Ethernet Desktop Hubs
8242 Models 008 and 016

Installation and Planning Guide

Ethernet Desktop Hubs
8242 Models 008 and 016

Installation and Planning Guide

IBM

```
┌─ Note ─────────────────────────────────────────────┐
│                                                     │
│  Before using this information and the product it supports, be sure to │
│  read the safety information under "Safety Information" on page ix and │
│  the general and emissions notices in Appendix A, "Notices" on │
│  page A-1.                                          │
│                                                     │
└─────────────────────────────────────────────────────┘
```

First Edition (May 1998)

This edition applies to Version 1 of IBM 8242 Ethernet Desktop Hub.

Order publications through your IBM representative or the IBM branch office serving your locality. Publications are not stocked at the address given below.

A form for readers' comments appears at the back of this publication. If the form has been removed, address your comments to:

Department CGF
Design & Information Development
IBM Corporation
PO Box 12195
RESEARCH TRIANGLE PARK NC 27709-9990USA
USA

When you send information to IBM, you grant IBM a nonexclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

Contents

Figures

v

Tables

Safety Information

⚠ **Danger:** Before you begin to install this product, read the safety information in Caution: Safety Information–Read This First, SD21-0030. This booklet describes safe procedures for cabling and plugging in electrical equipment.

⚠ **Gevarr:** Voodrat u begint met de installatie van dit produkt, moet u eerst de veiligheidsinstructies lezen in de brochure PAS OP! Veiligheidsinstructies–Lees dit eerst, SD21-0030. Hierin wordt beschreven hoe u electrische apparatuur op een veilige manier moet bekabelen en aansluiten

⚠ **Danger:** Avant de procéder à l'nstallation de ce produit, lisez d'abord les consignes de sécurité dans la brochure ATTENION: Consignes de sécurité–A lire au préalable, SD21-0030.   Cette bro-chure décrit les procédures pour câbler et connecter les appareils électriques en toute sécurité.

⚠ **Perigo:** Antes de iniciar a instalação deste produto, leia as informações de segurança Cuidado: Informações de Segurança–Leia Primeiro, SD21-0030. Este documento descreve como efectuar,de um modo seguro, as ligações eléctricos equipmentos.

⚠

危險：安裝本產品之前， 請先閱讀
"Caution: Safety Information--Read
This First" SD21-0030 　手冊中所提
供的安全注意事項。 這本手冊將會說明
使用電器設備的纜線及電源的安全程序。

　　　　　　　　　　　ix

Opasnost: Prije nego sto pŏcnete sa instalacijom produkta, pročitajte naputak o pravilima o sigurnom rukovanju u Upozorenje: Pravila o sigurnom rukovanju - Prvo pročitaj ovo, SD21-0030. Ovaj privitak opisuje sigurnosne postupke za priključrivanje kabela i priključivanje na električno napajanje.

Upozornění: než zahájíte instalaci tohoto produktu, přečtěte si nejprve bezpečnostní informace v pokynech „Bezpečnostní informace" č. 21-0030. Tato brožurka popisuje bezpečnostní opatření pro kabeláž a zapojení elektrického zařízení.

 Fare! Før du installerer dette produktet, skal du læse sikkerhedsforskrifterne i NB: Sikkerhedsforskrifter – Læs dette først SD21-0030. Vejledningen beskriver den fremgangsmåde, du sal bruge ved tilslutning af kabler og udstyr.

 Gevarr: Voodrat u begint met de installatie van dit produkt, moet u eerst de veiligheidsinstructies lezen in de brochure PAS OP! Veiligheidsinstructies–Lees dit eerst, SD21-0030. Hierin wordt beschreven hoe u electrische apparatuur op een veilige manier moet bekabelen en aansluiten

 VARRA: Ennen kuin aloitat tämän tuotteen asennuksen, lue julkaisussa Varoitus: Turvaohjeet–Lue tämä ensin, SD21-030, olevat turvaohjeet. Tässä kirjasessa on ohjeet siitä, mitensähkölaitteet kaapeloidaan ja kytketään turvallisesti.

 Danger : Avant d'installer le présent produit, consultez le livret Attention: Informations pour la sécurité–Lisez-moi d'abord, SD21-0030, qui décrit les procédures à respecter pour effectuer les opérations de câblage et brancher les équipments électriques en toute sécurité.

⚠ **Vorsicht:** Bevor mit der Installation des Produktes begonnen wird, die Sicherheitshinweise in Achtung: Sicherheitsinformationen–Bitte zuerst lesen, IBM Form SD21-0030. Diese Veröffentilchung beschreibt die Sicherheit-svorkehrungen für das Verkabien und Anschließen elektrischer Geräte.

⚠

Κίνδυνος: Πριν ξεκινήσετε την εγκατάσταση αυτού του προϊόντος, διαβάστε τις πληροφορίες ασφάλειας στο φυλλάδιο *Caution: Safety Information-Read this first,* SD21-0030. Στο φυλλάδιο αυτό περιγράφονται οι ασφαλείς διαδικασίες για την καλωδίωση των ηλεκτρικών συσκευών και τη σύνδεσή τους στην πρίζα.

⚠ **Vigyázat:** Mielôtt megkezdi a berendezés üzembe helyezését, olvassa el a Caution: Safety Information–Read This First, SD21-0030 könyvecskében leírt biztonsági információkat. Ez a könyv leírja, miyen biztonsági intézkedéseket kell megtenni az elektromos berendezés huzalozáskor illetve csatlakoztatásakor.

⚠ **Pericolo:** prima di iniziare l'installazione di questo prodotto, leggere le informazioni relatie alla sicurezza riportate nell'opuscolo Attenzion: Informazioni di sicurezza–Prime informazioni da leggere in cui sono descritte le procdure per il cablaggio ed il collegamento di apparecchiature elettriche.

⚠

危険：　導入作業を開始する前に、安全に関する
小冊子SD21-0030　の「最初にお読みください」
(Read This First)の項をお読みください。
この小冊子は、電気機器の安全な配線と接続の
手順について説明しています。

⚠

위험: 이 제품을 설치하기 전에 반드시
"주의: 안전 정보-시작하기 전에"
(SD21-0030) 에 있는 안전 정보를
읽으십시오.

⚠

ОПАСНОСТ
Пред да почнете да го инсталирате овој продукт, прочитајте
ja информацијата за безбедност:
"Предупредување: Информација за безбедност: Прочитајте го
прво ова", SD21-0030.
Оваа брошура опишува безбедносни процедури за каблирање
и вклучување на електрична опрема.

⚠ **Fare:** Før du begynner å installere dette produktet, må du lese
sikkeretsinformasjone i Advarsel: Sikkerhetsinformasjon – Les dette
forst, SD21-0030 som beskriver skkerhetsrutinene for kabling og
tikobling av elektrisk utstyr.

⚠

Uwaga:
Przed rozpoczęciem instalacji produktu należy zapoznać się z instrukcją:
"Caution: Safety Information - Read This First", SD21-0030.
Zawiera ona warunki bezpieczeństwa przy podłączaniu do sieci elektrycznej
 i eksploatacji.

⚠ **Perigo:** Antes de iniciar a instalação deste produto, leia as
informações de segurança Cuidado: Informações de Segurança–Leia
Primeiro, SD21-0030. Este documento descreve como efectuar, de
um modo seguro, as ligações eléctricos equipmentos.

⚠

ОСТОРОЖНО: Прежде чем инсталлировать этот
продукт, прочтите Инструкцию по технике безо-
пасности в документе "Внимание: Инструкция по
технике безопасности -- Прочесть в первую очередь",
SD21-0030. В этой брошюре описаны безопас-
ные способы каблирования и подключения элект-
рического оборудования.

⚠

Nebezpečenstvo: Pred inštaláciou výrobku si prečítajte
bezpečnosté predpisy v
Výstraha: Bezpeč osté predpisy - Prečítaj ako prvé,
SD21 0030. V tejto brožúrke sú opísané bezpečnosté
postupy pre pripojenie elektrických zariadení.

⚠

Pozor: Preden zaènete z instalacijo tega produkta
preberite poglavje: 'Opozorilo: Informacije
o varnem rokovanju-preberi pred uporabo,"
SD21-0030. To poglavje opisuje pravilne
postopke za kabliranje,

⚠ **Peligro:** Antes de empezar a instalar este producto, lea la
información de seguridad en Atención: Información de
Seguridad–Leia Primeiro, SD21-0030. Este documento describe los
proced-imientos de seguridad para cablear y enchufar equipos
eléctricos.

⚠ **Varning** — livsfars: Innan du börja installera den här
produkten bör du läsa säkerhetsinformtion i dokumente Varning:
Säkerhetsforeskrifter – Läs detta först, SD21-0030. Där beskrivs hur
du på ett säkert satt ansluter elektrisk

危險：

開始安裝此產品之前，請先閱讀安全資訊。

注意：

請先閱讀 - 安全資訊 SD21-0030

此冊子說明插接電器設備之電纜線的安全程序。

About This Manual

This manual provides information on planning, installation, and using an IBM 8242 Ethernet Desktop Hub Model 008 and Model 016.

Who Should Read This Manual

This manual is intended primarily for the person who will be responsible for planning and installing the 8242 Ethernet Desktop Hub.

How To Use This Manual

This manual contains the following sections:

- "About This Manual" lists the contents of the Ethernet Desktop Hub kit and describes the IBM 8242 Ethernet Desktop Hub Model 008 and Model 016.

- Chapter 2, "Installing the Ethernet Desktop Hub" on page 2-1 contains instructions for installing an Ethernet Desktop Hub.

- Chapter 3, "Troubleshooting the Ethernet Desktop Hub" on page 3-1 contains procedures for troubleshooting problems detected by an Ethernet Desktop Hub.

- Chapter 4, "Planning the Network" on page 4-1 provides guidelines for planning for the installation of an Ethernet Desktop Hub in a new or existing network. The chapter describes and provides the specifications for the kinds of cables you will need to connect devices to an Ethernet Desktop Hub.

- The glossary contains definitions of the acronyms and key terms used in this manual.

- The appendix contains product warranty, emissions notices, and trademark information.

Contents of the Ethernet Desktop Hub Kit

Along with this manual, the Ethernet Desktop Hub kit contains the following items:

- The 8242 Ethernet Desktop Hub Model 008 or Model 016
- One wall-mounting bracket
- AC/DC Power Adapter (Model 008 only)
- DC Power Cable Retention Clip (Model 008 only)
- AC Power Cord (ordered separately except U.S. and Canada)
- The Caution: Safety Information—Read This First booklet (SD21-0030)

If any item is missing or damaged, contact your place of purchase.

