.4 dB.

## B.1 Single-Mode Relative Power Loss Test Kit

The 1300-nm single-mode relative power loss test kit (Digital P/N 29-29033-01) contains:

- A FOTEC optical laser (LD) test source, 1300-nm nominal wavelength, equipped with a fixed FC-type connector
- A single-mode launch cable, terminated on both ends with FC/PC-type connectors
- An AC transformer
- Three FC-type connector couplers
- A consumables kit containing clean wipes

The test also requires the following items:

- An INTELCO optical power meter, part of the Dual Window Power Loss test kit (Digital P/N FC-10138-AC)
- An FC-type power meter adapter (Digital P/N 29-29036-01)

## B.2 Before Testing for Relative Power Loss

### NOTE

Before beginning the test procedure, copy the blank worksheets located at the end of this appendix. You will need two copies of worksheet 1 and one copy of worksheet 2 for each pair of optical fibers that you are testing.

Before testing for relative power loss, keep the following precautions in mind. Following them will help to ensure accurate test results.

- Use care when handling fiber optic cables and connectors. If cables are bent or twisted, damage can occur, especially near the connectors.
- Avoid dropping or otherwise physically impacting connectors; doing so can impair optical transmission.

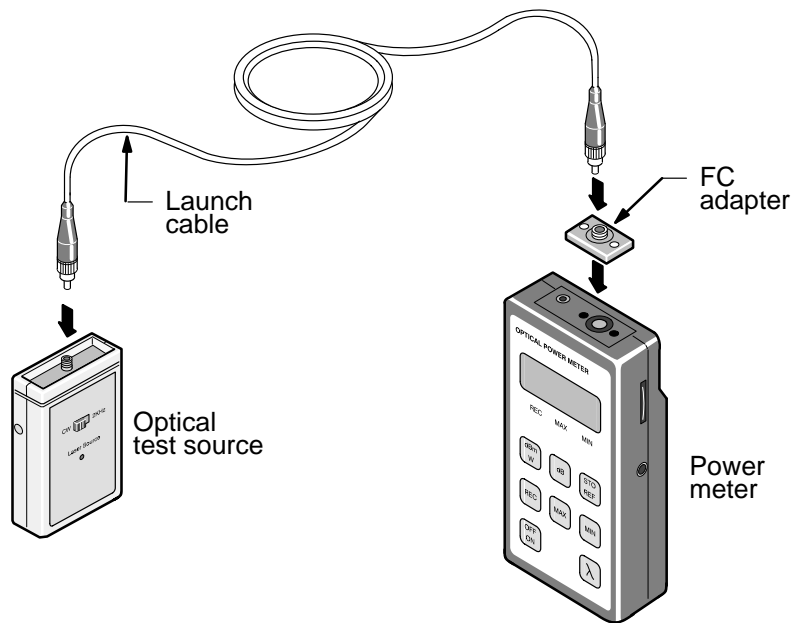
- Always clean the connectors before testing. Clean the connectors during testing as necessary. Use pads dipped in alcohol to remove dust, debris, or fingerprints from the fiber end of the connector.

### B.3 Measuring the Relative Power Loss

To measure the relative power loss, follow steps 1 through 6.

1. Place the optical test source close to the fiber links to be tested.
2. Set up the optical test source as follows:
  - a. Connect the optical test source to ac power, if available.
  - b. Using worksheet 1, enter the value of the **Optical Test Source Wavelength**, recorded on the label on the back of the optical test source.
  - c. Record the test source being used.
  - d. Clean and then connect the launch cable to the optical source (see Figure B-1).

**Figure B-1: Setting Up the Optical Test Source and Power Meter**



LKG-4631-901

3. Set up the power meter as follows:
  - a. Attach the FC-type adapter to the meter.
  - b. Clean the connector on the launch cable and connect it to the power meter.
  - c. Turn on the optical test source and the power meter.
  - d. Push the wavelength ( $\lambda$ ) button on the power meter until the display reads 1300 nm.
4. Perform the following reference-level-adjustment procedure:
  - a. Wait five minutes for the optical test source to stabilize.

**NOTE**

Once the optical test source is turned on, do not turn it off until all measurements are completed.

