4P BRI ST/U Adapter
Users Guide

Safety Precautions

The following general safety precautions must be observed during all phases of operation of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. IBM assumes no liability for the user's failure to comply with these requirements. As the user of the product, you must observe all stated warnings and safety precautions in order to safely operate the equipment in your environment.

Do Not Substitute Parts or Modify Equipment

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of the equipment. Contact your local IBM representative for service and repair to ensure that safety features are maintained.

Ground the Instrument

To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter, with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet.

Do Not Operate in an Explosive Atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Keep away from Live Circuits

Do not install or replace the component with power cables connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

Telephone Lines Unsafe Voltages

As unsafe voltages (Telecommunication Network Voltages) exist on ISDN lines, safety precautions must be taken to prevent contact with any dangerous area of the system.

⚠ *CAUTION*

- **The ISDN cable(s) must remain disconnected from the telecommunications system until the card has been installed in the system.**

- **The installation of the card in the host system must be done in a way that ensures at least 2mm of air gap between the Printed Circuit Board (PCB) card and any other components in the host system, so that the unsafe area remains located only on the ISDN card.**

- **The modem card must only be used in a host system with a screw-down cover / lid in order to protect the operator.**

Telephone Wiring Warnings

Never install telephone wiring during a lightning storm. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Never touch non-isolated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Any intervention on the card or in its proximity should be made with the telephone connector unplugged.

Observe Dangerous Procedure Warnings

Warnings precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed. You should also employ all other safety precautions which you deem necessary for the operation of the equipment in your operating environment.

Contents

CHAPTER 4   Installing the Software

CHAPTER 5   Setting Up WAN Firmware and Hardware

Using This Guide

Purpose

This Users Guide provides information about the IBM 4P BRI ST/U adapter. It describes general features, hardware and software installation procedures (with safety precautions), and the software modules that comprise the product. It also provides detailed information about the external software interface and about how the software modules interact.

Audience

This Users Guide assumes that its audience has a general understanding of computing and networking terminology. If you need more information about this terminology (in addition to what this manual provides), see the following web sites:

- ISDN links:

  http://www.bellcore.com/nic

  http://www.via-isdn.org

  http://www.comware.com/telcom/telcolnk.htm

- Networking glossary:

  http://www.ctcnet.com/html/telecom.htm

  (Select the **Library** tab.)

Admonition Conventions

Admonitions draw your attention to especially important information, such as the following:

Text Conventions

The following conventions are used in this manual. Computer-generated text is shown in typewriter font. Examples of computer-generated text are: program output (such as the screen display during the software installation procedure), commands, directory names, file names, variables, prompts, and sections of program code.

```
Example of computer-generated text
```

Commands to be entered by the user are printed in **bold Courier** type. For example:

cd /usr/tmp

Pressing the return key (↵ **Return**) at the end of the command line entry is assumed, when not explicitly shown. For example:

/bin/su

is the same as:

/bin/su ø Return

Required user input, when mixed with program output, is printed in **bold Courier** type.

1 Introduction

Adapter Overview

The IBM 4-Port Basic Rate Interface ST/U adapter, or *4P BRI ST/U,* is a single-slot Peripheral Component Interconnect (PCI) add-on board for PCI-based PCs, servers, and workstations. The adapter enables systems to connect to 4 ISDN basic rate interfaces (BRIs). Two versions of the adapter are available. One uses the ST interface, and the other uses the U interface. Both versions include 9 digital modems onboard that can be logically connected to 64-Kbps channels on WAN lines.

The 4P BRI ST/U adapter is powered by an IBM PowerPC 404CX 32-bit RISC processor at 66 Mhz. The modems use Central Site Modem Digital Signal Processing (DSP) technology from Rockwell Semiconductor Systems. This technology provides robust support for data-intensive applications.

The adapter software uses the standard Microsoft® Windows NT operating system. It leverages the Remote Access Service (RAS) features built into Windows NT server platforms to seamlessly integrate RAS services into existing LANs.

The adapter handles connections on ISDN B and D channels. The adapter's ISDN channels are accessible using RAS and digital modems. The adapter is designed for remote access systems that allow dial-in from ISDN or PSTN (analog) networks, combining the two most popular dial up access services under a single call number. The adapter's software enables it to handle ISDN calls, which are numerically terminated, and digital modem calls, which are analog terminated, simultaneously on ISDN B channels.

The adapter features a high-performance multi-function architecture. The onboard processor off-loads communications protocols such as ISDN signalling from the host CPU, boosting overall performance. Also, the adapter can be quickly and easily expanded to support evolving features or network technologies.
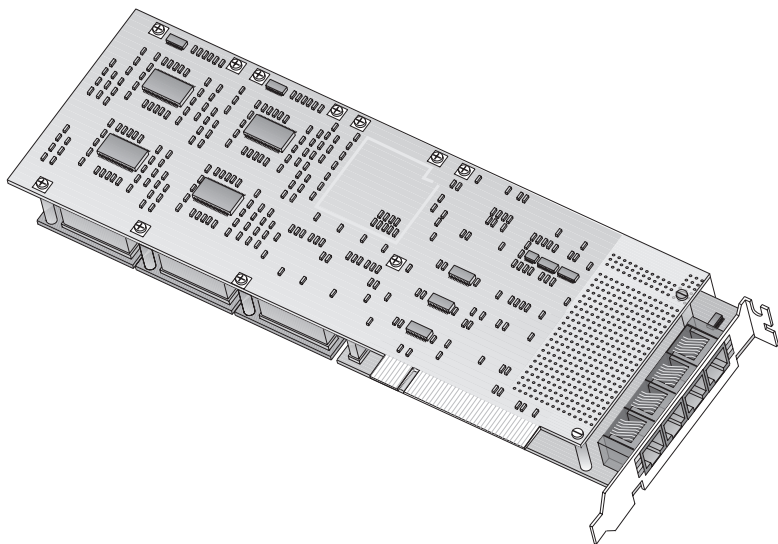
Figure 1-1. The 4P BRI ST/U Adapter