Chapter 1. Introduction

The Ethernet Desktop Hubs are 10BASE-T workgroup hubs.
Workgroup hubs are also referred to as repeaters. The Ethernet
Desktop Hubs conform to the repeater specifications in IEEE 802.3
10BASE-T (10BASE-T). The "T" in the term indicates that unshielded
twisted-pair (UTP), shielded twisted-pair (STP), or foiled twisted-pair
(FTP) cables are used to connect the devices in the network.
Figure 1-1 illustrates the IBM 8242 Ethernet Desktop Hub Model
008. Figure 1-2 on page 1-2 illustrates the IBM 8242 Ethernet
Desktop Hub Model 016. Using Ethernet Desktop Hubs, you can
build small 10BASE-T networks. You can also connect those
10BASE-T networks to the following types of IEEE 802.3 network
segments, each of which uses a different type of cabling :

- 10BASE5 (thick coaxial cabling)
- 10BASE2 (thin coaxial cabling)
- 10BASE-F (optical fiber cabling)

See Figure 1-4 on page 1-4 for AUI interface connections.
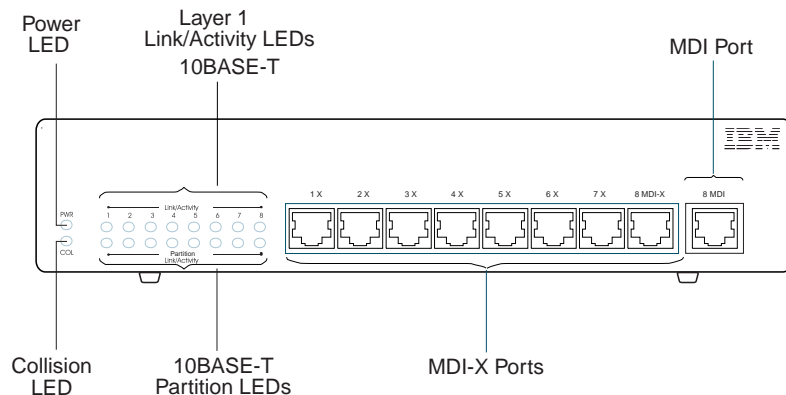
Figure   1-1. The IBM 8242 Ethernet Desktop Hub Model 008

1-1
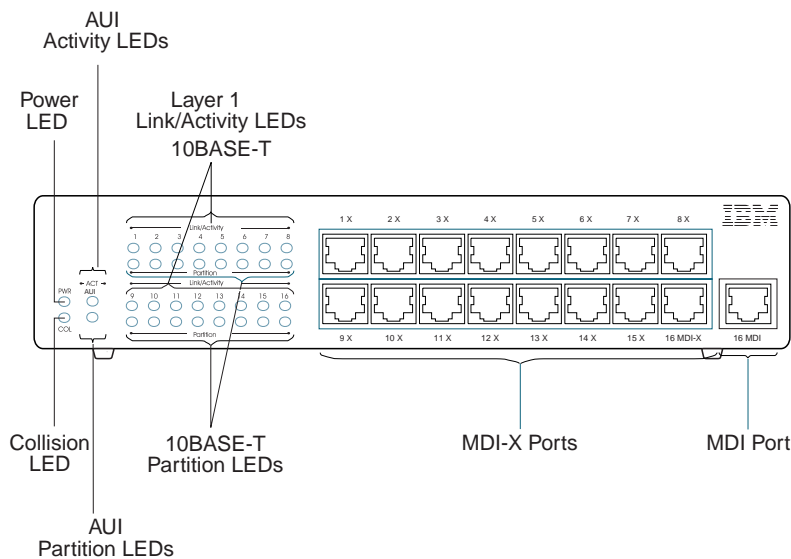
Figure   1-2. The IBM 8242 Ethernet Desktop Hub Model 016

The hub features include:

• Eight or sixteen 10BASE-T ports

These ports enable you to build a 10BASE-T network of two to eight devices (such as personal computers, servers, printers, and point-of-sale terminals) using the Model 008, or two to sixteen devices using the Model 016. Each device is connected to the hub by a UTP cable that can be up to 100 m (328 ft.) long.

Figure 1-1 on page 1-1 and Figure 1-2 show the 10BASE-T ports on the front panel of the hub. All of the 10BASE-T ports (except for the port marked "MDI") are Medium Dependent Interface-X (MDI-X) ports. These ports perform the crossover function.

The MDI port duplicates the last MDI-X port (labeled as either "8MDI-X" or "16MDI-X," depending on which model you pur-chased), but does not perform the crossover function. These two ports are wired directly together; therefore, you cannot connect devices to both of these ports on a single hub at the same time. However, the addition of the MDI port is very useful since you

can connect two hubs (cascade) with straight-through cables,
and crossover cables are not needed.

Figure 1-1 on page 1-1 and Figure 1-2 on page 1-2 show the
MDI port on the front panel of the Ethernet Desktop Hub.
Figure 1-3 illustrates cascading, using the MDI/X ports.

- Cascading ability

  The 10BASE-T and AUI ports (for Model 016) can be used to
  connect an Ethernet Desktop Hub to other Ethernet Desktop
  Hubs and other types of 10BASE-T hubs, which is called cas-
  cading. The most common method of cascading hubs is to
  connect a straight-through cable from the MDI port on one hub to
  an MDI-X port on the other hub. For further information, go to
  "Connecting the Ethernet Desktop Hub to Another 10BASE-T
  Hub" on page 2-8 or "Kinds of Cables in a Link Segment" on
  page 4-10.
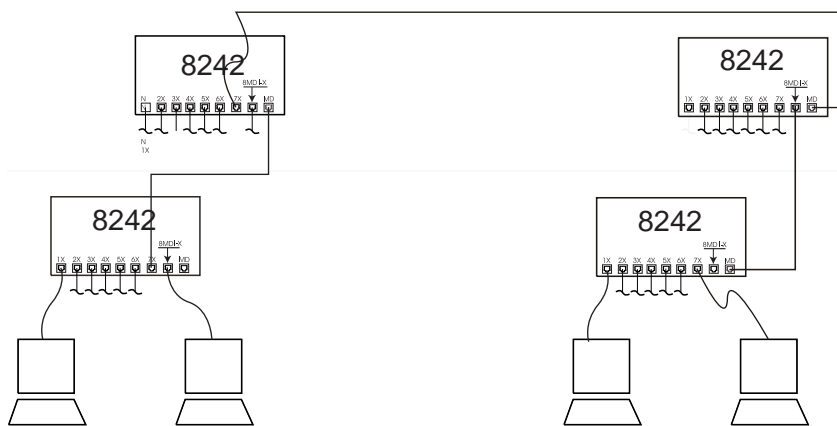
Figure 1-3. Cascading Ethernet Desktop Hubs

- One attachment unit interface (AUI) port for Model 016

  The AUI port enables you to connect an Ethernet Desktop Hub
  and its 10BASE-T connections to a 10BASE5, 10BASE2, or
  10BASE-F network segment. This feature is useful for network
  expansion. The AUI port is on the rear panel, as illustrated in
  Figure 1-4 on page 1-4.

AUI Port
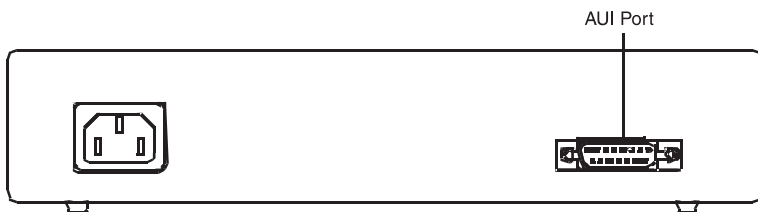
Figure   1-4. Rear Panel of the Ethernet Desktop Hub Model 016

- Tabletop and wall mounting

  The Ethernet Desktop Hub can be placed on a tabletop, equip-
  ment rack shelf, and similar surfaces. It can be mounted on a
  wall, cash register stand, and similar surfaces.

- Status and activity indicators

  Light-emitting diodes (LEDs) on the front panel indicate the
  status and activity of the hub and its individual ports. The LEDs
  for the hub are Power and Collision. The LEDs for each
  10BASE-T port are Link/Activity and Partition. In addition, there is
  an Activity and a Partition LED for the AUI port on the Model
  016.

  The information provided by the LEDs is useful for determining
  the status of the hub and for troubleshooting problems. "Under-
  standing the LEDS" on page 1-5 explains each LED.

- Automatic disabling of malfunctioning ports

  The Ethernet Desktop Hub disables a 10BASE-T or an AUI port
  if the port is not functioning correctly. Specifically, if the port has
  been involved in more than 30 consecutive collisions or the port
  is jabbering, the hub will automatically disable that port. The hub
  re-enables the port whenever that port receives a good frame.

- Automatic correction of polarity reversal

  Polarity reversal occurs when a wire in a cable that is supposed
  to have a positive signal (positive polarity) has a negative signal
  (negative polarity), or the converse condition occurs. If a cable
  containing reversed transmit data wires is connected to a
  10BASE-T port, the hub detects and correct the polarity reversal
  when it receives the reversed signal.

Understanding the LEDS

Table 1-1 on page 1-6 describes and explains the Ethernet Desktop Hub LEDs, which are illustrated in Figure 1-5 on page 1-6. The following definitions are of terms used in the table:

Collision   A condition that occurs when two or more devices on a network transmit at the same time.

Frame   The smallest unit of transmission for data and control signals on a network.

Jabbering   A condition in which a device is transmitting a frame that is excessively long.

Partitioned   A state to which the Ethernet Desktop Hub will set its port if it detects that the device connected to the port has been involved in more than 30 consecutive collisions or is jabbering. Another name for this state is disabled. While the port is disabled, the Ethernet Desktop Hub does not pass frames received through that port. The hub will re-enable the port whenever it receives a good frame from that device.

AUI
Activity LEDs

Power
LED

Layer 1
Link/Activity LEDs
10BASE-T

Collision
LED

10BASE-T
Partition LEDs

AUI
Partition LEDs
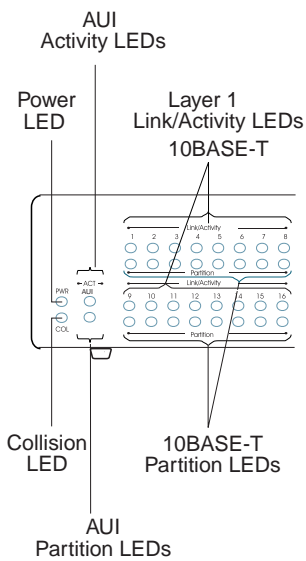
Figure   1-5. LEDS for the Ethernet Desktop Hub Model 016

Table   1-1 (Page 1 of 2). LED Explanations

LED	STATE	EXPLANATION
Power (Green)	On	The hub is receiving power from an electrical outlet and the power supply is functioning correctly.
	Off	The hub is not connected to an electrical outlet or there is a problem with the power cord or power supply.
Collision (Yellow)	Blinking	The hub has detected that a device connected to one of its ports (AUI or 10BASE-T) has had a collision. The devices that are involved in the collision will perform the collision resolution procedure (specified in IEEE 802.3) automatically.
	Off	The hub does not detect a collision on any of its ports and is operating normally.

Table 1-1 (Page 2 of 2). LED Explanations

LED	STATE	EXPLANATION
AUI/Activity (Green)	Blinking	A cable or transceiver is connected to the AUI port, the port detects that a device is connected to the other end of the cable, and the port is receiving a signal from the device.
	Off	A cable is not connected to the AUI port, or there is a problem with the cable, the port, or the device at the other end of the cable.
AUI/Partition (Yellow)	On	The hub has partitioned the port because of excessive collisions or jabbering by the device connected to the port.
	Off	The port is enabled (normal state).
10BASE-T Link/Activity (Green)	On	A cable is connected to the 10BASE-T port, the port detects that a device is connected to the other end of the cable, and the port can receive a signal from the device.
	Blinking	The 10BASE-T port is currently receiving a frame through that port.
	Off	A cable is not connected to the 10BASE-T port, or there is a problem with the cable, the port, or the device at the other end of the cable.
10BASE-T Partition (Yellow)	On	The hub has partitioned the port because of excessive collisions or jabbering by the device connected to the port.
	Off	The port is enabled (normal state).

Physical Characteristics and Requirements

The following is a summary of the physical characteristics and environmental requirements:

Dimensions	Height: 29 mm (1.1 in.) (**Model 008**) Width: 222.2 mm (8.7 in.) Depth: 135 mm (5.3 in.) Height: 49.8 mm (1.96 in.) (**Model 016**) Width: 219.0 mm (8.6 in.) Depth: 151.0 mm (5.9 in.)
Weight	0.76 kg (1.7 lb) **(Model 008)** 1.4 kg (3.1 lb) **(Model 016)**
Operation Clearances	Front: Adequate space for viewing the LEDs Sides: 50.8 mm (2.0 in.) Rear: 50.8 mm (2.0 in.)
Power	The external ac/dc power adapter supports standard voltages throughout the world. The nominal input voltage and frequency ranges are 100 - 250 V ac and 50 - 60 Hz, respectively. The output of the power adapter is DC 5V - 1A. **(Model 008)** The internal, auto-ranging power supply supports standard voltages throughout the world. The nominal input voltage and frequency ranges are 100 - 250 V ac and 50 - 60 Hz, respectively. **(Model 016)**
Power Dissipation (maximum)	5.9 Watts (36 BTU/hour) for the **Model 008** 17.5 Watts (59.5 BTU/hour) for the **Model 016**
Operating Environment	Dry-bulb temperature: 10° to 40° C (50° to 104° F) Relative humidity: 8% to 80% Maximum wet-bulb temperature: 27° C (81° F)
Storage Environment	Dry-bulb temperature: 1° to 60° C (33.8° t o 140° F) Relative humidity: 5% to 80% Maximum wet-bulb temperature: 29° C (84° F)

Chapter 2. Installing the Ethernet Desktop Hub

To install the Ethernet Desktop Hub, complete the following steps in order. You might want to copy this page for easy reference.