- b. Store the reference value in the meter by pressing the **STO REF** button on the meter twice.
  - c. Turn off the power meter and disconnect the launch cable from the power meter.
5. Measure the cable loss as follows:
  - a. Enter the **Test Date** and the **Cable Identification Number** for the cable to be tested on the worksheet.
  - b. Connect the launch cable to the cable under test with an FC-type connector coupler (see Figure B-2).
  - c. Go to the receive end (other end) of the cable being tested.
  - d. Clean the connector at the receive end of the cable under test and attach it to the power meter.

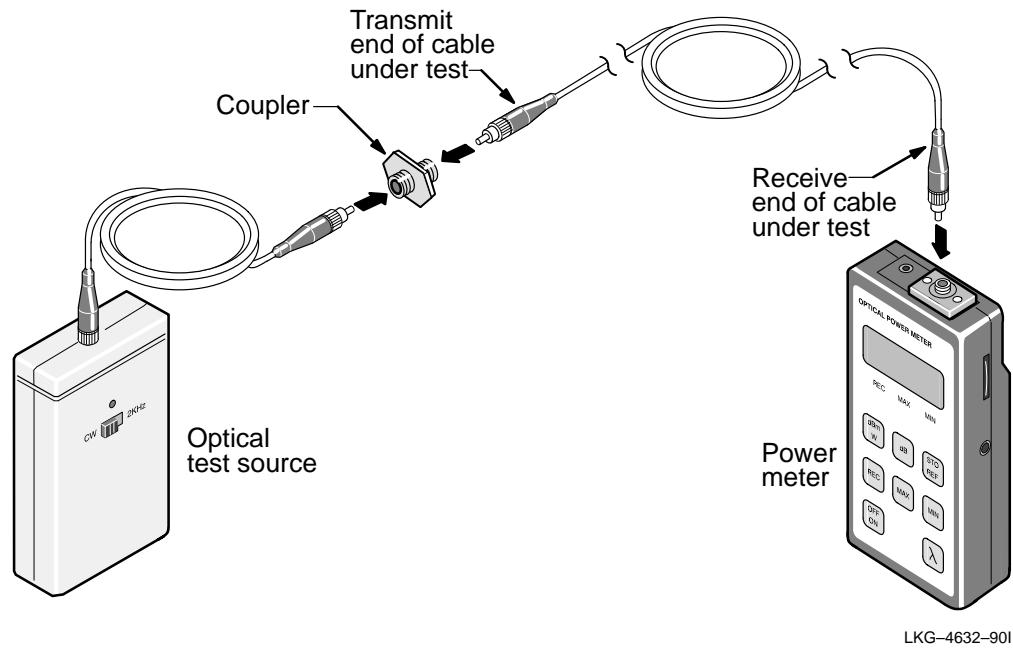
**NOTE**

If patch cables to the network devices are not present, use a jumper cable from the patch panel to the power meter.

- e. Turn on the power meter and read the display to make sure the 1300-nm range is selected. Push the wavelength ( $\lambda$ ) button until the display reads 1300 nm.
- f. Press the **dB** button and record the reading.

**Figure B-2: Connecting Cables**

---



6. Calculate the total wavelength corrected cable loss using worksheet 1 as follows:
  - a. Note the dB value (including the minus sign) displayed on the power meter. Enter the value on line 1 of the worksheet. This is the **Measured Relative Loss**.



- b. Round off the cable length to the next tenth of a kilometer. For example, if the cable length is 13.75 km, round-off to 13.8 km. If the cable length is unknown, use an Optical Time Domain Reflectometer (OTDR) to measure it. Enter the rounded-off value on line 2 of the worksheet. This is the **Length of Tested Cable**.
- c. Multiply the **Wavelength Correction Value** (0.06 dB/km), line 3 by the **Length of Tested Cable** (line 2). This is the **Total Wavelength Correction**. Enter the result on line 4 of the worksheet.
- d. Using a calculator, subtract the **Total Wavelength Correction** (line 4) from the **Measured Relative Loss** (line 1). This is the **Wavelength Corrected Cable Loss**. Enter the result on line 5 of the worksheet.

## B.4 System Certification Procedure

Table B–1 defines the minimum attenuation and system power budget for Digital devices used on a single-mode fiber optic cable link.