Hardware Overview

Following are the standard hardware features of the adapter:

- North America and Europe ISDN compatibility—NET3, NI-1, NI-2, ETSI (EuroISDN)
- Compliance to all industry standards and specifications (FCC part 15 class A and part 68, CE class A, IEC950)
- CPU mother board:
    - RISC processor 32-bit PowerPC 403 GCX at 66 MHz
    - 32-bit local bus at 33 MHz
    - 8-Mbyte DRAM memory
    - 512 KB Flash EEPROM for boot code and modem firmware
    - PCI 2.1-compliant master/target bus interface

- 9 digital modems onboard
- RAS support access to up to 8 ISDN B channels, including ISDN B channels associated with digital modems

Software Overview

The adapter software supports up to four 4P BRI ST/U adapters installed in a system.

The software handles three types of ports:

- ISDN(x), for ISDN communications using RAS
- DM(x), for digital modem communications using RAS
- COM(x), for digital modem communications using COM ports

The software package includes drivers, utilities, and a RAS management tool.

Drivers

The adapter software includes the following drivers:

- The Base driver for Windows NT is the basic driver required to support the adapter.
- The Serial driver manages COM port emulation on the adapter. It supports digital modem communications by enabling ISDN B channels to emulate COM ports. It is installed with the Base driver.
- The RAS support drivers support Microsoft Remote Access Service. They enable the transport of TCP/IP, IPX/SPX, and NetBEUI protocols over ISDN and digital modem lines. There are two types of RAS support drivers:
  - RAS support driver for ISDN communications
  - RAS support driver for digital modem communications

Utilities

The software also includes the following utilities, which are installed along with the Base driver:

- The WAN Adapter Setup utility enables you to manage adapter firmware and hardware.
- The Digital Modem Monitor utility enables you to monitor the adapter's digital modem connections.
- The Synwatch utility enables you to track connections and data traffic on ISDN channels.
- The LoopTest utility enables you to check the ISDN line.

RAS Management Tool

The Virtual Motion Remote Access Manager Suite™, by Virtual Motion™, Inc., is bundled with the adapter software. The Remote Access Manager Suite includes a set of resource management, access control, and usage accounting tools to help network administrators and Internet Service Providers manage Microsoft Windows NT dial-up RAS servers.

The Remote Access Manager Suite is a client/server application with three components: an administrator program, a RAS port manager program, and a RAS port monitoring program. You can select to install the Remote Access Manager components needed on a RAS server machine when you install a RAS support driver for the adapter.

The Remote Access Manager Suite provides the following capabilities:

- RAS Login Control prevents multiple users from logging in with the same dial-up account and limits the number of multi-link RAS connections a remote user can establish.
- RAS Port Access Control grants specified user groups access to particular communications ports.
- Port Session Control sets maximum idle and session connect times for each RAS server communications port.

- Port Resource Management limits the connect time allotted to individual users over a specified time interval.
- Static IP Address Port Assignment associates a static IP address with a particular RAS communications port.
- RASView provides real-time monitoring of RAS ports and provides alerts for defined RAS server events.
- RAS usage accounting, reporting, and event logging functions detail each user's RAS sessions.

The Virtual Motion Remote Access Manager Suite requires Windows NT 4.0 and the Windows NT Service Pack 3 or higher. For detailed information about the suite, see the Virtual Motion Remote Access Manager documentation included in PDF format on the IBM 4P BRI ST/U adapter installation CD.

RAS Support Overview

The 4P BRI ST/U adapter supports Microsoft Remote Access Service (RAS), which enables remote user connections over ISDN lines. RAS enables the transport of TCP/IP, IPX/SPX, and NetBEUI protocols.

RAS supports all of the mainstream networking clients, including the following:
- Windows for Workgroups
- LAN Manager
- Windows 95
- Windows NT Workstations
- Windows NT Servers
- UNIX
- Macintosh
- NetWare
- OS/2-based clients

RAS connection enables all services typically available to a LAN-connected user (including file- and print-sharing, database access, and messaging), as shown in the following illustration:
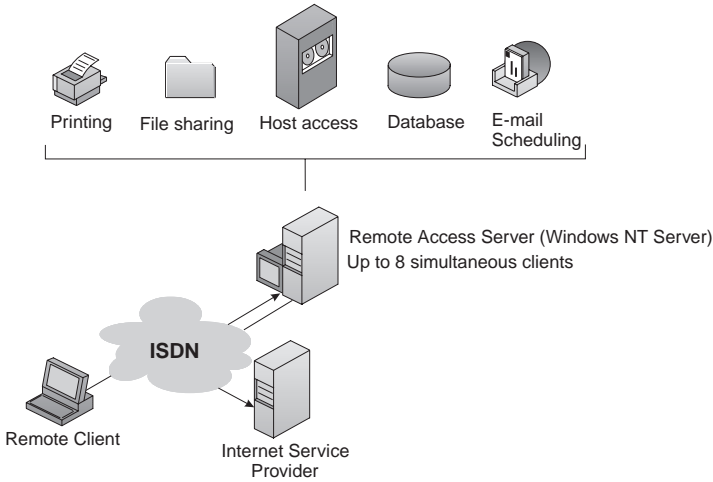
Figure 1-2. RAS Features