.

___ 1 Preparation

- Read the information in "About This Manual" on page xv.

- Check the shipping package contents list in "Contents of the Ethernet Desktop Hub Kit" on page xvi.

- Collect the necessary cables. In most cases, only straight-through cables will be needed. See Chapter 4, "Planning the Network" on page 4-1 for cabling specifications.

- Review documentation of network topology to become familiar with the hub's position in the network.

___ 2 For placement of the hub follow the instructions under "Placing the Ethernet Desktop Hub" on page 2-2.

___ 3 Connect devices (such as personal computers) to the hub by following the instructions in "Connecting Devices to the Ethernet Desktop Hub" on page 2-5.

___ 4 If the hub will be connected to another Ethernet Desktop Hub or another type of 10BASE-T hub, follow the instructions under "Connecting the Ethernet Desktop Hub to Another 10BASE-T Hub" on page 2-8.

___ 5 If the hub will be connected to a 10BASE5, 10BASE2, or 10BASE-F network segment, follow the instructions under "Connecting Ethernet Desktop Hubs Using the AUI Port" on page 2-10.

  __   6 Verify that the hub operates correctly by following the
instructions under "Verify that the Ethernet Desktop Hub
Operates Correctly" on page 2-12.

Placing the Ethernet Desktop Hub

You can place the Ethernet Desktop Hub on a tabletop (or a similar
surface, such as on an equipment rack shelf) or mount it on a wall or
under a desk or cash register stand.

For wall mounting, you will need:

- One mounting bracket (shipped with the Ethernet Desktop Hub).

- Two screws for securing the Ethernet Desktop Hub to the wall.
  Make sure you purchase screws that are suitable for your
  surface and that will support the weight of the hub. We recom-
  mend standard #4 (M3) flathead screws. For drywall mounting
  use suitable drywall mounting hardware.

- A screwdriver

Follow these steps to place an Ethernet Desktop Hub:

1 Select the location for the hub. The location should provide the
correct clearances so that the LEDs and port connections can
be easily seen and easy access can be gained to a power
outlet. You should leave at least 2 inches (51 mm) to the left,
right, and rear of the hub. You should leave enough space to
the front to adequately view the LEDs and ports.

2 For wall mounting, perform the following steps:

    a Mark the screw positions on the wall using the wall
mounting bracket hole locations as your guide.

    b Attach the mounting bracket to the wall at the positions
you marked using the correct screws mentioned above.
Tighten the screws so that the bracket is secured firmly to
the wall.

    c Hold the hub over the mounting bracket so that the slots
       on the back of the hub rest firmly on the mounting
       bracket. Figure 2-1 on page 2-3 illustrates this step.

    d Ensure that the hub is placed securely on the mounting
       bracket before continuing.

  3 To continue installing the Model 008 go to "Attaching the DC
    Power Cord Using the DC Power Cord Clip" on page 2-4. To
    continue installing Model 016, go to "Connecting Devices to the
    Ethernet Desktop Hub" on page 2-5.

**Horizontal
Mounting**
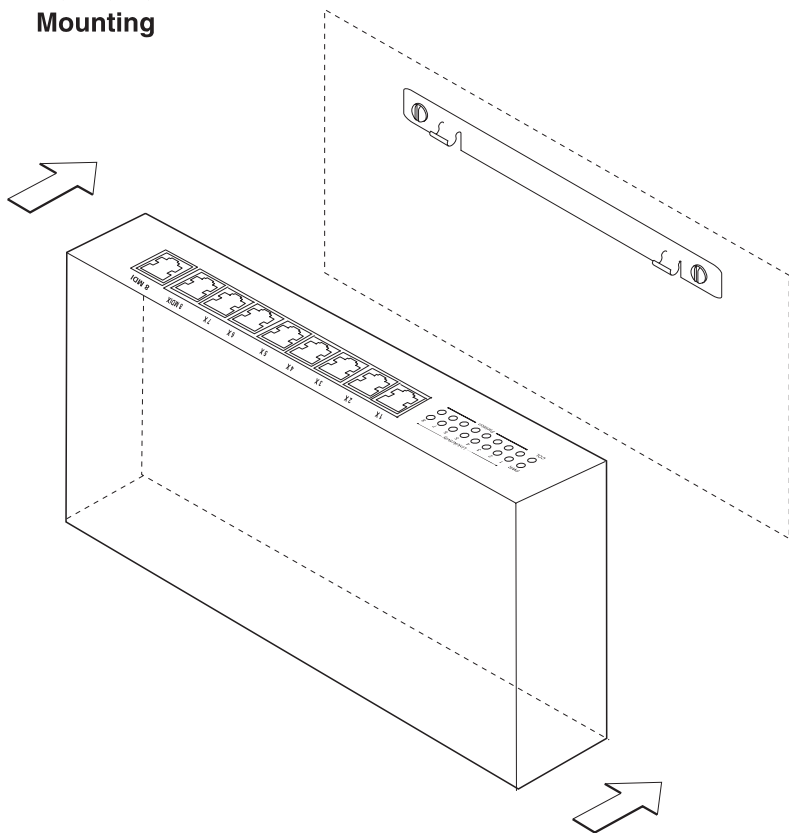
Figure   2-1. Wall Mounting an Ethernet Desktop Hub

Attaching the DC Power Cord Using the DC Power Cord Clip

To prevent accidental power cord disconnection, use the following procedure to attach the DC power Cord to the rear of the Model 008. See Figure 2-2.

1 Insert the DC connector through the large round opening in the retention clip.

2 Plug the DC connector into the DC receptacle on the rear of Model 008 before attaching the clip.

3 To attach the DC power cord clip with DC receptacle on the rear of Model 008, first insert the two fingers of the clip into the holes to the left of the DC receptacle.

4 Squeeze the clip slightly and insert the three remaining fingers of the clip into the holes on the right side of the DC receptacle.

5 Ensure that the DC connector is completely inserted into the DC receptacle.

Figure 2-2. DC Power Cord Clip for the Model 008

6 To continue installing the Model 008, go to "Connecting Devices to the Ethernet Desktop Hub" on page 2-5.
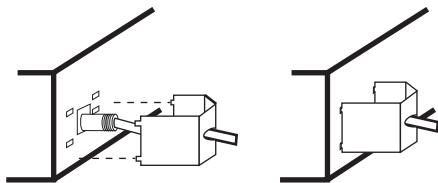
Connecting Devices to the Ethernet Desktop Hub

This section provides instructions for connecting devices (such as personal computers, printers, servers, and point-of-sale terminals) to an Ethernet Desktop Hub.

Remember these tips when connecting cables:

- Avoid excessively stretching and bending the cables.

- Avoid routing the cables near potential sources of electromagnetic interference, such as motorized devices and fluorescent lights.

- Avoid trip hazards by routing the cables away from aisles and other areas where people walk. If such routes cannot be avoided, use floor cable covers or similar material to secure and protect the cables.

- Be sure that the cables connected to the hub are supported so that the cable connectors are not excessively strained. This is especially important for AUI cables that are connected to wall-mounted hubs.

Connecting Devices Without Using Building Wiring

Follow these steps to connect one or more devices to an Ethernet Desktop Hub without using building wiring.

1 Verify that the cables being used meet the 10BASE-T specifications. "Cabling Requirements" on page 4-7 contains a summary of those specifications.

2 Connect one end of a straight-through cable to the 10BASE-T connector on the adapter (sometimes called a NIC) in the device and the other end to one of the 10BASE-T ports on the hub. See Figure 2-3 on page 2-6 for an illustration of this connection. If the device has an external 10BASE-T instead of an internal adapter, connect the straight-through cable to the transceiver and then to the hub.
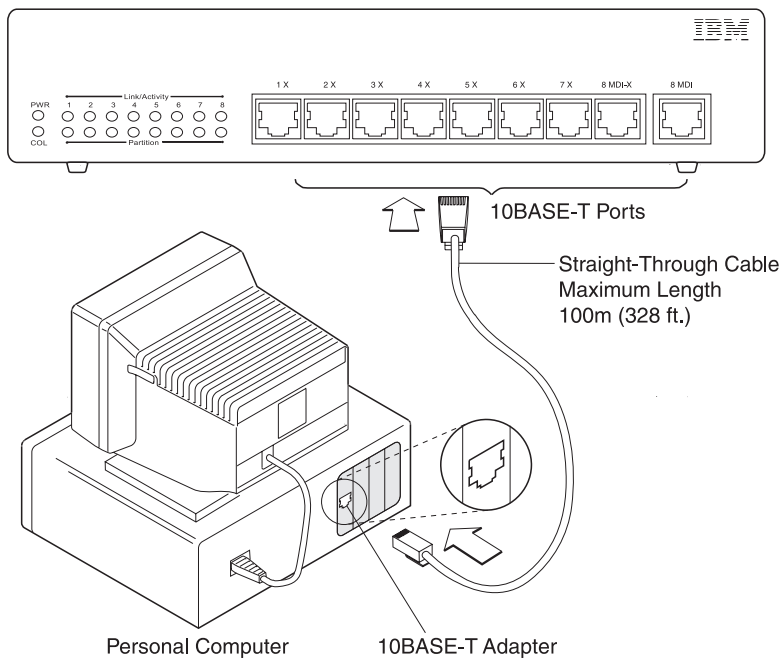
Figure 2-3. Using One Straight-Through Cable

3 If you will be using the hub for cascading, go to "Connecting the Ethernet Desktop Hub to Another 10BASE-T Hub" on page 2-8, or "Connecting Ethernet Desktop Hubs Using the AUI Port" on page 2-10 if you will be connecting to a 10BASE2, 10BASE5, or 10BASE-F network segment for Model 016. Otherwise, go to "Verify that the Ethernet Desktop Hub Operates Correctly" on page 2-12.

Connecting Devices Using Building Wiring

If you will use building wiring (in-the-wall cables) to connect the device to the Ethernet Desktop Hub, perform the following steps.

1 Verify that the building wiring meets the 10BASE-T specifications. "Cabling Requirements" on page 4-7 contains a summary of the specifications.

2 Start connecting the cables in the work area. Connect one end of a straight-through cable to the 10BASE-T connector on the adapter (sometimes called a NIC) in the device and the other end to the 10BASE-T connector on the faceplate where the building wiring cable terminates. See Figure 2-4 on page 2-8 for an illustration of this connection.

If the device has an external 10BASE-T transceiver instead of an internal adapter, connect the straight-through cable to the transceiver and then to the faceplate.

3 In the wiring closet, connect a straight-through cable to the 10BASE-T connector on the patch panel or other equipment where the building wiring cable terminates. Connect the other end of the straight-through cable to a 10BASE-T port on the hub.