**Table B–1: System Power Budget for 1300 nm**

Product Family	Minimum Attenuation	System Power Budget
Digital FDDI	12 dB <sup>1</sup>	22 dB at 1300 nm

<sup>1</sup>If attenuation is less than this value, use the appropriate inline loss element to induce the required loss (refer to Table B–2).

Use worksheet 2 to perform the cable system certification procedure as follows:

1. Enter the **Network Product** on worksheet 2.
2. Enter the **System Power Budget** from Table B–1 on line 1 of worksheet 2.
3. Calculate the **Maintenance Splice** value by allowing **0.5 dB per cable segment** for future maintenance splices. Enter the value on line 2 of the worksheet. For example, if the end-to-end link consists of two cable segments concatenated by a patch panel, enter **1.0 dB (2 • 0.5 dB)**.
4. Calculate the **Cable Power Budget** by subtracting line 2 from line 1. Enter the value on line 3 of worksheet 2. The derated budget allows for measurement uncertainty and for future cable repairs.

5. Compare the **Wavelength Corrected Cable Loss** (line 5, worksheet 1) to the **Cable Derated Power Budget** (line 3, worksheet 2). Ignore any minus signs. If the value from worksheet 1 is less than the value on worksheet 2, the **Wavelength Corrected Cable Loss** is acceptable.
6. If the **Wavelength Corrected Cable Loss** is acceptable, refer to Table B-2 to determine whether an inline loss element needs to be installed on the cable. The cable requires an inline loss element if it has less than 12 dB of loss.

Refer to Appendix D for inline loss element vendors.

**Table B-2: Cable Loss Range and Inline Loss Element to Use**

<b>Wavelength Corrected Cable Loss Range</b>	<b>Inline Loss Element to Use</b>
0 dB–6 dB	12 dB–16 dB
6 dB–12 dB	6 dB–10 dB
12 dB–22 dB	None needed

If you successfully planned and designed the cable plant, you have allowed for splice loss, connector coupling, and future maintenance of the installation. The calculated **Cable Derated Power Budget** allows for future maintenance of the cable plant. Future maintenance includes splices or replacement of network device transmitters/receivers.

## Worksheet 1: Single-Mode Cable Loss

---

Test Date: \_\_\_\_\_

Cable I.D.: \_\_\_\_\_

Optical Test Source  
Wavelength: \_\_\_\_\_

Test Source:  FOTEC  \_\_\_\_\_

(1) \_\_\_\_\_ Measured Relative Loss

(2) \_\_\_\_\_ Length of Tested Cable

(3) 0.06 dB/km \_\_\_\_\_ Wavelength Correction Value

(4) \_\_\_\_\_ Total Wavelength Correction  
(Multiply 2 by 3)

(5) \_\_\_\_\_ Wavelength Corrected Cable  
(Subtract 4 from 1) Loss

## Worksheet 2: Cable Derating

---

Single-Mode Network Product: \_\_\_\_\_  
(For example: DEFCN-CA, DEFCN-DA)

(1) \_\_\_\_\_ System Power Budget  
(From Table B-1)

(2) \_\_\_\_\_ Maintenance Splices  
(Minimum of 0.5)

(3) \_\_\_\_\_ Cable Derated Power Budget  
(Subtract 2 from 1)

---

## DECconcentrator 500 Identification List

Use the DECconcentrator 500 Identification List to record the following information:

- DECconcentrator 500 model number
- DECconcentrator 500 serial number
- Network Management Card
  - cable ID number
  - hardware address
  - ports used
  - switch 1 setting
  - switch 2 setting
- Port Card
  - ports used
  - cable ID number

Fill in the DECconcentrator 500 Identification List (see Figure C-1) and give a copy to the system/network manager.