ISDN Reference Model for S/T and U BRI Interfaces

The Integrated Services Digital Network (ISDN) Reference Model for the BRI S/T and U interface is shown in the following illustration:
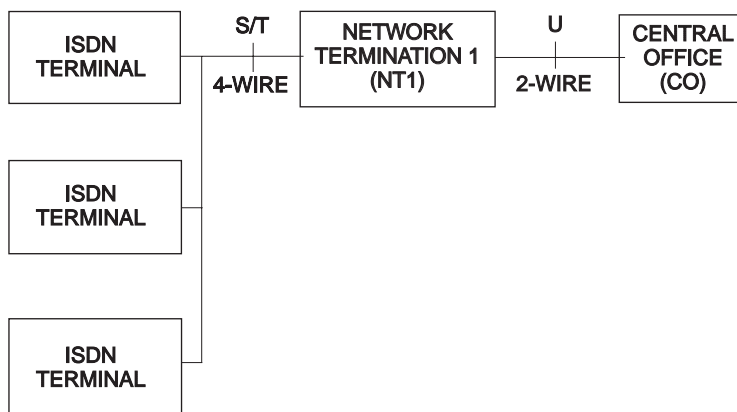
Figure 1-3. ISDN Reference Model for BRI S/T and U

This general model can be adapted to many different implementations of the ISDN. The ISDN terminal uses the four-wire Basic Access Interface (the S/T interface) in Europe for its physical connection to the Network Terminal 1 (NT1). It uses the two-wire Basic Access Interface (the U interface) in the United States for its physical connection to the Central Office (CO).

Minimum System Requirements

Following are the minimum system requirements for using this adapter with Microsoft Remote Access Service (RAS):

- Intel® system running Windows NT Version 4.0
- PCI Bus architecture conforming to PCI Local Bus Specification Revision 2.1
- Pentium processor at 133 MHz
- 64 MB RAM (possibly 128 MB or more, depending on your RAS configuration and usage)
- Hard disk with 5 MB free
- 3.5" diskette drive or a CD-ROM drive
- One to four functional S/T or U ISDN basic rate interfaces per adapter
- Microsoft Windows NT Service Pack 3 or higher required for Virtual Motion Remote Access Manager Suite bundled with adapter software

2 Installing the Hardware

Overview

You can install the adapter in any suitable PCI expansion slot. To install the adapter, follow these basic steps:

1. Verify that the system meets minimum requirements.

2. Inspect the adapter.

3. Install the adapter in a host expansion slot.

4. Connect the adapter to an MVIP Bus, if required.

The tools required are a grounding strap and a #1 Phillips head screwdriver.

Note: Refer to the users manual that came with your personal computer for additional detailed installing instructions.

Verifying Minimum Requirements

Before installing this adapter, verify that your system meets the minimum requirements described in *Minimum System Requirements on page 1-8*.

Inspecting the Adapter

Before installing the adapter in your computer, visually inspect it for any damage that might have occurred during shipment from the factory.

1. Open the shipping container and carefully remove its contents.

2. Inspect each item for damage. If you find any omissions or damage, contact your network supplier and the carrier (for example, UPS or Federal Express) that delivered the package.

Installing the Adapter

With a grounding strap connected to your wrist or ankle, do the following to install the adapter:

1. Turn off the computer's power switch, and unplug the unit from its power source.
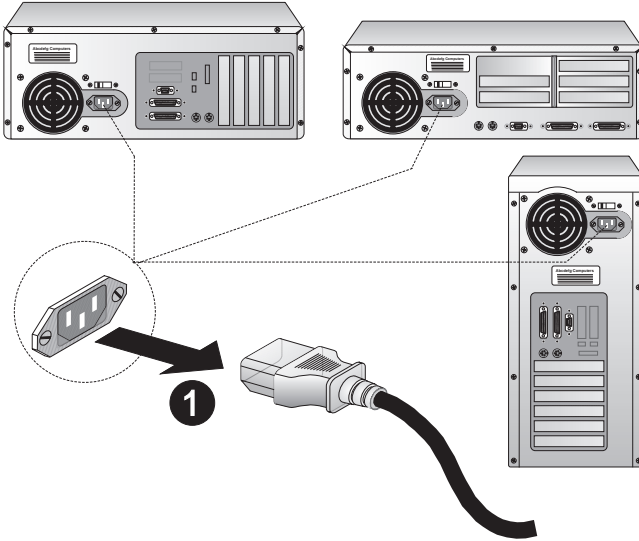
Figure 2-1. Unplugging the Computer