4 To continue installing the Ethernet Desktop Hub, go to "Connecting the Ethernet Desktop Hub to Another 10BASE-T Hub" on page 2-8 or "Connecting Ethernet Desktop Hubs Using the AUI Port" on page 2-10, depending on the type of connections you need to make. Otherwise, go to "Verify that the Ethernet Desktop Hub Operates Correctly" on page 2-12.
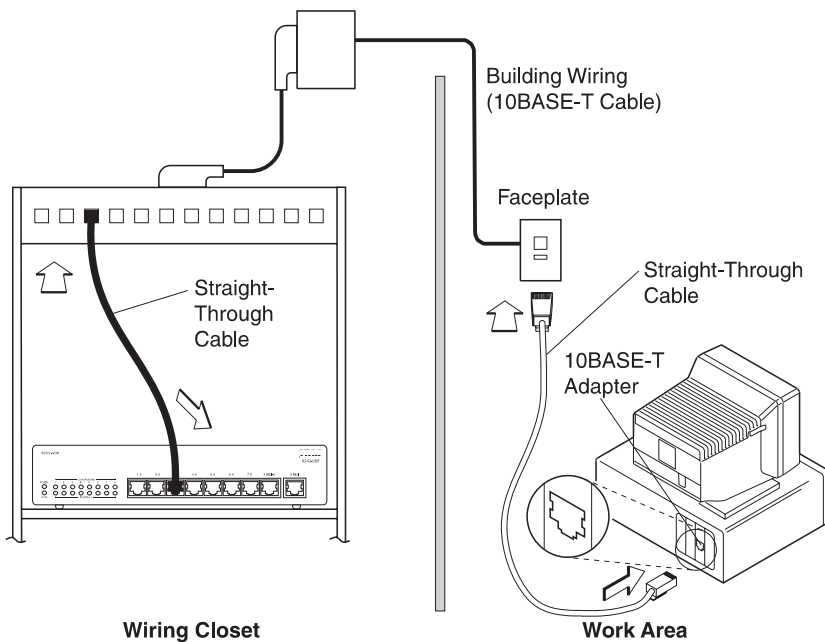
Figure   2-4. Using Straight-Through Cables and Building Wiring

Connecting the Ethernet Desktop Hub to Another 10BASE-T Hub

There are several ways to connect Ethernet Desktop Hubs to other 10BASE-T hubs, but the easiest and most common way is with straight-through cables. Perform the following procedure if you need to make such connections:

1 To connect two hubs, perform one of the following steps:

- If the other hub is an Ethernet Desktop Hub, connect a straight-through cable from any 10BASE-T port on the Ethernet Desktop Hub marked with an "X" to the 10BASE-T port marked "MDI" on the other Ethernet Desktop Hub.

  Note: The "X" on the 10BASE-T ports means that those ports perform the crossover function. Connections between the ports on any two hubs will be suc- cessful as long as there is an odd number (in most

cases just one) of crossovers. Since the port on the
hub marked "MDI" does not perform the crossover
function, you will need only a straight-through cable.
The connection to the MDI-X port on the other end
will ensure an odd number of crossovers. However,
remember that you cannot use the MDI port and the
last MDI-X port on any given hub at the same time,
since these ports are wired directly together.

- If the Ethernet Desktop Hub will be connected to another
  type of 10BASE-T hub and that hub has one or more
  10BASE-T ports that are marked with an "X," connect a
  straight-through cable from the 10BASE-T port on the
  Ethernet Desktop Hub marked "MDI" to a 10BASE-T port
  on the other hub marked with an "X."

- If the Ethernet Desktop Hub will be connected to another
  type of 10BASE-T hub **without an "X"** on any of the ports,
  connect a straight-through cable from a 10BASE-T port on
  the Ethernet Desktop Hub marked with an "X" to any
  10BASE-T port on the other hub.

- If the Ethernet Desktop Hub will be connected to another
  type of 10BASE-T hub **without an "X"** on any of the ports
  and a crossover cable is all that is available, connect the
  crossover cable from the port marked "MDI" on the
  Ethernet Desktop Hub to any port on the other hub.

2 If you used a crossover cable in the previous step, consider
marking an "X" at each end of the cable, or using a different
color label or some other identifier to distinguish it from straight-
through cables.

3 Now you can connect devices to the 10BASE-T ports on both
hubs.

4 To connect to a 10BASE5, 10BASE2, or 10BASE-F segment
on the Model 016, go to "Connecting Ethernet Desktop Hubs
Using the AUI Port" on page 2-10.

Connecting Ethernet Desktop Hubs Using the AUI Port

If the Model 016 will be connected to a 10BASE5, 10BASE2, or 10BASE-F network segment using the AUI port, perform the following procedures:

Note: If you want to test the 10BASE-T portion of the network before connecting it to the rest of the network, perform the steps under "Verify that the Ethernet Desktop Hub Operates Correctly" on page 2-12 first. Then, perform this procedure and repeat the steps in "Verify that the Ethernet Desktop Hub Operates Correctly" on page 2-12.

  1 Connect one end of the AUI cable to the AUI port of the Ethernet Desktop Hub and the other end to a 10BASE5, 10BASE2, or 10BASE-F transceiver. See Figure 2-5 on page 2-11 for an illustration of this connection.

  If the transceiver is located close enough to the Ethernet Desktop Hub, you may be able to connect the hub directly to the transceiver without using an AUI cable.

AUI Port

AUI Cable
(Optional)

AUI Port

10BASE5, 10BASE2,
or 10BASE-F
Transceiver
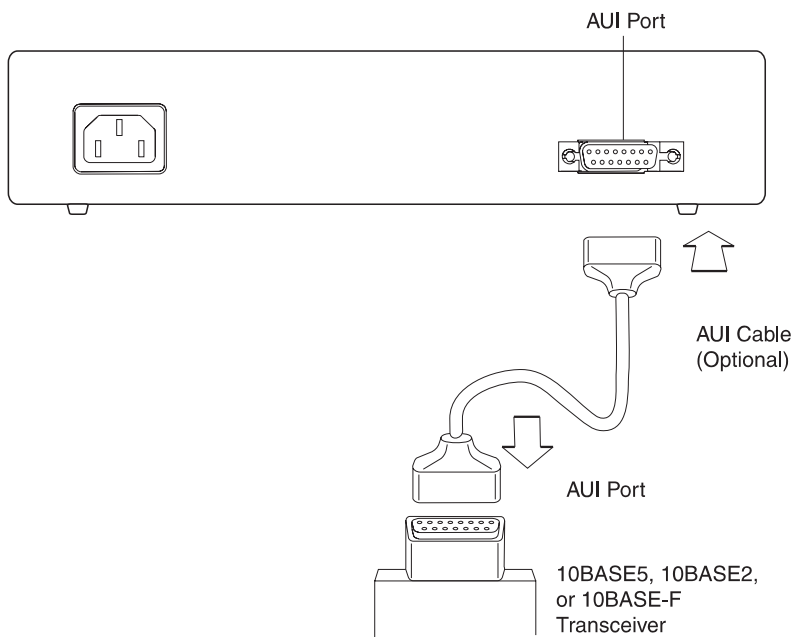
Figure   2-5. Connecting an AUI Cable (Model 016)

2 To secure the AUI cable (or the 10BASE5, 10BASE2, or
   10BASE-F transceiver) in place on the hub's AUI port, push
   the slide latch on the AUI port to the left. See Figure 2-6 for an
   illustration of how to push the latch.
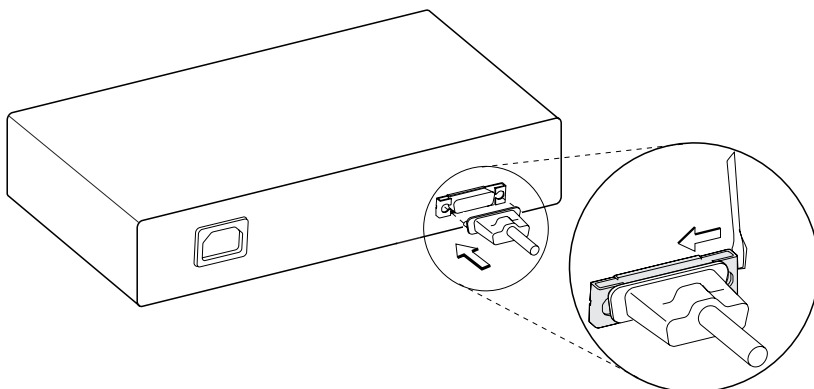
Figure   2-6. Pushing the Slide Latch on the AUI Port (Model 016 only)

3 To continue installing the Ethernet Desktop Hub, go to "Verify
   that the Ethernet Desktop Hub Operates Correctly" on
   page 2-12.

Verify that the Ethernet Desktop Hub Operates Correctly

To verify that the hubs you have installed operates correctly, perform
the following steps:

1 For each hub that you have installed, connect the power cord
   to the hub and to a non-switched, grounded electrical outlet.

   The Power LED should turn on.

   If none of the LEDs are on or if one of the LEDs is yellow, go
   to "Start of Troubleshooting Process" on page 3-1. See "Under-
   standing the LEDS" on page 1-5, if you need an explanation of
   the LED states.

2 Start one or more devices connected to the hub and try to com-
   municate with those devices. If the devices cannot communi-
   cate, see "Start of Troubleshooting Process" on page 3-1.

3 Unless you are cascading or connecting to a 10BASE2,
   10BASE5, or 10BASE-F segment, the installation process is
   complete.

Chapter 3. Troubleshooting the Ethernet Desktop Hub

This chapter contains procedures that help you troubleshoot problems with an Ethernet Desktop Hub and its connections.

Start of Troubleshooting Process

If one or more devices (such as personal computers) connected to an Ethernet Desktop Hub are unable to communicate with other devices in the network, use the following steps to start the troubleshooting process:

1 Locate the hub to which the device is connected. Use the network sketch, the label on the 10BASE-T cable connected to the device, or other network records to help you locate the hub.

2 Observe the LEDs on the front panel. Figure 3-1 on page 3-2 illustrates the LEDs. (See "Understanding the LEDS" on page 1-5 if you want to review the explanations of the LEDs before you continue with this troubleshooting process.)

3 In Table 3-1 on page 3-2, locate the symptom that best describes the communication problem and the LED pattern you observed. Then, go to the section that contains the recommended actions for resolving the problem and follow that procedure.

NOTES:

1. The Ethernet Desktop Hub does not contain serviceable parts. However, if it appears that a hub is defective, see Appendix A, Notices for information concerning service for the product.

2. A link segment means a single cable or interconnected cables between an Ethernet Desktop Hub 10BASE-T port and the device at the other end. A link segment can contain one straight-through cable, one crossover cable, or straight-through cables connected to building wiring (in-the-wall cable).
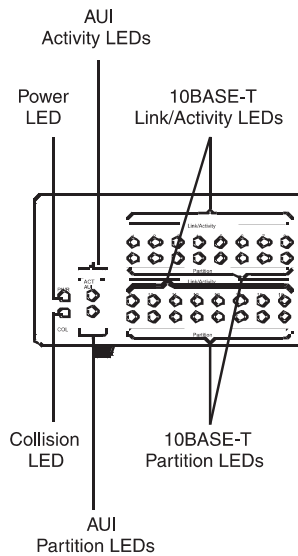
Figure 3-1. LEDs for the IBM 8242 Ethernet Desktop Hubs

Table 3-1 (Page 1 of 2). Symptom, LED State, and Recommended Procedure

SYMPTOM AND LED STATE	GO TO
None of the devices connected to the Ethernet Desktop Hub can communicate, and no LEDs are on.	"Procedure A" on page 3-3
None of the devices connected to the Ethernet Desktop Hub can communicate, and the Power LED is on.	"Procedure B" on page 3-3
A single device connected to the Ethernet Desktop Hub is having trouble communicating, and all of the LED indications are normal.	"Procedure B" on page 3-3
One of the 10BASE-T Partition LEDs is on.	"Procedure B" on page 3-3
A 10BASE-T Link/Activity LED is off and a device is connected to that port.	"Procedure B" on page 3-3

Table 3-1 (Page 2 of 2). Symptom, LED State, and Recommended Procedure

SYMPTOM AND LED STATE	GO TO
All of the devices connected to the hub communicating slowly, and the Collision LED is on.	"Procedure C" on page 3-6
A device is connected to the AUI port and the AUI Partition LED is on or a device is connected to a 10BASE-T port and the Activity LED for that port is off.	"Procedure D" on page 3-6

Procedure A

Use the following procedure if none of the devices connected to the hub can communicate and no LEDs are on:

1 Verify that the power cord or power supply is connected at both ends and test the power outlet to be sure power is present.

2 If the power cord or power supply is connected correctly and the outlet is working, the problem is in the hub. Contact your place of purchase.

Procedure B

Use this procedure if none of the devices connected to the hub can communicate and the Power LED is on:

1 Reset the hub by disconnecting the power cord and reconnecting it to the electrical outlet.

   a If the problem goes away, no further action is required.

   b If the problem persists, continue with step 2.

