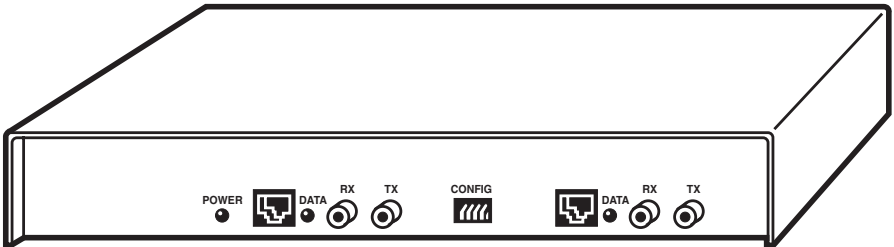




# Fiber Optic Converter I Fiber Optic Converter II



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This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

*This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.*

*Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.*

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#### INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
  - A: El cable de poder o el contacto ha sido dañado; u
  - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
  - C: El aparato ha sido expuesto a la lluvia; o
  - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
  - E: El aparato ha sido tirado o su cubierta ha sido dañada.

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# 1. Specifications

<b>Indicators</b> —	(1) Power and (1) Data
<b>Speed</b> —	4 or 16 Mbps
<b>Connectors</b> —	<b>LT221A:</b> (1) RJ-45 female, (2) ST; <b>LT222A:</b> (2) RJ-45 female, (4) ST
<b>Power</b> —	115/230 VAC switch-selectable, 6 watts
<b>Size</b> —	1.7"H x 11.4"W x 4"D (4.3 x 29 x 10.2 cm)
<b>Weight</b> —	2.1 lb. (0.9 kg)

## 2. Introduction

Fiber Optic Converters allow you to expand the geographic distance of a token ring network. They are also a useful tool in eliminating the electromagnetic interference which often causes problems with copper cabling. And, because fiber optic cable is much more difficult to tap than copper cable, Fiber Optic Converters are desirable for networks requiring higher security.

### 2.1 Main Ring Applications

Fiber Optic Converters are used in pairs. The Fiber Optic Converter II converts the signal of both the primary and backup paths of the network.

A typical token ring network using type 3 copper cable without Converters is shown in Figure 2-1. The maximum geographical size of the network is determined according to rules given in token ring network planning documents.

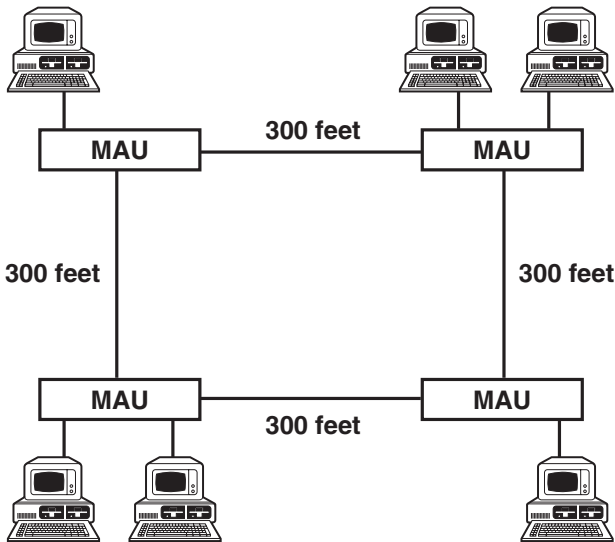


Figure 2-1. Typical Token Ring Network.



## FIBER OPTIC CONVERTERS I & II

The same network using the Fiber Optic Converter I is shown in Figure 2-2. In Figure 2-1 the main ring size is 1200 feet (365.8 m); in Figure 2-2, the same main ring using the Fiber Optic Converter I is 7200 feet (2194.6 m). For planning purposes, fiberoptic sections of the ring can be disregarded, making the functional

main ring length only 600 feet (182.9 m). Distances vary depending on network configuration and copper cable type.

An application using the Fiber Optic Converter II is shown in Figure 2-3.