2. Disconnect all cables connected to the main system unit, and remove the computer cover according to the manufacturer's instructions.
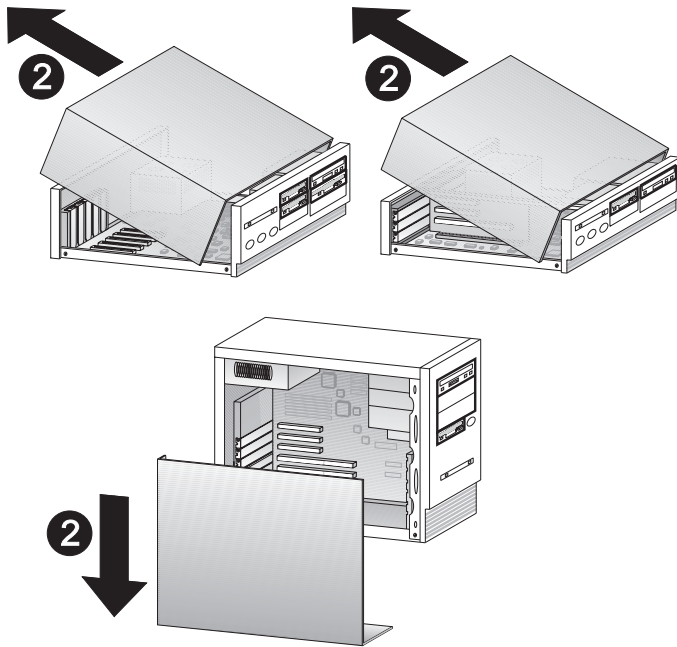
Figure 2-2. Removing the Computer Cover

3. Locate a suitable PCI expansion slot, and remove the screw that attaches the expansion plate to the computer. Save the screw for Step **6**.

   This adapter is a full-length PCI add-on card. Choose a slot in which the adapter will not be in contact with other elements of the mother board, such as memory modules, connectors, or the host processor's heat sink.

Note: If you plan to connect the adapter to an MVIP Bus, the location of the adapter depends on the other MVIP adapters. See *Connecting the Adapter to an MVIP Bus* on page 2-7 for instructions before proceeding with the installation process.

4. Remove the expansion plate.
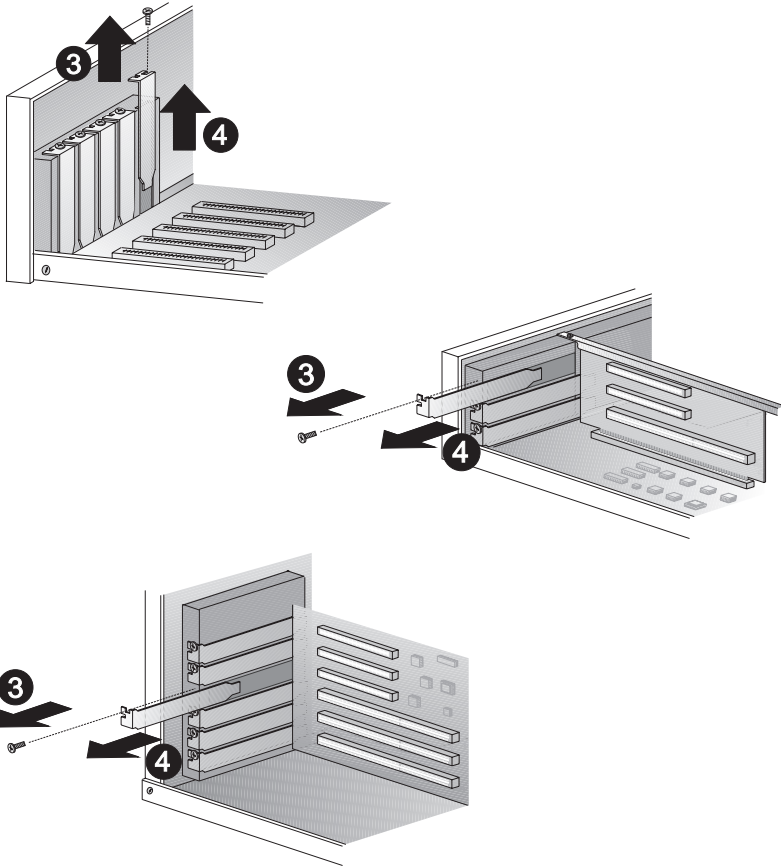
Figure 2-3. Removing the Expansion Plate

5. Carefully remove the adapter from its antistatic bag, and position the adapter in the PCI expansion slot. Align the

adapter's connector pins with the slot's receptacle; then press gently but firmly on the board to seat it in the slot.

6. Attach the adapter with the screw removed in step **3**.
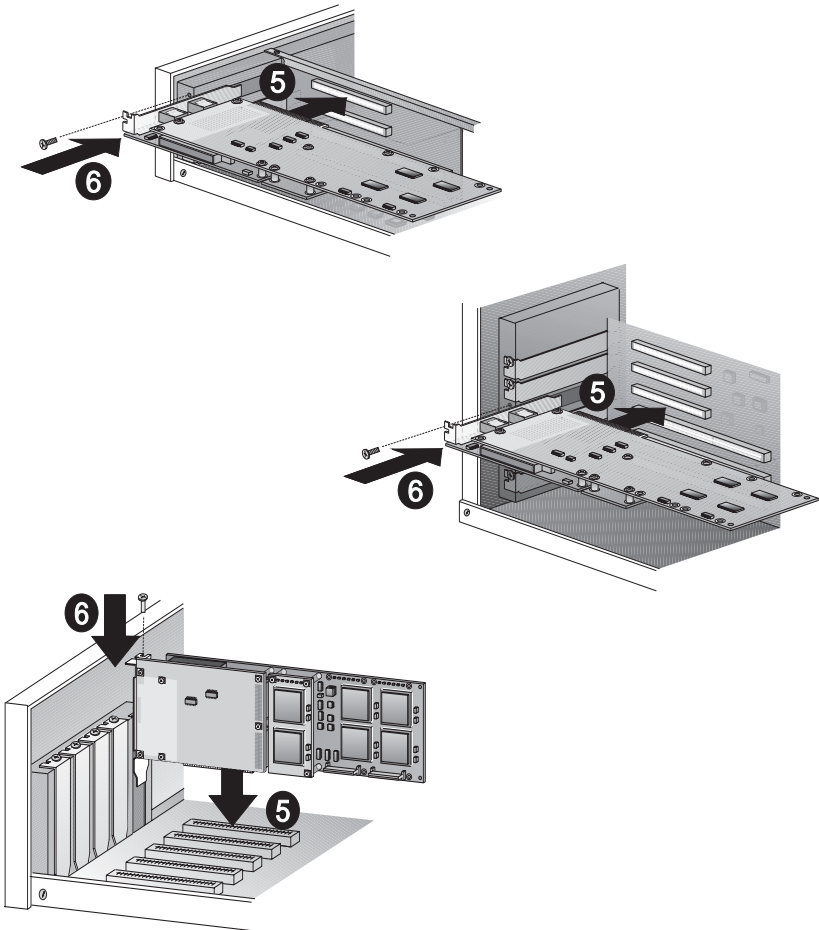
Figure 2-4. Inserting the Adapter