2 Observe the Link/Activity LED and the Partition LED for each 10BASE-T port to which a link segment is connected.

   a If a Link/Activity LED is off or a Partition LED is on, continue with step 3 on page 3-4.

b If all of the Link/Activity LEDs for the ports that are con-
   nected are on and all of the Partition LEDs are off, go to
   step 4 on page 3-4.

3 For each 10BASE-T port whose Link/Activity LED is off or Parti-
   tion LED is on, perform the following steps:

a Verify that each cable in the link segment is connected at
   both ends. You will hear a click when a 10BASE-T cable
   connector (an RJ-45 plug connector) is fully inserted into
   a 10BASE-T jack connector (on an Ethernet Desktop Hub,
   10BASE-T adapter, faceplate for building wiring, or patch
   panel).

   Be sure to check each cable in the link segment from the
   hub to the device at the other end. Check any building
   wiring (in-the-wall cable) connections carefully.

b Verify that the cable or cables you have used in the link,
   in conjunction with the end devices, provides an odd
   number of crossovers. Most connections will involve
   straight-through cables, but check to make sure that there
   are the required odd number of crossovers from that port.
   See "Connecting the Ethernet Desktop Hub to Another
   10BASE-T Hub" on page 2-8 or "Kinds of Cables in a
   Link Segment" on page 4-10 for further explanation of the
   crossover function.

c Verify that each cable in the link segment is good. If you
   do not have cable testing equipment, replace the cable
   with a cable that is the correct type and known to be
   good.

4 If the Ethernet Desktop Hub is connected to another Ethernet
   Desktop Hub or another type of 10BASE-T hub, perform the
   following steps:

a Verify that the other hub is operating correctly.

b Verify that only one cable interconnects the two hubs.

5 If the Model 016 is connected to a 10BASE5, 10BASE2, or
   10BASE-F transceiver and none of the devices connected to
   the hub can communicate with the devices in the 10BASE5,
   10BASE2, or 10BASE-F portion of the network, go to "Proce-
   dure D" on page 3-6.

6 For each device that is having a communication problem,
   connect its link segment to another 10BASE-T port on the hub.
   Try each of the remaining ports to determine whether the
   problem will go away.

   a If the problem goes away, the problem might be in the
      hub. Contact your place of purchase.

   b If the problem persists, continue with step 7.

7 For each device that is having a communication problem, verify
   that the link LED on its 10BASE-T adapter (sometimes called a
   NIC) is on, which indicates that the link segment is connected.

   a If the link LED is on, continue with step 8.

   b If the link LED is off, replace the cable connected to the
      adapter with a cable that is known to be good.

   c If the link LED is still off, there might be a problem with
      the adapter that is preventing the device from communi-
      cating on the network. Test the adapter by running diag-
      nostics.

   d If the adapter does not have a link LED, run the adapter
      diagnostics.

   e Replace the adapter with one that is known to be good. If
      the problem persists, continue with step 8.

8 Refer to your documentation on your network operating system
   to verify that the network software is operating correctly. You
   might also want to consult your network administrator for assist-
   ance in this process. If you do not detect an error in your
   network software, continue with step 9 on page 3-6.

9 The problem appears to be in the Ethernet Desktop Hub. Contact your place of purchase.

Procedure C

If all of the devices connected to the hub are communicating slowly and the Collision LED is on, there is heavy traffic the AUI net port. The hub is operating correctly.

If this problem persists, consider dividing the network (a single collision domain) into two or more collision domains and connecting the domains with bridges or routers. See "Network Constraints" on page 4-1 if you need an explanation of collision domain.

Procedure D

Use this procedure if a device is connected to the AUI port and the AUI Partition LED is on, or a device is connected to the AUI ports and the Activity LED for that port is off. Also, use this procedure if you were sent here by "Procedure B" on page 3-3.

1 Verify that the cables are firmly connected at each end of the link segment and that the link LEDs at each end are lit to ensure connectivity.

2 Verify that the AUI cable is good.

If an AUI cable connects the Ethernet Desktop Hub to the transceiver, replace the cable with one that is known to be good.

Then, verify the condition of the transceiver by replacing it with one that is known to be good.

3 If the AUI Partition LED is off, verify that the devices connected to the hub can communicate with each other.

4 If the problem persists, the problem might be in the Ethernet Desktop Hub. Contact your place of purchase.

Before You Call Service

Many computer problems can be resolved without outside assistance by using information on the World Wide Web or printed documentation that comes with the Ethernet Desktop Hub.

On the World Wide Web the IBM Networking Support page for the Ethernet Desktop Hub provides technical tips and product information such as, specifications, announcement data, documentation (English and translated versions), and other related materials.

The address for the IBM Networking Support page is:

`http://www.networking.ibm.com/support/8242`

Getting Help by Telephone

During the warranty period you can get help and information by telephone through the IBM PC Helpcenter. In the U.S., call 1-800-772-2227 and in Canada, call 1-800-IBM-SERV (1-800-426-7378). All other countries contact your IBM reseller or IBM marketing representative.

Purchasing Additional Services

During and after the warranty period, you can purchase additional services, such as support for IBM On-Site Repair (IOR), IBM and non-IBM hardware, network setup and configurations, upgraded or extended hardware repair services, and custom installation. Service availability and name might vary by country. You should call 1-800-IBM-SERV (1-800-426-7378).

Chapter 4. Planning the Network

This chapter provides the information you will need to plan for installing Ethernet Desktop Hubs in a new or existing network. It describes the kinds of networks in which Ethernet Desktop Hubs can be used, the cables used to connect devices to an Ethernet Desktop Hub, and the transceivers used to connect an Ethernet Desktop Hub and its 10BASE-T connections to 10BASE5, 10BASE2, and 10BASE-F network segments.

Note: The Ethernet Desktop Hub does not support outdoor cable runs. Ethernet connections (excluding optical fiber) are restricted to indoor wiring only.

Network Constraints

Based on IEEE Standard 802.3, the following constraints apply to 10BASE-T networks:

- The maximum length of a link segment is 100 m (328 ft.).

  In simple terms, a link segment is a single cable or intercon-
  nected cables that connect a device to a 10BASE-T hub.
  Figure 4-1 illustrates link segments used to connect devices to
  an Ethernet Desktop Hub. Each link segment is UTP cable. Only
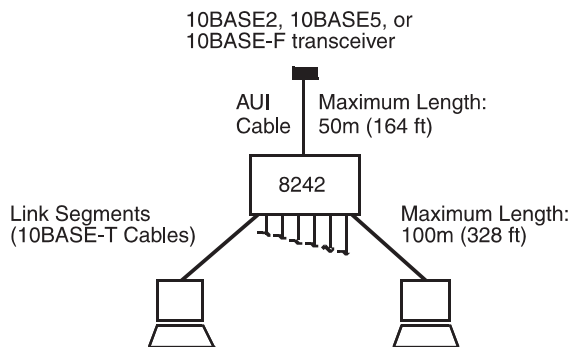 one device can be connected to each 10BASE-T port.

Figure   4-1. Link Segment and AUI Cable for Model 016

- The maximum length of an AUI cable is 50 m (164 ft.).

An AUI cable is the cable used to connect the AUI port of a device to a 10BASE5, 10BASE2, or 10BASE-F segment through a transceiver. In some cases, when the transceiver is in close proximity to the hub, the AUI cable is optional in that the AUI port of an Ethernet Desktop Hub can be connected directly to the transceiver. Figure 4-1 on page 4-1 illustrates an AUI cable.

- The IEEE 802.3 standard for optical fiber cabling (10BASE-F) addresses four types of cabling:

  - Fiber-optic inter-repeater link (FOIRL)
  - 10BASE-FL
  - 10BASE-FB
  - 10BASE-FP

  The types have different specifications. Each type can be used in an inter-repeater fiber segment, which consists of an optical fiber cable with an optical fiber transceiver at each end. Each end of the segment is connected to a 10BASE5, 10BASE2, or 10BASE-T hub, or a 10BASE-F segment. Inter-repeater fiber segments are frequently used when an IEEE 802.3 network is extended between buildings.

- A maximum of four hubs (four repeater hops) and five segments can be in the path between two devices in the same collision domain.

  A segment is the common cabling to which devices are connected. A collision domain consists of one segment or multiple segments that are physically interconnected by hubs. A collision domain cannot contain bridges or routers, which are devices that interconnect segments logically. The maximum number of devices permitted in a collision domain is 1024.

  Figure 4-2 on page 4-3 illustrates a single collision domain that contains three types of segments. A, E, and G are 10BASE-T link segments. B, C, and F are 10BASE5 segments. D is a 10BASE2 segment.
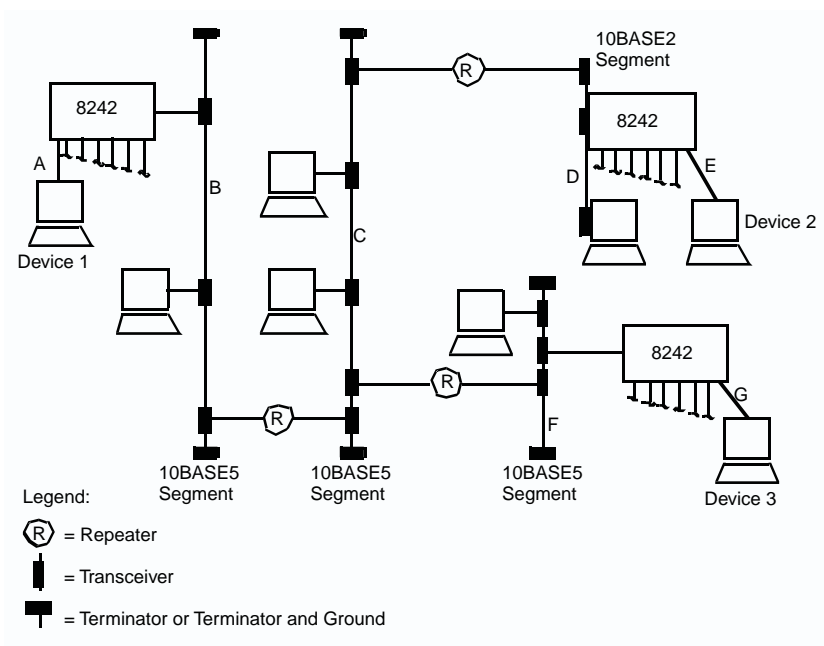
Figure   4-2. A Network Containing Multiple Segments and Hubs

In the illustration, the path from DEVICE 1 to DEVICE 3 contains
four hubs (two Ethernet Desktop Hubs and two 10BASE5 hubs)
and five segments (A, B, C, F, and G). Although no more than
four hubs and five segments are allowed in a path, a collision
domain can contain more than four hubs and five segments, as
shown in the illustration.

- The maximum of five segments in a path can consist of a
  maximum of two link segments and three coaxial segments.

A 10BASE5 segment can be up to 500 m (1640 ft.) long and
contain up to 100 devices. A 10BASE2 segment can be up to
185 m (607 ft.) long and contain up to 30 devices. In both cases,
hubs count toward the maximum device limits.

See your product supplier if you need more information about
10BASE5 or 10BASE2 networks.

- If a path contains an inter-repeater fiber segment, the maximum length of the segment depends on the number of hubs in the path.

  If there are four hubs and five segments in a path, an FOIRL, 10BASE-FL, or 10BASE-FB segment in the path is limited to a length of 500 m (1640 ft.). A 10BASE-FP segment in such a path cannot exceed 300 m (984 ft.).

  If there are three hubs and four segments, an FOIRL, 10BASE-FL, or 10BASE-FB segment in the path can be up to 1000 m (3280 ft.) in length. In such cases, a 10BASE-FP segment cannot exceed 700 m (2297 ft.).