The Fiber Optic Converters may also be used to extend the length of

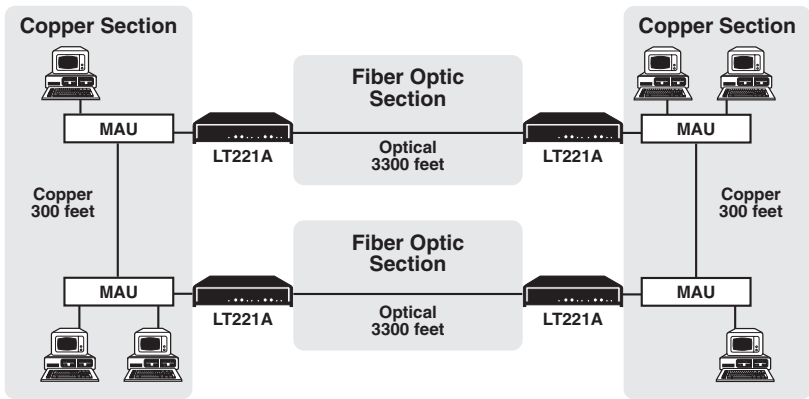


Figure 2-2. Token Ring Network Using Fiber Optic Converter I.

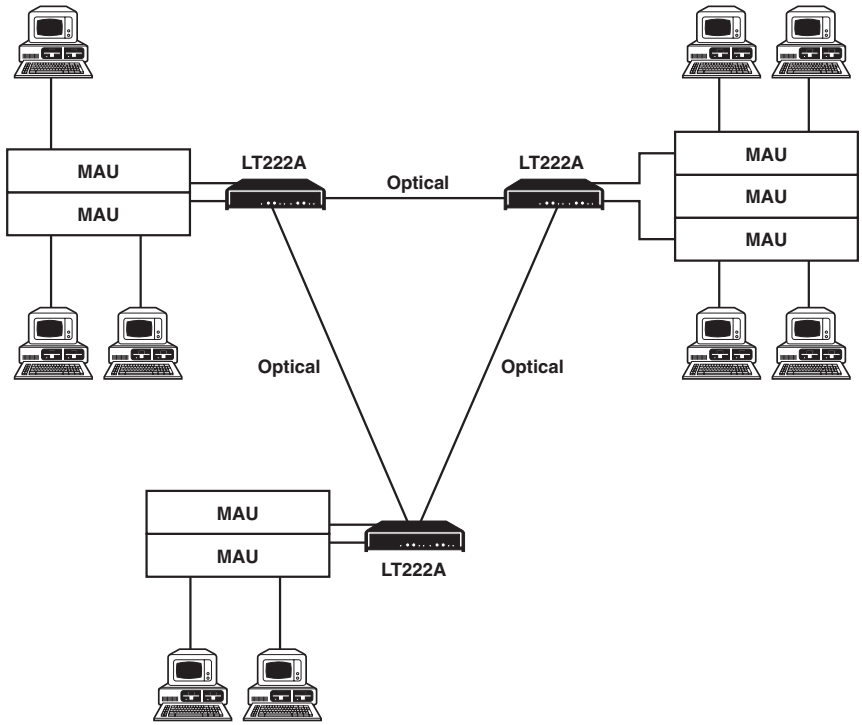
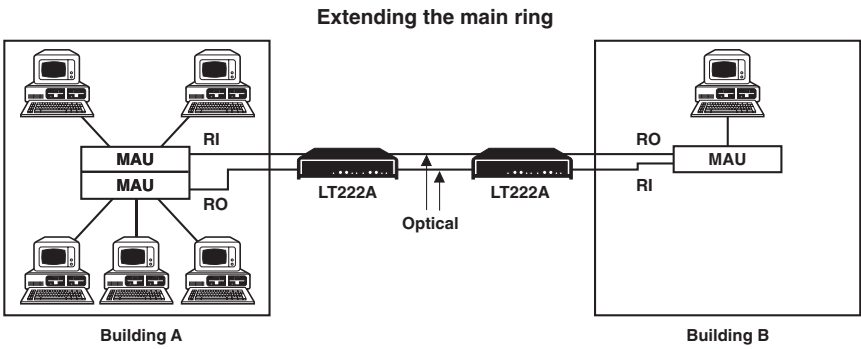


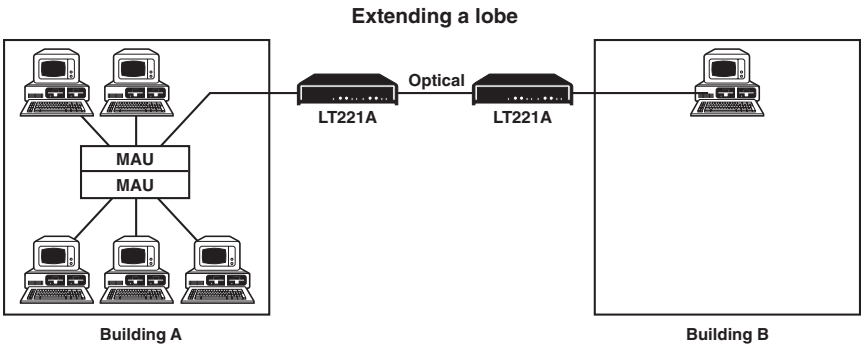
Figure 2-3. Token Ring Network Using Fiber Optic Converter II.

individual station lobes. Extending an individual lobe is more economical than extending the main

ring using two Fiber Optic Converters (II) and a MAU.