7. Continue as follows:

    – If you still need to interconnect the adapter to other MVIP telephony processing adapters in the cabinet, such as voice, data, fax, video or image processing adapters, skip to the next section, *Connecting the Adapter to an MVIP Bus*.

    – Otherwise, replace the computer cover according to the manufacturer's instructions. Then connect the adapter to the line, as described in *Connecting to the Line* on page 3-1.

WARNING

Keep the computer *closed* while the adapter is running, so that the fan works properly and prevents overheating.

Connecting the Adapter to an MVIP Bus

You must connect the adapter to an MVIP Bus if you plan to integrate the adapter with other MVIP telephony processing adapters, such as voice, data, fax, video or image processing adapters.

For optimal electrical signal quality on the MVIP ribbon cable, you must place the MVIP adapters in a specific order (depending on the number of connections) and electrically terminate two MVIP clock signals, as described in the following topics.

MVIP Electrical Termination Requirements

For systems with five or fewer MVIP Bus connections and less than 90 pF load on the clock lines, it is adequate to do the following:

1. Place the circuit board that is the master clock source at one end of the cable.

2. Electrically terminate the MVIP Bus only on the circuit board located at the other end of the cable.

Note: The 4P BRI ST/U adapter is generally the master clock source because it is connected to the network. In this case, place the 4P BRI ST/U adapter at one end of the cable, and do not electrically terminate the bus on the adapter.

On systems with more than five MVIP Bus connections or more than 90 pF of load on the clock lines, both ends of the cable must be electrically terminated. No other boards should be electrically terminated.

Configuring MVIP Electrical Termination

If this is the last board in a multiple MVIP Bus configuration, the adapter requires electrical termination in the MVIP Bus. To provide the required electrical termination, place two jumpers on the two 2-pin connectors located next to the MVIP connector.

Each jumper must be inserted perpendicular to the printed circuit board, as shown in the following figure:
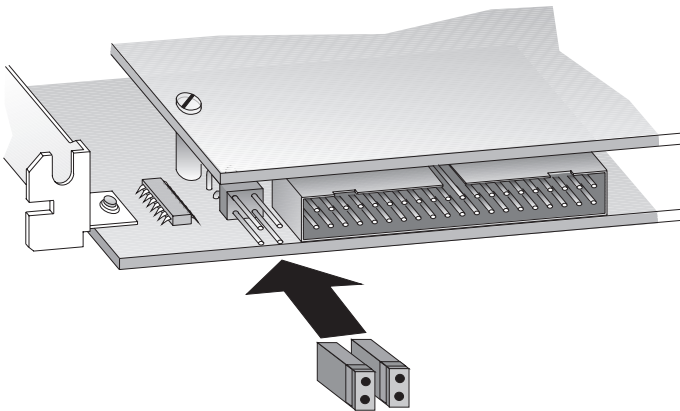
Figure 2-5. Electrically Terminating the MVIP Bus

If the adapter does not need to be electrically terminated, do not place any jumpers on the 2-pin connectors.

Modem Connection LEDs

The 4P BRI ST/U adapter provides an LED for each modem included on the adapter (for example, 9 LEDs for 9 modems). These LEDs turn on when a modem has established a connection on the MVIP Bus. They turn off when the modem has interrupted the connection.

Completing the MVIP Bus Connection

To create a dedicated interconnection between MVIP adapters, connect a ribbon cable to the 40-pin, double-row, right-angled headers on the top edge of all MVIP adapters.

After you finish connecting the adapter to the MVIP Bus, finish the remaining steps in the *Installing the Adapter* section.

3 Connecting to the Line

Overview

The type of line your carrier provides depends on whether you are in North America or Europe. This chapter provides the following information required to connect your IBM 4P BRI ST adapter to the line:

- Connection methods and requirements for connecting to a North American 4P BRI U line or 4P BRI S/T line
- Connection methods and requirements for connecting to a European 4P BRI S/T line
- Summary of steps to connect the adapter to the network.

If you are in North America, continue to the next section. If you are in Europe, skip to *European Line Connections* on page 3-2.

North American Line Connections

In North America, the adapter may require an external Network Termination 1 device (NT1 device), which allows a direct connection to the telephone company's line. This requirement depends on the adapter's basic access interface type.