Using Ethernet Desktop Hubs in 10BASE-T Networks

Using a single Ethernet Desktop Hub Model 008, you can build a 10BASE-T network that consists of two to eight devices. Figure 4-3. illustrates such a network. A single Ethernet Desktop Hub Model 016 can be used to build a network that consists of 2 to 16 devices.
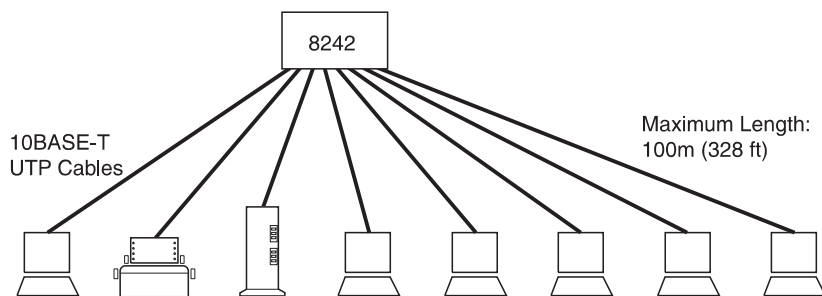

Figure   4-3. Building a 10BASE-T Network with a Single Model 008

An Ethernet Desktop Hub can be connected to other Ethernet Desktop Hubs and other types of 10BASE-T hubs through its 10BASE-T ports, which is known as cascading. Figure 4-4 on page 4-5 illustrates a cascaded configuration.
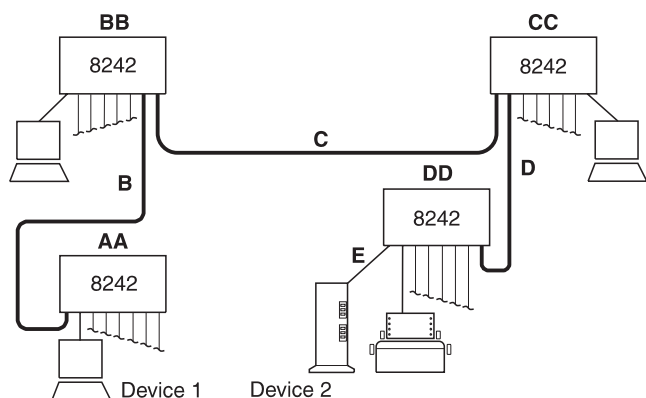
Figure 4-4. Building a 10BASE-T Network with Cascaded Ethernet Desktop Hubs

You can build cascaded 10BASE-T networks larger than the one illustrated in Figure 4-4, but no more than four hubs (four repeater hops) can be in a path between devices. For example, instead of connecting devices (such as personal computers) to BB and CC, you could connect additional Ethernet Desktop Hubs.

If the number of devices that will be connected to the 10BASE-T network exceeds the number that you can accommodate using cascaded Ethernet Desktop Hubs, consider dividing the network into two or more collision domains and connecting the domains with bridges or routers. Another option is to connect the hub to a backbone segment.

Using Ethernet Desktop Hubs in Mixed Networks

As discussed earlier, an Ethernet Desktop Hub Model 016 can be attached to other types of networks through its AUI ports. In Figure 4-5 on page 4-6, the Ethernet Desktop Hubs are connected to either a 10BASE5 or 10BASE2 segment. In Figure 4-6 on page 4-7, the Ethernet Desktop Hubs are connected to 10BASE5 segments and an FOIRL is used to interconnect those segments. In Figure 4-7 on page 4-7, the Ethernet Desktop Hubs are connected to an FOIRL.

In addition to observing the constraints described under "Network Constraints" on page 4-1, remember the following guidelines when using Ethernet Desktop Hubs in networks that contain different cabling types:

- Adhere to any network constraints described in your 10BASE5, 10BASE2, or 10BASE-F product documentation.

- Ensure that adding an Ethernet Desktop Hub to a coaxial or optical fiber segment will not cause the maximum device limit to be exceeded.

- A path between two devices should not contain a 10BASE2 segment between two 10BASE5 segments.
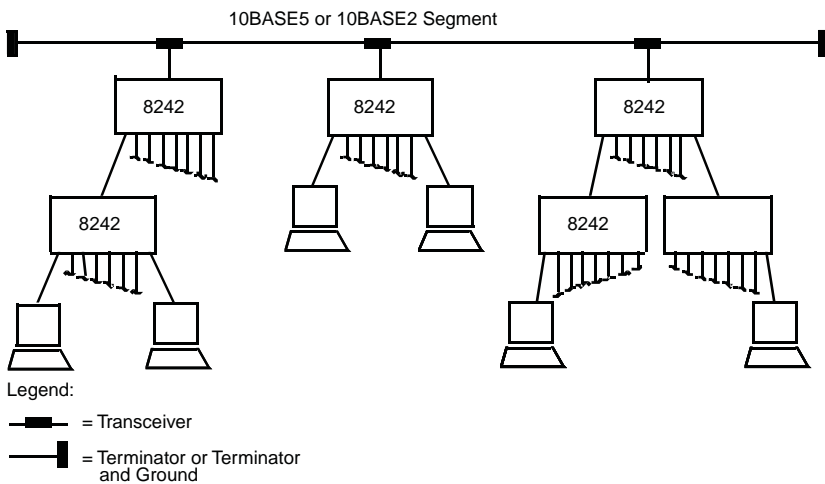
Figure 4-5. Ethernet Desktop Hubs Model 016 in a Network with Coaxial Segments
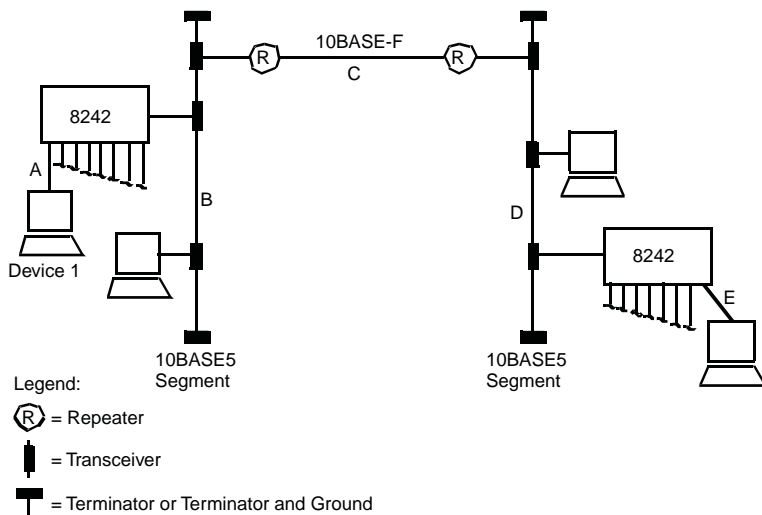
Figure 4-6. Ethernet Desktop Hubs Model 016 in a Network with 10BASE-F and Coaxial Segment
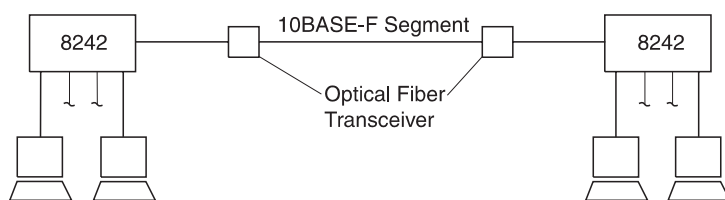
Figure 4-7. Ethernet Desktop Hubs Model 016 in a Network with a 10BASE-F Segment

Cabling Requirements

This section describes the cables required to connect devices to an Ethernet Desktop Hub, connect two Ethernet Desktop Hubs, connect an Ethernet Desktop Hub to another type of 10BASE-T hub, and connect an Ethernet Desktop Hub and its 10BASE-T connections to another type of network segment.

10BASE-T Cabling Specifications

Problems with LANs are frequently due to incorrect cabling. So that your 10BASE-T network will operate as intended, use care in selecting the cabling and ensure that it is correctly installed. Table 4-1, Table 4-2, and Table 4-3 on page 4-9 describe the specifications for cables used in 10BASE-T link segments.

If 150-ohm STP or 120-ohm FTP cabling is used, impedance-matching devices must be used as well.

Table 4-1. Cabling Specifications for UTP Link Segments

CHARACTERISTIC	SPECIFICATION (Note 1)
Cable type	UTP with 2 twisted pairs of 22, 24, or 26 AWG (Note 2)
Nominal impedance	100 ohms
Velocity propagation	0.585 c (Note 3)
Maximum attenuation	8 to 10 dB per 100 m at 10 MHz

Notes:

1. Cables that have been certified as EIA/TIA-568 category 3, 4, and 5 are among the cable types that meet all of the 10BASE-T specifications.

2. The cable can contain two to four twisted pairs, but only two of the pairs will be used by the 10BASE-T network.

3. The c represents the velocity of light traveling in a vacuum, which is approximately 300 000 km/sec (180 000 mi/sec).

Table 4-2 (Page 1 of 2). Cabling Specifications for STP Link Segments

CHARACTERISTIC	SPECIFICATION (Note 1)
Cable type	STP with 2 twisted pairs of 22, 24, or 26 AWG (Note 3)
Nominal impedance	150 ohms
Velocity propagation	0.585 c (Note 3)

Table 4-2 (Page 2 of 2). Cabling Specifications for STP Link Segments

CHARACTERISTIC	SPECIFICATION (Note 1)
Maximum attenuation	8 to 10 dB per 100 m at 10 MHz

Notes:

1. Cables that have been certified as EIA/TIA-568 category 1, 6, 9, 1A, 6A, and 9A are among the cable types that meet all of the 10BASE-T specifications.

2. The cable can contain two to four twisted pairs, but only two of the pairs will be used by the 10BASE-T network.

3. The c represents the velocity of light traveling in a vacuum, which is approximately 300 000 km/sec (180 000 mi/sec).

Table 4-3. Cabling Specifications for STP Link Segments

CHARACTERISTIC	SPECIFICATION (Note 1)
Cable type	FTP with 2 twisted pairs of 22, 24, or 26 AWG (Note 2)
Nominal impedance	100 or 120 ohms
Velocity propagation	0.585 c (Note 3)
Maximum attenuation	8 to 10 dB per 100 m at 10 MHz

Notes:

1. Cables that have been certified as EIA/TIA-568 category 1, 6, 9, 1A, 6A, and 9A are among the cable types that meet all of the 10BASE-T specifications.

2. The cable can contain two to four twisted pairs, but only two of the pairs will be used by the 10BASE-T network.

3. The c represents the velocity of light traveling in a vacuum, which is approximately 300 000 km/sec (180 000 mi/sec).

Do not use telephone extension cables in 10BASE-T networks. The wire pairs in those cables are not twisted and the cable does not meet other requirements for use in a 10BASE-T network. You can identify telephone extension cables by their flat and thin appearance. UTP cables are rounder and thicker than telephone extension cables.
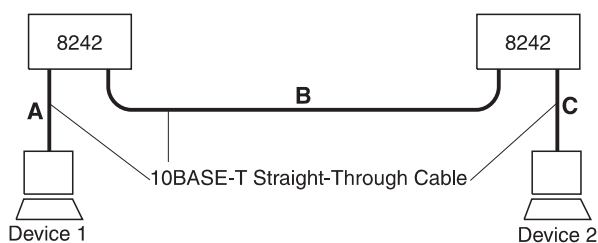
The cables used in a 10BASE-T link segment do not require
grounding. However, all of the devices connected to the cables must
be grounded. The Ethernet Desktop Hub is grounded.

Kinds of Cables in a Link Segment

Again, a link segment is the cabling used to connect devices to an
Ethernet Desktop Hub. A link segment might consist of a single cable
or interconnected cables. The number and kinds of cables needed
depend on whether you use building wiring (in-the-wall cables) in
your 10BASE-T network and whether the Ethernet Desktop Hub is
connected to other 10BASE-T hubs. Building wiring extends from a
central location (a wiring closet) to each location requiring network
service.

Figure 4-8 on page 4-11 illustrates cabling in networks with and
without wiring closets. An example of an environment in which wiring
closets would not be needed is when the Ethernet Desktop Hubs and
the attached devices are placed in an open work area. An example
of an environment in which wiring closets would be needed is a
building in which the Ethernet Desktop Hubs and the attached
devices are on separate floors.