**Figure C-1: DECconcentrator 500 Identification List**

---

<input type="checkbox"/>	DECconcentrator 500 Model Number	_____
<input type="checkbox"/>	DECconcentrator 500 Serial Number	_____
<input type="checkbox"/>	Network Management Card: Hardware address	_____
<input type="checkbox"/>	Network Management Card: switch 1 setting	_____
<input type="checkbox"/>	Network Management Card: switch 2 setting	_____
<input type="checkbox"/>	Network Management Card: ports used	_____
	Port A cable ID number	_____
	Port B cable ID number	_____
<input type="checkbox"/>	First Port Card: ports used	_____
	Port 1 cable ID number	_____
	Port 2 cable ID number	_____
	Port 3 cable ID number	_____
	Port 4 cable ID number	_____
	Port 5 cable ID number	_____
	Port 6 cable ID number	_____
<input type="checkbox"/>	Second Port Card: ports used	_____
	Port 1 cable ID number	_____
	Port 2 cable ID number	_____
	Port 3 cable ID number	_____
	Port 4 cable ID number	_____
	Port 5 cable ID number	_____
	Port 6 cable ID number	_____
<input type="checkbox"/>	Third Port Card: ports used	_____
	Port 1 cable ID number	_____
	Port 2 cable ID number	_____
	Port 3 cable ID number	_____
	Port 4 cable ID number	_____
	Port 5 cable ID number	_____
	Port 6 cable ID number	_____

---

## Vendors and Part Numbers

The Appendix contains part descriptions, part numbers, and vendor names and addresses.

### D.1 Patch Cables

You can purchase single-mode patch cables from many vendors. Table D-1 and Table D-2 list the patch cable descriptions and part numbers. Equivalent cables from other vendors can be substituted.

**Table D-1: Single-Mode Fiber Patch Cables (Duplex)**

<b>Patch Cable</b>	<b>Anixter Brothers Part Number</b>
3M FC to FC	FCFC3
3M FC to ST	FCST3
3M FC to Biconic	FCB3
10M FC to FC	FCFC10
10M FC to ST	FCST10
10M FC to Biconic	FCB10

**Table D-2: Single-Mode Fiber Patch Cables (Simplex)**

Patch Cable	AMP Incorporated Part Number	AT&T Part Number	Dorran/3M Part Number
3M FC to FC	501868-4	LS2H2-H2-10	AALAL-AT0003
3M FC to ST		LS2H2-E-10	AALAM-AT0003
3M FC to Biconic	502141-3	LS2H2-A-10	AAAAL-AT0003
10M FC to FC	501868-1	LS2H2-H2-32	AALAL-AT0010
10M FC to ST		LS2H2-E-32	AALAM-AT0010
10M FC to Biconic	502141-0	LS2H2-A-32	AAAAL-AT0010

## D.2 Connector Couplers

You can purchase connector couplers from many vendors. Table D-3 and Table D-4 list the coupler descriptions and part numbers. Equivalent parts from other vendors may be substituted.

**Table D-3: Connector Coupler**

Coupler	Dorran/3M Part number	AMP Incorporated Part Number
FC to FC Coupler	02-00075	501506-1

**Table D-4: Connector Coupler Panel**

Coupler	AT&T Part Number
Coupler Panel (accepts 6 couplers)	105 428 254



### D.3 Single-Mode Inline Loss Element

You can purchase inline loss elements from many vendors. Table D-5 lists the inline loss element descriptions and part numbers. Equivalent parts from other vendors may be substituted.

**Table D-5: Inline Loss Element**

<b>Inline Loss Element</b>	<b>Amphenol Corporation Part Number</b>	<b>Aster Corporation Part Number</b>
6 dB-10 dB	945-999-1468-8	AS0170
12 dB-16 dB	945-999-1468-14	AS0165

### D.4 Vendor Information

The following charts identify the product and provide vendor addresses and telephone numbers.

#### **Single-Mode Fiber Patch Cable (Duplex)**

Anixter Brothers  
4711 Golf Road  
Skokie, IL 60076 (708) 677-2600

Boston office (508) 682-8870

#### **Single-Mode Fiber Patch Cable (Simplex)**

AMP Incorporated  
P.O. Box 3608  
Harrisburg, PA 17105 (717) 564-0100 or (800) 522-6752

AT&T  
2000 Northeast Expressway  
Norcross, GA 30071 (800) 824-1931

### **Single-Mode Connector Coupler**

Dorran/3M  
10 Industrial Street  
Eatontown, NJ 07724 (201) 544-0938

### **Single-Mode Connector Coupler Panel**

AT&T  
2000 Northeast Expressway  
Norcross, GA 30071 (800) 824-1931

AT&T Network Systems (800) 344-0223 Extension 020

### **Single-Mode Inline Loss Element**

Amphenol Corporation  
1925 A Ohio Street  
Lisle, IL 60532 (708) 960-1010

Aster Corporation  
113 Cedar Street  
Milford, MA 01757 (508) 478-5995

---

## Software Microcode Upgrade Part Numbers

Digital Equipment Corporation plans periodic software microcode updates. Contact your sales representative or see the *Network Buyer's Guide* to find out if new software microcode is available. Table E-1 lists the software microcode upgrade package part numbers and the media on which they are available.