4P BRI U

The 4P BRI U adapter, which has a 2-wire (U) basic access interface, does not require the NT1 device. The 4P BRI U adapter must be connected directly to the telephone company's line.

4P BRI ST

The 4P BRI ST adapter, which has a 4-wire (S/T) basic access interface, requires the NT1 device. In North America, the carrier does not provide the NT1 device. If you use the 4P BRI ST adapter, you must obtain one external NT1 device per line. On each line, you must connect the adapter to an external NT1, which connects to the ISDN network.

WAN Adapter   NTI   Telco
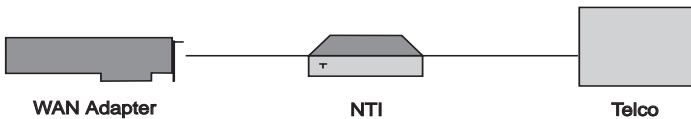
Figure 3-1. Connection Through an External NT1 Device

European Line Connections

Carrier lines in Europe require the 4P BRI ST adapter, which has a 4-wire (S/T) basic access interface. The carrier provides the NT1 device to interface between the adapter and the ISDN network. Therefore, you need to connect the adapter to the NT1, as shown in Figure 3-1.

Connector Pinouts and LEDs

The 4P BRI U adapter uses four ISDN U connectors. The U connectors are standard miniature modular 8 (ISO/DIS 8877) with RJ49C wiring (according to FCC 68). Following is a pinout of the ISDN U RJ49C connectors:

Pin	Signal
1	
2	

Table 3-1. ISDN U RJ49C Connector Pinout

Pin	Signal
3	
4	Ring
5	Tip
6	
7	
8	

Table 3-1. ISDN U RJ49C Connector Pinout

The 4P BRI ST adapter uses four ISDN S/T connectors. The S/T connectors are standard miniature modular 8 (ISO/DIS 8877). Following is a pinout of the ISDN S/T connectors:

Pin	Signal
1	
2	
3	Out+
4	In+
5	In-
6	Out-
7	
8	

Table 3-2. ISO/DIS 8877 ISDN S/T Connector Pinout

Two light-emitting diodes (LEDs) for each connector display the status of the link.

The following illustration shows the faceplate and LEDs of the 4P BRI U:
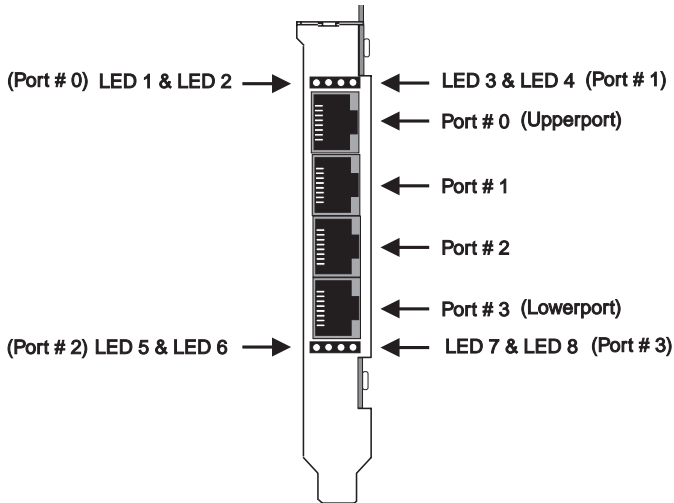
Figure 3-2. Adapter's Faceplate

For detailed information about the LEDs, see *Interpreting Adapter LEDs* on page 8-1.

Connecting the Adapter to the Network

With the adapter installed, you are ready to connect the adapter to the network, as follows:

1. Attach the appropriate RJ49C-compliant (U loop) or ISO/DIS 8877-compliant (S/T) connector to the adapter.

2. Reconnect the power cable and turn on the computer.

After connecting the adapter to the network, install the adapter drivers. See *Installing the Software* on page 4-1.

4 **Installing the Software**

Overview

This chapter describes the procedures for installing and setting up your adapter's software on Microsoft Windows NT 4.0 workstations. Use this process to install the Base driver (along with the Serial driver and adapter utilities) and one or both IBM RAS support drivers (the ISDN RAS Support driver and/or the Digital Modem RAS Support driver). This chapter also explains how to remove the drivers, if required.

To install the software, follow these basic steps:

1. Verify that your system meets minimum requirements.

2. Install the Base driver, with accompanying software, and appropriate RAS support driver(s).

3. Set up WAN adapter card and port properties.

4. Set up RAS support properties for the installed RAS driver(s).

5. Set up ISDN B and Digital Modem channels as RAS ports.

6. If you want to use Virtual Motion RAS management services on the computer, install Virtual Motion Remote Access Manager Suite components.

7. Complete the installation to make driver settings take effect.

Review the *Read Me* text file on the IBM 4P BRI ST/U adapter installation CD before installing the adapter software. It contains information about the files included on the CD. Also, if *Read Me First* documentation is included in your installation kit, review it for information about changes and updates made to this Users Guide after the print date.

In addition, if you plan to install the Virtual Motion Remote Access Manager Suite, review the Virtual Motion PDF documentation included on the installation CD before starting the installation.

Verifying Minimum Requirements

If you have not already done so, verify that your system meets the minimum requirements described in *Minimum System Requirements on page 1-8*.

Installing the Drivers

Before you start, make sure the adapter is installed in your machine, and that you are logged on with administrator rights to the Windows NT 4.0 system.