**Figure 2-4. Extending the Main Ring.**



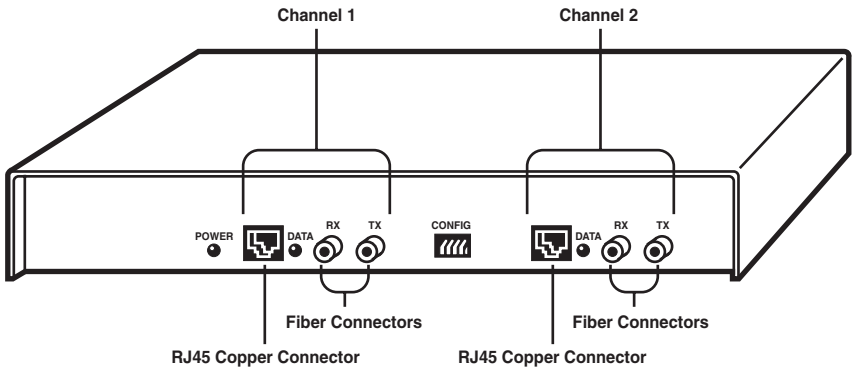
**Figure 2-5. Extending a Station Lobe.**

## 3. Hardware

### 3.1 Front Panel

The Fiber Optic Converter I has one female RJ-45 copper connector on the front panel. The Fiber Optic

Converter II has two RJ-45 connectors on the front panel. Figure 3-1 shows the front panel of the Fiber Optic Converter II. You can configure the RJ-45



**Figure 3-1. Front Panel of the Fiber Optic Converter II.**

connectors in several ways by using the **Config** switch on the Converter's front panel. The RJ-45 connectors can be configured to connect to either the **Ring In** or **Ring Out** port of a MAU. You can also configure them for lobe extension applications.

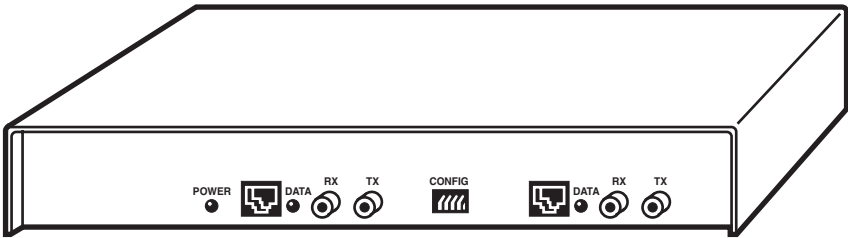
Configuration of the RJ-45 connectors is covered in Chapter 4. The connectors labeled RX (for receive) and TX (for transmit) are ST receptacles for connection to fiberoptic cables. The Fiber Optic Converter I has two fiberoptic

connectors. The Fiber Optic Converter II has four. SMA fiberoptic connectors are an option on all models.

The power cord receptacle and fuse are located on the back panel.

## 3.2 LEDs

Figure 3-2 shows the front-panel LEDs.



**Figure 3-2. Front Panel LEDs.**

When the **Power** LED is lit, power is being supplied to the unit. When the **Data** LED is lit, data is being transmitted on the RJ-45 side.

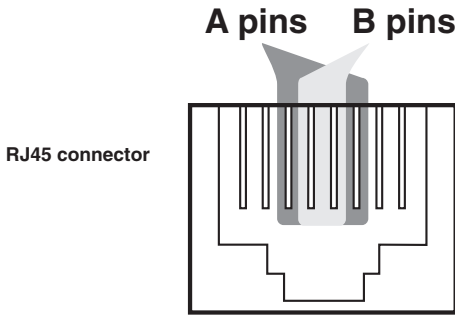
## 3.3 RJ-45 Connectors

Figure 3-3 shows the transmit and receive pins of the RJ-45 connectors in all configurations. Configuration of the RJ-45 copper connectors is discussed in Chapter 4.