**Table E-1: Upgrade Packages**

<b>Upgrade Package Media</b>	<b>Digital Part Number</b>
FDDI DECconcentrator 500 Software Upgrade Package for VMS, 16MT9	QB-YX2A9-AA
FDDI DECconcentrator 500 Software Upgrade Package for VMS, TK50	QB-YX2A9-AB
FDDI DECconcentrator 500 Software Upgrade Package for ULTRIX/VAX, 16MT9	QB-YX2A9-AC
FDDI DECconcentrator 500 Software Upgrade Package for ULTRIX/VAX, TK50	QB-YX2A9-AD
FDDI DECconcentrator 500 Software Upgrade Package for ULTRIX/RISC, 16MT9	QB-YX2A8-AE
FDDI DECconcentrator 500 Software Upgrade Package for ULTRIX/RISC, TK50	QB-YX2A8-AF

---

## Related Documents

The following documents contain additional information. Refer to the back of this manual for ordering information.

- *DECconcentrator 500 Problem Solving* (Order No. EK-DEFCN-PS)  
This manual describes isolating DECconcentrator 500 faults to the field-replaceable unit (FRU) and removing and replacing each FRU. This is a field problem-solving manual.
- *DECbridge 500/600 Installation and Upgrade* (Order No. EK-DEFEB-IN)  
This manual describes the installation and upgrade procedures for the DECbridge 500/600 series.
- *DECbridge 500/600 Problem Solving* (Order No. EK-DEFEB-PS)  
This manual describes isolating DECbridge 500/600 faults to the field-replaceable unit (FRU) and removing and replacing each FRU. This is a field problem-solving manual.
- *DECconnect System Fiber Optic Planning and Configuration* (Order No. EK-DECSY-FP)  
This manual describes the planning requirements, product information, and guidelines for configuring DECconnect System Fiber Optic Networks that use the DECconnect System fiber optic products.

- *DECconnect System Fiber Optic Installation* (Order No. EK-DECSY-FI)  
This manual describes how to install a DECconnect System fiber optic cable plant.
- *DECelms Installation* (Order No. AA-PAK1A-TE)  
This manual describes how to install and verify DECelms (DEC Extended LAN Management Software) on a VMS system.
- *DECelms Reference* (Order No. AA-PBWBA-TE)  
This is a reference manual to the DECelms (DEC Extended LAN Management Software) commands.
- *DECelms Use* (Order No. AA-PAK2A-TE)  
This manual describes how to use DECelms (DEC Extended LAN Management Software) to configure, manage, and monitor the LAN Bridge 100, LAN Bridge 150, LAN Bridge 200, DECbridge 500, and DECconcentrator 500 units.
- *DECmcc Installation* (Order No. AA-PD58-BTE)  
This manual describes how to plan for and install DECmcc.
- *DECmcc Bridge Access Module Use* (Order No. AA-PD1BC-TE)  
This manual describes the DECmcc bridge entity model, entity management, and the directives necessary to perform typical management operations.
- *DECmcc Concentrator Access Module Use* (Order No. AA-PH31A-TE)  
This manual describes the DECconcentrator 500 entity model, entity management, and the directives necessary to perform typical management operations.
- *Fiber Distributed Data Interface Network Configuration Guidelines* (Order No. EK-DFDDI-CG)  
This manual describes the guidelines for connecting devices to an FDDI network. It also includes network configuration examples and cable specifications.

- *Fiber Distributed Data Interface System Level Description*  
(Order No. EK-DFSLD-SD)

This manual describes the FDDI system, how it works, and the role of the individual components.

### **Additional Networking Documentation**

Refer to the Network Management Software documentation specific to your network product. Also refer to the following documents for additional information.