To install the appropriate drivers for the adapter:

1. From **Start** menu, select **Settings,** and then **Control Panel.** Then double-click the **Network** icon, and select the **Adapters** tab to display the Adapters dialog box:
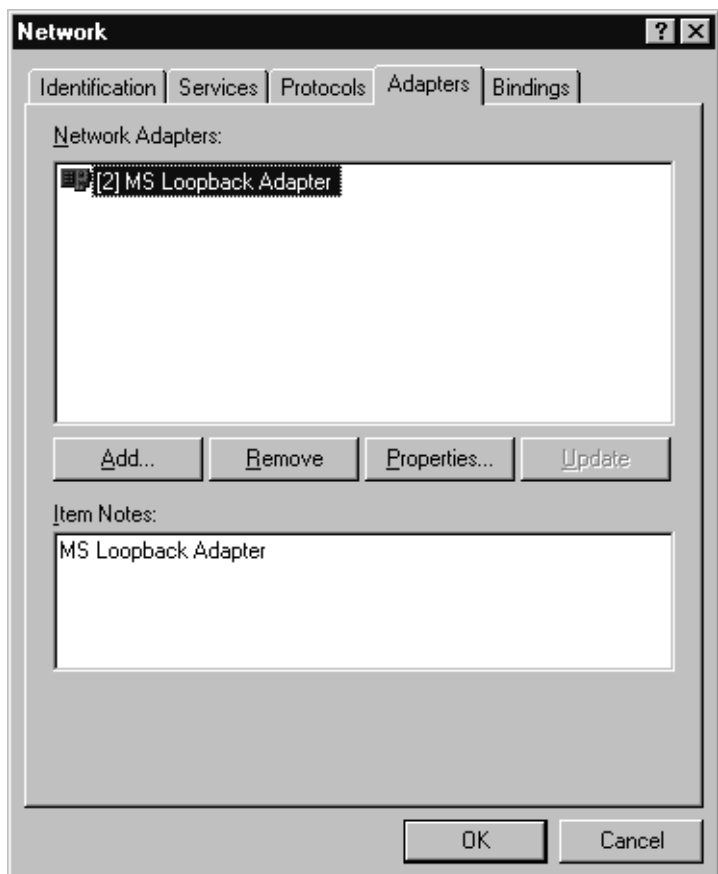
Figure 4-1. Network Adapters Dialog Box

2. Click **Add** to begin loading the drivers.

The system creates an adapter list in the Select Network Adapter dialog box:
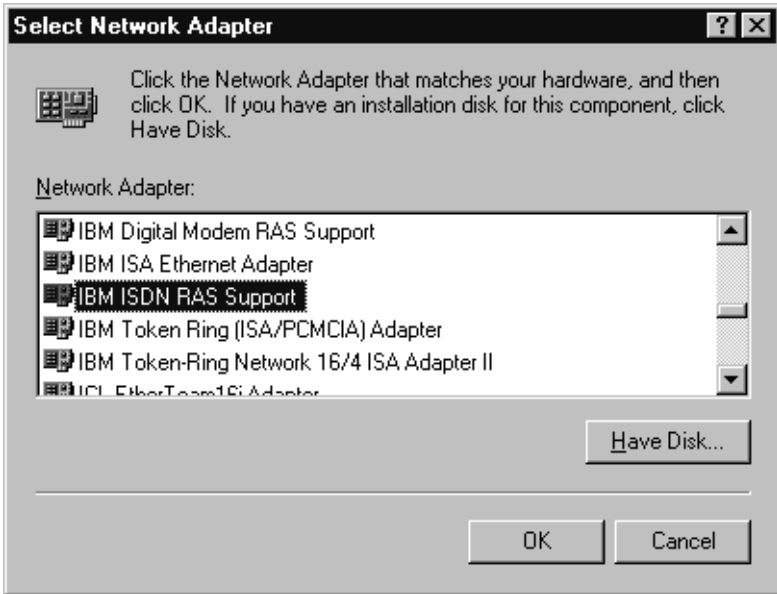
Figure 4-2. Network Adapters List

3. Click **Have Disk.**

The Insert Disk dialog box appears, prompting you to insert the disk and identify the file location:

┌───┐
│ Insert Disk   [×] │
│   │
│   ┌──┐   Insert disk with software provided by the software or │
│   │ │   hardware manufacturer. If the files can be found at a │
│   └──┘   different location, for example on another drive type a │
│   new path to the files below.   │
│   │
│   ┌──────────────────────────────────────┐   │
│   │ A: │   │
│   └──────────────────────────────────────┘   │
└───┘
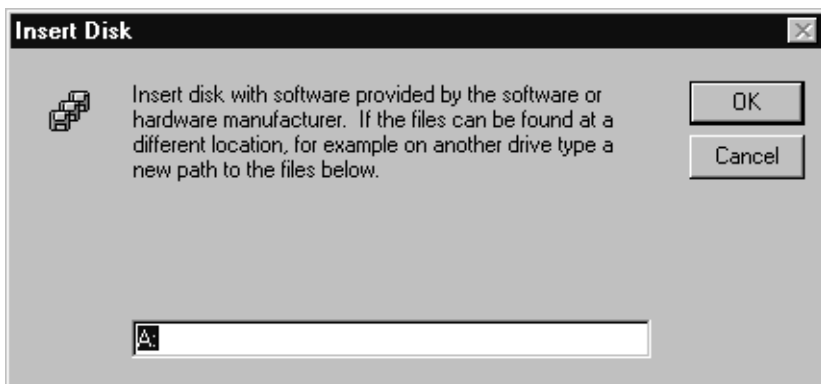
Figure 4-3. Insert Disk Dialog Box