RJ-11 male connectors may be used instead of RJ-45 male connectors on the twisted-pair cable connected to the RJ-45 connector. Whether you use RJ-45 or RJ-11 male connectors, the transmit and receive pins are always the four center pins in the connector, as shown in Figure 3-3.

### NOTE

The shielded or unshielded twisted-pair copper cable used with the Converters must have at least two twisted pairs of wire. This means a minimum of four separate wires, whether or not all four will be used. Also, the cable must be wired “straight through,” as shown in Figure 3-4. Do not twist transmit and receive wires in the same twisted pair; Figure 3-4 shows how to avoid this.



RJ-45 Connector Configuration	Pin Function	
	A Pins	B Pins
Ring In	Transmit	Receive
Ring Out	Receive	Transmit
Lobe Extension Station End	Receive	Transmit
Lobe Extension MAU End	Transmit	Receive

Figure 3-3. RJ-45 Copper Connector Transmit and Receive Pins.

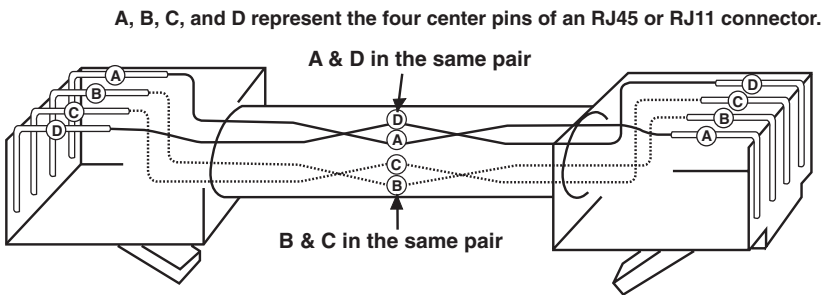


Figure 3-4. Straight-through Wiring.

## 3.4 Config Switch

The Config switch on a Converter's front panel is used to configure the RJ-45 copper connectors for the different applications mentioned in the previous section, RJ-45 Connectors. Figure 3-5 shows the functions of different positions of the switch.

**Phantom** refers to the phantom voltage that is required from the Converter when it is connected directly to a station port on a MAU, such as in a lobe extension application. When the switch is on the **On** position, phantom voltage is presented.

The **Station** switch is used in lobe-extension applications when the converter is on the station end of the lobe. When the **Station** switch is in the **On** position, phantom voltage from the station is detected by the converter.

### NOTE

**The converter will not operate if Switch 3 (Phantom) and Switch 4 (Station) are in the On position at the same time.**

Specific instructions for setting the Config Switch are given in Chapter 4.

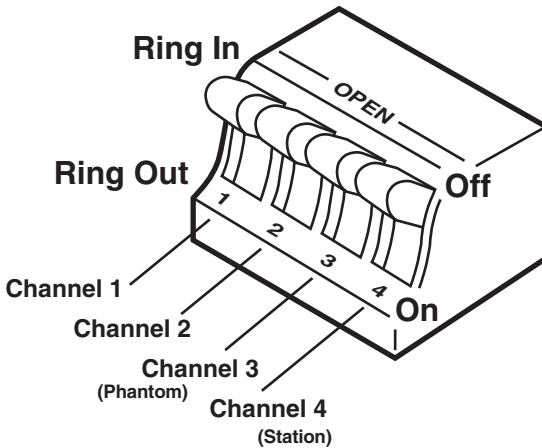


Figure 3-5. Config Switch Functions.

## 4. Installation

In this chapter, installation procedures are given for the following:

- Main ring installation
- Lobe extension installation

### 4.1 Network Planning

A floor plan of the area in which your network will operate is vital for planning. You should also draw a detailed map of the installation. You should know where you want all MAUs, stations, Fiber Optic Converters, and bridges to be located, and what wire gauge or cable type the main ring and station lobes will use.

Plan the network to have the smallest possible number of wiring closets. This allows for greater lobe lengths and can facilitate network expansion at a later date.

The maximum number of attaching devices on a single ring using Type 3 cable is 72. The maximum number of attaching devices on a ring using Type I or Type 2 cable is 260.

Source-routing token-ring bridges may be used to more efficiently partition the network. They connect rings and allow greater control over network traffic.

#### 4.1.1 FIBEROPTIC SECTIONS

As long as the fiberoptic sections of the network do not exceed maximum distances, their lengths can be disregarded when you calculate main ring and station lobe lengths.

There may be as many as four pairs of optical fiber connectors between Converters, including the connectors used to attach to the Converters. With the Fiber Optic Converter II, which has two channels, each channel may have up to four pairs of optical fiber connectors.