No-Wiring Closet Environment

```
   ┌──────────┐                              ┌──────────┐
   │   8242   │                              │   8242   │
   └──────────┘              B               └──────────┘
      A│   └──────────────────────────────┘   │C
       │                                       │
   ┌──────┐                                ┌──────┐
   │      │     10BASE-T Straight-Through Cable  │      │
   └──────┘                                └──────┘
   Device 1                                Device 2
```

Wiring Closet Environment

25-Pair
Telco Cable

Type 66
Block,
Harmonica
Splitter,
or Modular
Break Out
Box

Patch Panel

8242

I

H

K

Straight-
Through
Cables

8242

J

F

G

10BASE-T UTP
Cable or
EIA/TIA
Category
3, 4, or 5

Device 3

D

10BASE-T
Straight-
Through
Cables

E

Faceplate   Device 4

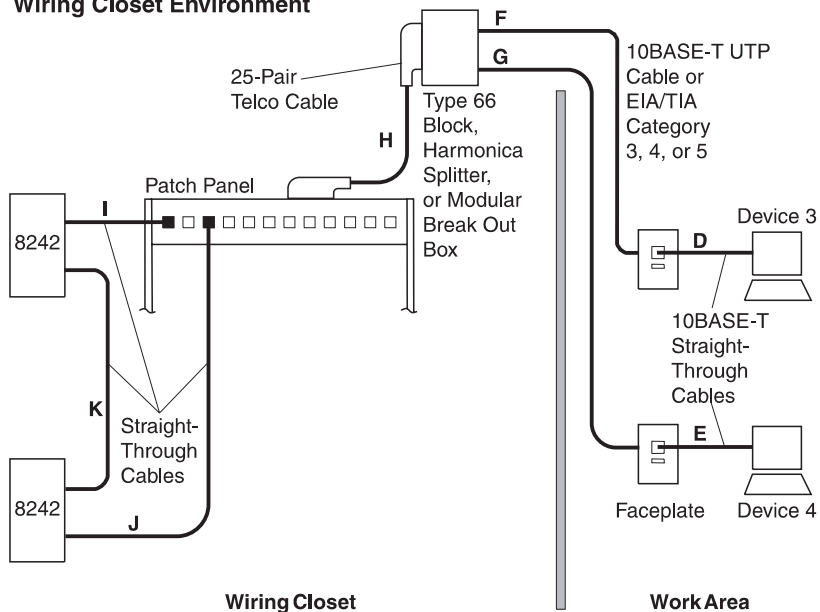**Wiring Closet**   **Work Area**

Figure   4-8. Cabling with and without Wiring Closets

A link segment can contain the following kinds of cables:

Straight-Through Cable
Use a single straight-through cable to connect a device to an
Ethernet Desktop Hub when building wiring is not to be used in the
link segment. Cables **A** and **C** in Figure 4-12 on page 4-17 are link
segments that contain a single straight-through cable.

If building wiring is used in the link segment, use a straight-through cable to connect the device to the faceplate where the building wiring terminates and another straight-through cable to connect the other end of the building wiring to the Ethernet Desktop Hub. In Figure 4-8, the link segment for DEVICE 3 contains two straight-through cables: D and I.

Always interconnect Ethernet Desktop Hubs by using a straight-through cable to connect the MDI port of one to the MDI-X port of the other. In Figure 4-8 on page 4-11, cables B and K are straight-through cables that interconnect the Ethernet Desktop Hubs.

In a straight-through cable, the transmit and receive data pairs are wired so that each signal wire is terminated at the same pin position at each end of the cable. Figure 4-9 illustrates the wiring in a straight-through cable. Use that information and the specifications under "10BASE-T Cabling Specifications" on page 4-8 to purchase or make straight-through cables. Consider obtaining a few extra cables to use later as replacements for worn or damaged cables.

RJ-45 Modular Connector			**10BASE-T Cable**	**RJ-45 Modular Connector**		
Twisted Pair	Signal Name*	Pin		Pin	Signal Name*	
1	TD+	1	————————————	1	TD+	
1	TD−	2	————————————	2	TD−	
2	RD+	3	————————————	3	RD+	
2	RD−	6	————————————	6	RD−	
3, 4	(Not used)	4, 5, 7, 8		4, 5, 7, 8	(Not used)	

  * Relative to the device connected to the IBM 8242

Figure   4-9. Wiring in a Straight-Through Cable

Figure 4-11 on page 4-15 illustrates the connector used at each end of a straight-through cable.
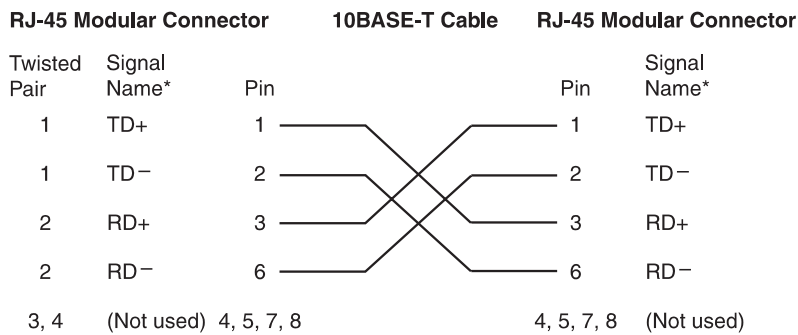
Crossover Cable

Use a crossover cable to connect a crossover port (MDI-X) on an Ethernet Desktop Hub to a crossover port on another type of 10BASE-T hub. A crossover cable is required when connecting two crossover ports.

The 10BASE-T standard requires that in each link segment the transmit and receive data pairs are crossed so that the output (transmit signals) from the device at one end of the link segment is input (receive signals) for the device at the other end. This crossover function can be performed within the hub ports or in the link segment. If two hubs are cascaded by connecting a crossover port on one to a crossover port on the other, the crossover function must be performed again in the link segment that connects the hubs to ensure an odd number of crossovers.

In a crossover cable, the transmit and receive data pairs are wired so that the transmit pair is terminated at the pin positions used by the receive pair at the opposite end of the cable. (The signals are crossed in the same manner within hub ports that perform the crossover function.)

Figure 4-10 on page 4-14 illustrates the wiring in a crossover cable. Use that illustration and the information under "10BASE-T Cabling Specifications" on page 4-8 to purchase or make crossover cables. Be aware that some cable suppliers sell UTP cables that are cross-pinned, but the crossing is different from that required for the 10BASE-T crossover cable.

If you purchase or make crossover cables and the cables do not have a mark or color coding that indicates that they are crossover cables, consider marking an "X" at each end of the cables, or using a different color label or some other identifier on the cable to distinguish them from straight-through cables.

RJ-45 Modular Connector   **10BASE-T Cable**   **RJ-45 Modular Connector**

Twisted Pair	Signal Name*	Pin		Pin	Signal Name*
1	TD+	1		1	TD+
1	TD⁻	2		2	TD⁻
2	RD+	3		3	RD+
2	RD⁻	6		6	RD⁻
3, 4	(Not used)	4, 5, 7, 8		4, 5, 7, 8	(Not used)

* Relative to the device connected to the IBM 8242

Figure 4-10. Wiring in a Crossover Cable

Figure 4-11 on page 4-15 illustrates the connector used at each end of a crossover cable.

Building Wiring

The wiring closet environment section of Figure 4-8 on page 4-11 illustrates the use of building wiring (in-the-wall cables) in a link segment. Cabling installations might vary in the type of devices used to terminate the building wiring in the wiring closet and connect that termination point to the Ethernet Desktop Hub. Those termination devices and the connections they make are known as a cross-connect.

If you elect to use building wiring, ensure that the wiring meets the specifications listed in "10BASE-T Cabling Specifications" on page 4-8. Likewise, ensure that the connectors in the faceplates and other devices in the link segment are of the same quality as the cable. Poor-quality connectors can cause problems.

If new building wiring will be installed, consider having the cable installer make straight-through cables and crossover cables (if needed) from the same cable lot. This will reduce the likelihood of impedance mismatch, which causes transmission errors in the network. Impedance mismatch is a significant difference between the impedance of two or more interconnected cables. Although they meet the same specifications, cables from different vendors and different lots from the same vendor can have slightly different impedances.

Connectors for Link Segment Cables

Straight-through cables and crossover cables require an 8-pin, RJ-45 modular plug connector at each end. In some cases, building wiring is terminated in the wiring closet with an RJ-45 plug. Figure 4-11 illustrates an RJ-45 plug connector.

The two twisted pairs in the cable are terminated as illustrated in Figure 4-9 on page 4-12 and Figure 4-10 on page 4-14. The cables you use can contain two to four twisted pairs, but only two pairs are used by the 10BASE-T network. The pin positions for the extra twisted pairs depend on how you use the extra pairs.

The jack connectors in faceplates and other devices at the ends of building wiring must be wired according to the 10BASE-T standard. The pin assignments for those connectors are the same as for the plug connectors on the straight-through cable as shown in Figure 4-9 on page 4-12.

If you make straight-through and crossover cables,ensure that the twists in the cable pairs are maintained up to the connectors. Failure to maintain the twists can cause a disturbance in transmission known as crosstalk.
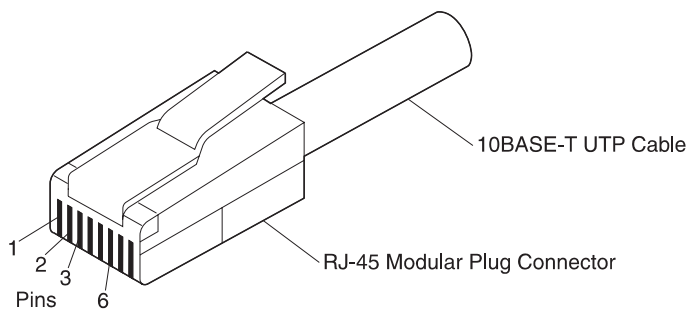

Figure   4-11. RJ-45 Modular Plug Connector for 10BASE-T

AUI Cables

Other names for an AUI cable are transceiver drop cable and transceiver cable. Use an AUI cable if you need to connect the AUI port of an Ethernet Desktop Hub Model 016 to a 10BASE5, 10BASE2, or 10BASE-F segment. If the Ethernet Desktop Hub Model 016 is very close to the 10BASE5, 10BASE2, or 10BASE-F transceiver to which it will be connected, you might be able to connect the hub's AUI port directly to the AUI port on the transceiver without using an AUI cable.

In many cases, hubs are placed at the end of a segment in 10BASE5 and 10BASE2 networks. The same practice can be applied to selecting the cascaded Ethernet Desktop Hub Model 016 to be connected to a 10BASE5, 10BASE2, or 10BASE-F segment. Select the hub that is at the end of the longest path through the 10BASE-T network formed by the cascaded hubs. For example, in Figure 4-4 on page 4-5, hubs AA and DD are at opposite ends of the longest path through the network. Either AA or DD could be selected.

Only one of the Ethernet Desktop Hubs in a group of cascaded hubs can be connected to a single 10BASE5, 10BASE2, or FOIRL segment. Connecting more than one hub in a cascaded group would create a parallel path to the 10BASE-T network formed by the hubs. Active parallel paths are not permitted in IEEE 802.3 networks.The Ethernet Desktop Hub Model 016 AUI port connector is a 15-pin, D female connector that conforms to IEEE Standard 802.3 10BASE5. The connector is equipped with a slide latch. Figure 4-13 on page 4-17 illustrates the slide latch.

The AUI cable connector on the Ethernet Desktop Hub Model 016 end of the cable must be a 15-pin D male connector and have locking posts. One end of the cable is connected to the hub's AUI port and the other end is connected to one of the following devices:

- A 10BASE5 transceiver
- A 10BASE2 transceiver
- A 10BASE-F transceiver

The connector on the other end of the AUI cable must be compatible
with the AUI port of the transceiver or converter to which it will be
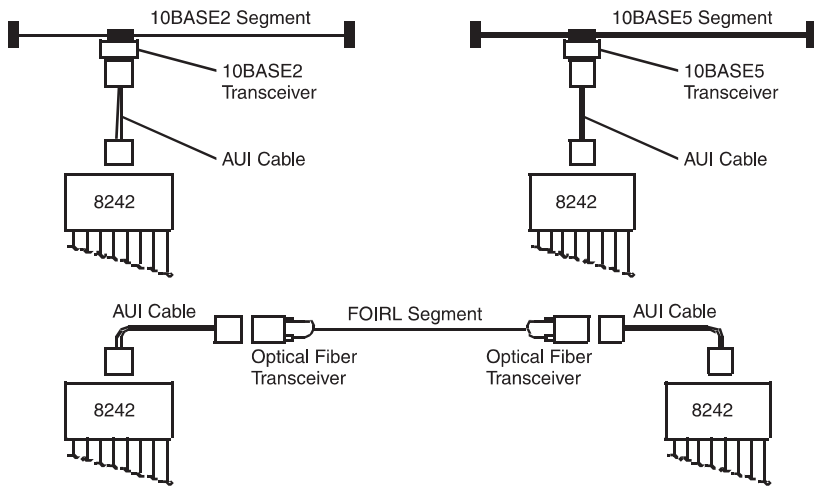connected. Figure 4-12 on page 4-17 illustrates such connections.