- *Networks and Communications Product Documentation*  
(Order No. EK-NACPD-RE)

This manual lists the title and order number for each publication associated with Digital Equipment Corporation's Networks and Communications products.

- *Network Buyer's Guide*

This guide describes Digital's networking products. Contact your local sales office to receive a copy.

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## Glossary

**American National Standards Institute (ANSI)**

An organization that compiles and publishes computer industry standards.

**ANSI**

*See* American National Standards Institute.

**attenuation**

Magnitude of optical power loss usually expressed in units of decibels (dB).

**cable**

As used in this manual, the physical medium for transmitting signals; includes copper and optical fiber.

**concentrator**

An FDDI node that provides additional attachment points for stations that are not part of the dual ring, or for other concentrators in a tree structure. A concentrator has two Physical Layer entities and can have one or more Data Link layer entities. The concentrator is the focal point of Digital's dual ring of trees.

**configuration switch**

The switches on the Network Management Card handle. Switch 1 is used to enable/disable the reset to default parameters function (active only during initialization). Switch 2 is used to enable/disable remote write access.

**Fiber Distributed Data Interface (FDDI)**

A set of ANSI/ISO standards that define a high-bandwidth (100-Mb/s) general-purpose local area network connection between computers and peripheral equipment in a timed-token passing, dual ring of trees configuration.

**ANSI Media Interface Connector (MIC)**

A category of connectors that meet the ANSI PMD standard and are used to connect single attachment stations, dual attachment stations, and concentrators to an FDDI network. Type A and B connectors are used to connect a concentrator to the dual ring. Type M and S connectors are used to connect concentrators and single attachment stations.

**FDDI connector**

*See* ANSI Media Interface Connector.

**FDDI network**

A fiber optic network that meets the ANSI X3T9 standard. A counter rotating timed-token dual ring network operating at a bandwidth of 100 Mb/s.

**fiber**

Dielectric that guides light; waveguide.

**fiber optic cable**

A transmission medium designed to transport signals in the form of pulses of light.

**fiber optics**

A technology whereby signals are transmitted over an optical waveguide medium through the use of light-generating transmitters and light-detecting receivers.

**LASER**

Light Amplification by Stimulated Emission of Radiation. Predominantly used for transmission over single-mode cable systems.

**Network Management Card**

An option card for the concentrator that provides for the connection to the dual ring and the hardware/firmware to allow remote management. A Network Management Card has two ports and two switches.

**optical receiver**

An optoelectronic circuit that converts an incoming optical signal to an electronic logical signal.

**optical transmitter**

An optoelectronic circuit that converts an outgoing electronic logical signal to an optical signal.

**Port Card**

An option card for the concentrator that provides for the connection of stations to the concentrator. The Port Card conforms to the ANSI X3T9 standard.

**receive**

The act of a station accepting a frame, token, or control sequence from the ring.



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# Index

## HOW TO ORDER ADDITIONAL DOCUMENTATION

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In New Hampshire  
Alaska or Hawaii  
call 603-884-6660

### DIRECT MAIL ORDERS (U.S. and Puerto Rico\*)

DIGITAL EQUIPMENT CORPORATION  
P.O. Box CS2008  
Nashua, New Hampshire 03061

### DIRECT MAIL ORDERS (Canada)

DIGITAL EQUIPMENT OF CANADA LTD.  
940 Belfast Road  
Ottawa, Ontario, Canada K1G 4C2  
Attn: A&SG Business Manager

### INTERNATIONAL

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A&SG Business Manager  
c/o Digital's local subsidiary  
or approved distributor

Internal orders should be placed through Publishing and Circulation Services (P&CS),  
Digital Equipment Corporation, 10 Forbes Road, Northboro, Massachusetts 01532-2597

\*Any prepaid order from Puerto Rico must be placed  
with the Local Digital Subsidiary:  
809-754-7575

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\_\_\_\_\_

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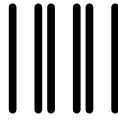
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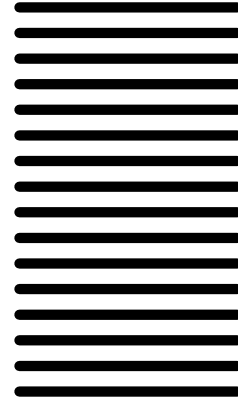
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