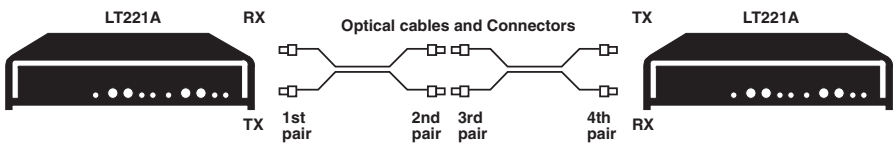


Figure 4-1. Max. Number of Fiber Connectors Between Converters.



## 4.1.2 COPPER SECTIONS

Copper sections of the ring are planned in the usual way, taking into account the main ring length, lobe lengths, number and type of MAUs, copper cable type, and other factors.

## 4.1.3 CONVERTER PLACEMENT

The Fiber Optic Converter may be either rack-mounted or placed on a shelf or table. An optional rack-mount kit (model RM-S00) is available which allows installation in a standard 19" equipment rack.

## 4.2 Installation in the Main Ring

Once the network has been fully planned, all devices have been placed and the proper cabling has been routed to all areas where it will

be needed, use the following procedure to finish the installation. (If you are using Converters to extend an individual lobe, don't use this section. See Chapter 4.)

1. Configure each Converter's RJ-45 connectors for their intended use with the Config Switch, located on a converter's front panel. A Fiber Optic Converter II has two RJ-45 connectors; a Fiber Optic Converter I has one. Figure 4-2 shows a sample application and tells how the RJ-45 connectors must be configured.

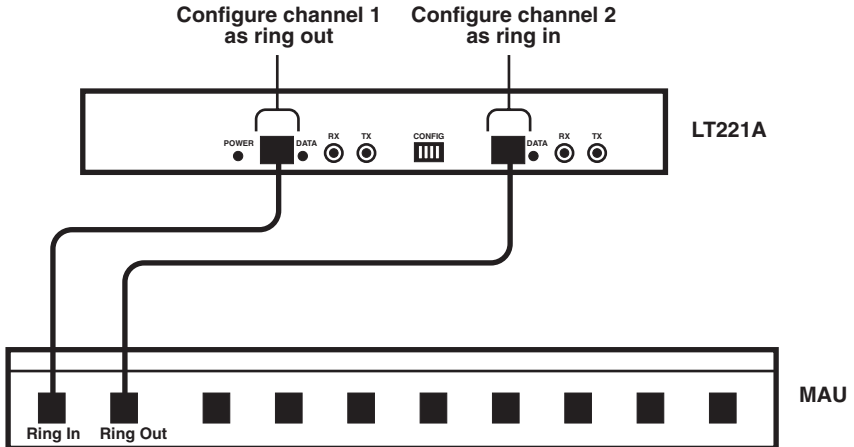


Figure 4-2. Configuration Example.

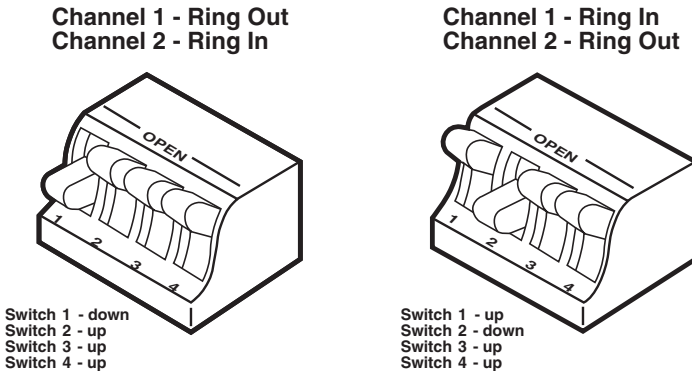
**NOTE**

a) Because the Fiber Optic Converter I has only one RJ-45 connector (it uses only Channel 1), the setting of Switch 2 can be disregarded.

b) When converters are used in the main ring, Switches 3 and 4 should always be in

the up position (open).

Refer to Figure 4-3 for switch setting information. Configure the RJ-45 connector as Ring In if it connects to Ring Out of a MAU, and vice versa. See Figure 4-2 for an example. (More information on the Config switch is given in Chapter 3.)