*Figure   4-12. Ethernet Desktop Hub Model 016 Connections to Different
Cabling Types*

Figure 4-13 and Table 4-4 on page 4-18 describe the pin assign-
ments for the Ethernet Desktop Hub AUI port. Use this information if
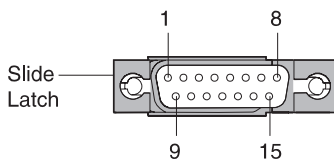you need to obtain an AUI cable.

Figure   4-13. Ethernet Desktop Hub Model 016 AUI Port

Table   4-4. Pin Assignments for Ethernet Desktop Hub AUI Port Connector

PIN NUMBER	SIGNAL NAME	DESCRIPTION
3	DO-A	Data out circuit A
10	DO-B	Data out circuit B
11	DO-S	Data out shield
5	DI-A	Data in circuit A
12	DI-B	Data in circuit B
4	DI-S	Data in circuit shield
7	CO-A	Control out circuit A
15	CO-B	Control out circuit B
8	CO-S	Control out circuit shield
2	CI-A	Control in circuit A
9	CI-B	Control in circuit B
1	CI-S	Control in circuit shield
6	VC	Voltage common
13	VP	Voltage plus
14	VS	Voltage shield
Shell	PG	Protective ground

Documenting Your Network Topology

Whether you create a new network using Ethernet Desktop Hubs or
adding hubs to an existing network, you should document the
network topology (physical layout). Make a sketch of the network
that shows the hubs and the cables and devices to be connected to
them. If any of the Ethernet Desktop Hubs Model 016 will be con-
nected to a 10BASE5, 10BASE2, or 10BASE-F segment, include
those segments and any hubs on the segments in your sketch. If any
crossover cables will be connected to the hub, distinguish those
cables from straight-through cables in the sketch. Include any other
information in the sketch that you think will be helpful during installa-
tion of the Ethernet Desktop Hubs.

Appendix A. Notices

References in this publication to IBM products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service in this publication is not intended to state or imply that only IBM's product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any of IBM's intellectual property rights may be used instead of the IBM product, program, or service. Evaluation and verification of operation in conjunction with other products, programs, or services, except those expressly designated by IBM, are the user's responsibility.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to the IBM Director of Licensing, IBM Corporation, 500 Columbus Avenue, Thornwood NY 10594 USA.

Notice to Users of Online Versions of This Book

For online versions of this book, we authorize you to:

* Copy, modify, and print the documentation contained on the media, for use within your enterprize, provided you reproduce the copyright notice, all warning statements, and other required statements on each copy or partial copy.

* Transfer the original, unaltered copy of the documentation when you transfer the related IBM product (which may be either machines you own, or programs, if the program's license terms permit a transfer). You must, at the same time, destroy all other copies of the documentation.

You are responsible for payment of any taxes, including personal property taxes, resulting from this authorization.

THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Some jurisdictions do not allow the exclusion of implied warranties, so the above exclusion may not apply to you.

Your failure to comply with the terms above terminates this authorization. Upon termination, you must destroy your machine-readable documentation.

Saftey Notices

Telecommunications Safety Requirements in the United Kingdom

This IBM product is made to high safety standards. It complies inherently with telecommunications safety standard BS 6301. It is not designed to provide protection from excessive voltages appearing externally at its interfaces. Therefore, when this product is connected to a public telecommunications network via any other equipment, and you connect to this product items not supplied by IBM United Kingdom Ltd., you must comply with mandatory telecommunications safety requirements.

Statement of Compliance with the United Kingdom Telecommunications Act 1984

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connections to the public telecommunications systems in the United Kingdom.

Electronic Emission Notices

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance

with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult an IBM authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM authorized dealers. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class B Emission Compliance Statement

This Class B digital apparatus complies with Canadian ICES-003.

Avis de conformitè aux normes d'Industrie Canada

Cet appareil numérique de la classe B est conform à la norme NMB-003 du Canada.

European Norm (EN) Statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for an failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class B Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class B equipment were derived for typical residential environments to provide reasonable protection against interference with licensed communication devices.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Gerãten (EMVG) vom 30. August 1995 (bzw. der EMC EG Richlinie 89/336).

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Konformitätserklärung nach Paragraph 5 des EMVG ist die IBM Deutschland Informationssysteme GmbH, 70548 Stuttgart.

Informationen in Hinsicht EMVG Paragraph 3 Abs. (2) 2:

> Das Gerät erfüllt die Schutzanforderungen nach EN 50082-1 und EN 55022 Klasse B.

EN 50082-1 Hinweis
"Wird dieses Gerät in einer industriellen Umgebung betrieben (wie in EN 50082-2 festgelegt), dann kann es dabei eventuell gestört

werden. In solch einem Fall ist der Abstand bzw. die Abschirmung zu der industriellen Störquelle zu vergrößern."

Anmerkung
Um die Einhaltung des EMVG sicherzustellen sind die Geräte, wie in den IBM Handbüchern angegeben, zu installieren und zu betreiben.

Japanese Voluntary Control Council for Interference (VCCI) Statement

This product is a Class B Information Technology Equipment and conforms to the standards set by the Voluntary Control Council for Interference by Technology Equipment (VCCI). This product is aimed to be used in a domestic environment. When used near a radio or TV receiver, it may become the cause of radio interference. Read the instructions for correct handling.

　この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に
基づくクラスB情報技術装置です。この装置は、家庭環境で使用することを目的
としていますが、この装置がラジオやテレビジョン受信機に近接して使用される
と、受信障害を引き起こすことがあります。
　取扱説明書に従って正しい取り扱いをして下さい。

Trademarks

IBM is a trademark of the IBM Corporation in the United States or other countries or both.

Microsoft, Windows, Windows NT, and the Windows 95 logo are trademarks or registered trademarks of Microsoft Corporation.

Other company, product and service names may be trademarks or service marks of other companies.

IBM

International Business Machines   Armonk, NY 10504

Statement of Limited Warranty

The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you originally purchase for your use, and not for resale, from IBM or an IBM authorized reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. Machines are subject to these terms only if purchased in the United States or Puerto Rico, or Canada, and located in the country of purchase. If you have any questions, contact IBM or your reseller.

Machine	**8242 Ethernet Desktop Hub Model 008** **8242 Ethernet Desktop Hub Model 016**

Warranty Period*   One Year

*Elements and accessories are warranted for three months. Contact your place of purchase for warranty service information.

Production Status

Each Machine is manufactured from new parts, or new and serviceable used parts (which perform like new parts). In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's warranty terms apply.

The IBM Warranty

IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications. IBM calculates the expiration of the warranty period from the Machine's Date of Installation. The date on your receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

During the warranty period, IBM or your reseller will provide warranty service under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine. IBM or your reseller will specify the type of service.

For a feature, conversion, or upgrade, IBM or your reseller may require that the Machine on which it is installed be 1) the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Some of these transactions (called "Net-Priced" transactions) may include additional parts and associated replacement parts that are provided on an exchange basis. All removed parts become the property of IBM and must be returned to IBM.

Replacement parts assume the remaining warranty of the parts they replace.

If a Machine does not function as warranted during the warranty period, IBM in its sole discretion will repair, replace it (with a Machine that is at least functionally equivalent), or refund the purchase price. To obtain coverage under the warranty you may be required to present proof of purchase.This warranty is non-transferable by the end-user customer.

This warranty is non-transferable by the end-user customer.

Warranty Service

To obtain warranty service for the Machine, you should contact your reseller or call IBM. In the United States, call IBM at 1-800-772-2227. In Canada, call IBM at 1-800-IBM-SERV (1-800-426-7378). You may be required to present proof of purchase.

Depending on the Machine, the service may be 1) a "Repair" service at your location (called "On-site") or at one of IBM's or a reseller's service locations (called "Carry-in") or 2) an "Exchange" service, either On-site or Carry-in.

When a type of service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced.

It is your responsibility to:

1 obtain authorization from the owner (for example, your lessor) to have IBM or your reseller service a Machine that you do not own;

2 where applicable, before service is provided—

  a follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provide,

  b secure all programs, data, and funds contained in a Machine,

  c inform IBM or your reseller of changes in a Machine's location, and

  d for a Machine with exchange service, remove all features, parts, options, alterations, and attachments not under warranty service. Also, the Machine must be free of any legal obligations or restrictions that prevent its exchange; and

3 be responsible for loss of, or damage to, a Machine in transit when you are responsible for the transportation charges.

Extent of Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

Misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible may void the warranties.

IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HOWEVER, SOME LAWS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES. IF THESE LAWS APPLY, THEN ALL EXPRESS AND IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

In Canada, warranties include both warranties and conditions.

Some jurisdictions do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

Limitation of Liability

Circumstances may arise where, because of a default on IBM's part (including fundamental breach) or other liability (including negligence and misrepresentation), you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages, IBM is liable only for:

1 bodily injury (including death), and damage to real property and tangible personal property; and

2 the amount of any other actual loss or damage, up to the greater of $100,000 or the charge for the Machine that is the subject of the claim.

Under no circumstances is IBM liable for any of the following:

1 third-party claims against you for losses or damages (other than those under the first item listed above);

2 loss of, or damage to, your records or data; or

3 economic consequential damages (including lost profits or savings) or incidental damages, even if IBM is informed of their possibility.

Some jurisdictions do not allow the exclusion or limitation of inci-
dental or consequential damages, so the above limitation or exclu-
sion may not apply to you.

This warranty gives you specific legal rights and you may also have
other rights which vary from jurisdiction to jurisdiction.

Index

Numerics

10 BASE-F segment
    cabling type   1-1
10BASE-F
    transceiver   2-10
10BASE-F segment
    in mixed network   4-1
    in mixed networks   4-7
    maximum length   4-1
    transceiver   2-10, 4-2, 4-17
10BASE-T link segment
    Cabling Specifications   4-8
    cabling type   1-1
    connecting cables   2-5, 2-6
    EIA/TIA cables   4-8
    FTP   4-9
    kinds of cable used in   4-10
    maximum length   1-2, 4-1
10BASE-T link segments
    STP   4-8
    UTP   4-8
10BASE-T ports
    cabling   2-5, 2-6
    troubleshooting   3-1
    use   1-2
10BASE2 segment
    cabling type   1-1
    in mixed network   4-1, 4-5
    maximum length and
        devices   4-3
    transceiver   2-10, 4-16
10BASE5 segment
    cabling type   1-1
    in mixed network   4-1, 4-5
    maximum length and
        devices   4-3

10BASE5 segment *(continued)*
    tranceiver   2-10
    transceiver   4-16

A

adapter (10BASE-T)   2-5
AUI cable
    connecting   2-10
    maximum length   4-1
AUI port
    cabling   2-10
    pin assignments   4-17
    use   4-2
AUI ports
    use   1-3

B

building wiring   2-5, 2-6, 4-10, 4-14

C

cabling
    10BASE-T Specifications   4-8
    AUI cable   4-2, 4-16
    building wiring   2-5, 4-14
    crossover cables   4-13
    Ethernet Desktop Hub   2-5
    link segment   4-1
    RJ-45 connector   4-15
    straight-through cable   2-5, 2-7,
        2-8, 4-11
    transceiver drop cable   4-16
cascading Ethernet Desktop
  Hubs   1-3, 4-4
collision   1-5

X-1

IBM.

Part Number: 25L4901

Printed in U.S.A.