**Figure 4-3. Config Switch Settings for Main Ring Installations.**

2. Plug the power cords into the backs of all Converters and into electrical outlets.
3. Connect the fiberoptic cables to the appropriate connectors on the Converters. TX on a converter must connect to RX on its mate. Two optical fibers are required between each pair of the Fiber Optic Converter I; four optical fibers are required between each pair of the Fiber Optic Converter II.
4. If the network is not activated, connect the RJ-45 pins on the converters to the appropriate Ring In and Ring Out connectors on the MAUs. (Ring In receives the cable from the previous MAU or Converter; Ring Out connects to the cable going to the next MAU or converter.)

Bring up the network and make sure it is operating properly.

If the network is already operating, the Converters may be installed in the main ring by connecting the RJ-45 ports on the Converters to the appropriate Ring In and Ring Out connectors on the MAUs, as long as the ring is not broken for more than five to ten seconds.

### CAUTION

**If the main ring is broken for more than five to ten seconds, the network will be completely disabled and will have to be restarted. Data loss may occur.**

5. The installation is complete. See Chapter 3 for a description of LED operation.

### 4.3 Installation Between a MAU and a Station

The Fiber Optic Converters can be used to extend individual station lobes.

The network should be fully planned before installation of converters. Refer to Section 4.1.

The Converters may be either rack-mounted or placed on a shelf or table.

Follow these steps to install the Fiber Optic Converter between a MAU and a station.

1. Decide which lobes require converters.
2. Refer to Figure 4-4 to determine the maximum copper and fiberoptic cable lengths.

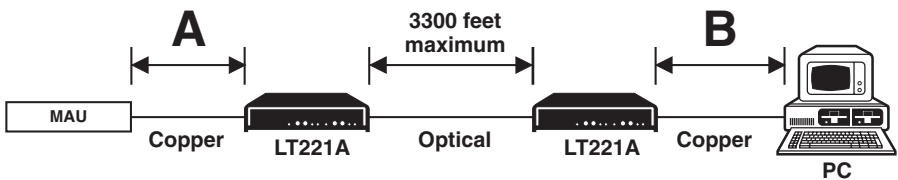
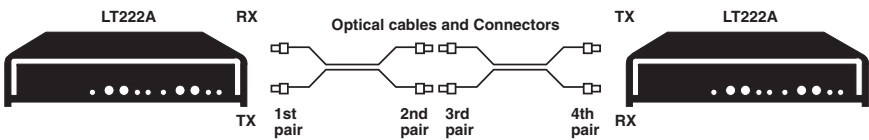


Figure 4-4. Maximum Cable Lengths.

3. Connect optical cable to the transmit and receive connectors on the Converters. TX on a Converter must connect to RX on its mate.

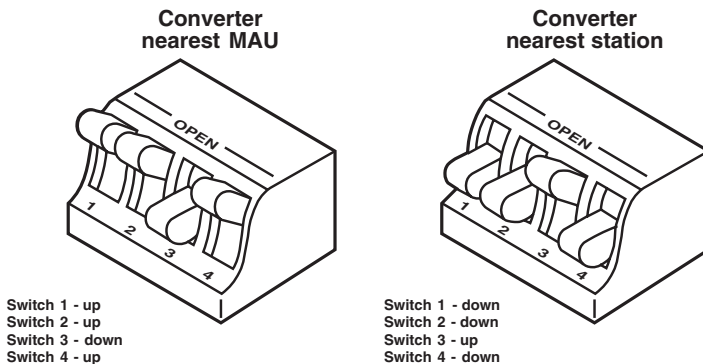
There may be as many as four pairs of optical fiber connectors between Converters, including the connectors used to attach the cable to the Converters. With the Fiber Optic Converter II, which has two channels, each channel may have up to four pairs of connectors.



**Figure 4-5. Connecting the Cable to the Converters.**

4. Configure each Converter using the Config switch on its front panel. The Converter that is closest to the MAU requires a

different switch setting than the Converter closest to the station. Use the Figure 4-6. (More information on the Config switch is given in Chapter 3.)



**Figure 4-6. Config Switch Settings for Lobe Extensions.**

### NOTE

**Because Switches 3 and 4 control both channels of the Fiber Optic Converter II, both channels must be used for the same purpose. For example, if Channel 1 connects to a station, then Channel 2, if used, must also connect to the station.**

5. Turn off the stations to which the lobes will attach, and connect the copper cable between the stations and the Converter. Connect the copper cable between the MAU and its closest Converter.
6. Attach the power cords to the Converters and plug them into a power source.
7. Turn on the station or stations.
8. The installation is complete. See Chapter 3 for a description of LED operation.



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