4. Insert the diskette or CD containing the adapter software.
    Then do the following:

    –   If you are installing the software from a diskette, change
        the installation path to the appropriate drive, if needed,
        and click **OK.**

    –   If you are installing the software from a CD, change the
        installation path to **[drive]:\IBMCARD** (where
        [drive] is the CD-ROM drive—for example,
        D:\IBMCARD.) Then click **OK.**

The Select OEM Option dialog box appears, listing available IBM RAS support drivers:

Select OEM Option   ☒

Choose a software supported by this hardware manufacturer's disk.

```
IBM Digital Modem RAS Support
IBM ISDN RAS Support
```

| OK | Cancel | Help |
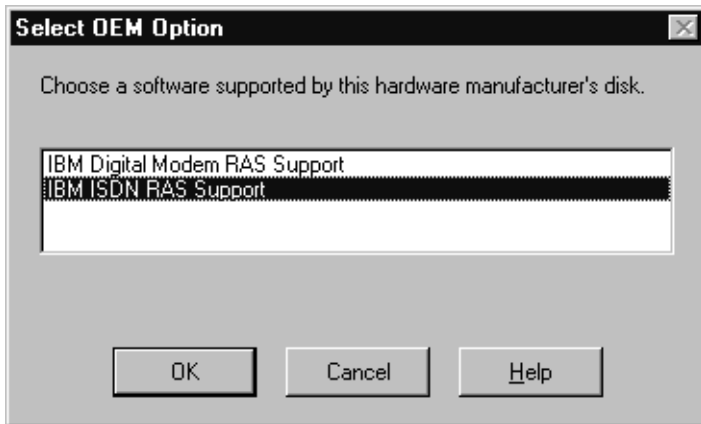
Figure 4-4. Select OEM Option Dialog Box

You can install the IBM Digital Modem RAS Support driver, the IBM ISDN RAS Support driver, or both drivers, depending on your needs. However, you can select only one driver to install at a time.

5. Select the RAS support driver you want to install at this time, and click **OK.**

Next, continue as follows, depending on whether you are installing the first or second selected RAS support driver:

– If you are installing the first RAS support driver, the IBM Base driver dialog box appears after you select the driver to install. Continue to step **6**.

– If you are installing the second RAS support driver, the RAS Support General dialog box appears. Skip to *Setting Up RAS Support Properties* on page 4-14.

6. The IBM Base Driver dialog box prompts you to accept or change the installation directory and begin installation:
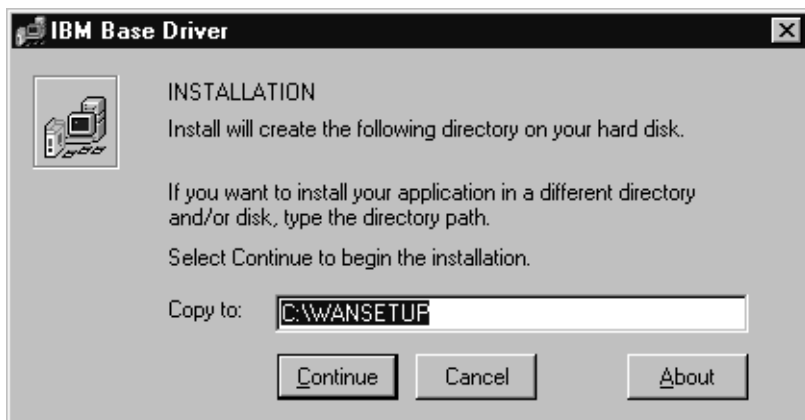
Figure 4-5. Base Driver Installation

If needed, change the default installation path in the **Copy To** field to the desired path name.

7. Click **Continue** to install the Base driver and the first selected RAS support driver.

The installation program copies product files to the directory specified in the Copy To field, and creates a program group in the Windows NT Start menu.

A message box displays the installation progress.

To continue the software installation, set up the adapter's card and port properties as described in the next section.

If you are installing both RAS support drivers, complete the basic configuration of the first driver, as described in the following topics, before installing the second driver.

Setting Up WAN Adapter Card and Port Properties

After the initial driver software is installed as described in *Installing the Drivers*, the WAN Adapters Setup dialog box appears:

Figure 4-6. WAN Adapters Setup Dialog Box

This dialog box enables you to set up adapter firmware and hardware for the adapter. The adapter is displayed in the Cards section.

Note: If the Cards list is empty, the adapter might not be properly installed. See *Problems and Possible Solutions* on page 8-2 for information about correcting the problem.

Use the Cards section to do the following WAN adapter setup tasks:

- If your adapter is connected to an MVIP Bus, enable the MVIP bus connection.

- Set up the adapter's ISDN port properties.

  Configure ISDN port properties for both ISDN **and** Digital Modem RAS support drivers.

- If you plan to install the Digital Modem RAS Support driver, set up the adapter's digital modem port properties. Set up digital modem **and** ISDN port properties at this point (regardless of which driver you selected first).

Enabling the MVIP Bus Connection

If the adapter for which you are installing the software is connected to an MVIP Bus, enable the Bus connection as follows:

1. In WAN Adapters Setup dialog box, select the adapter.

2. Click the **Properties** button in the Cards section.

   The Card Properties dialog box appears:
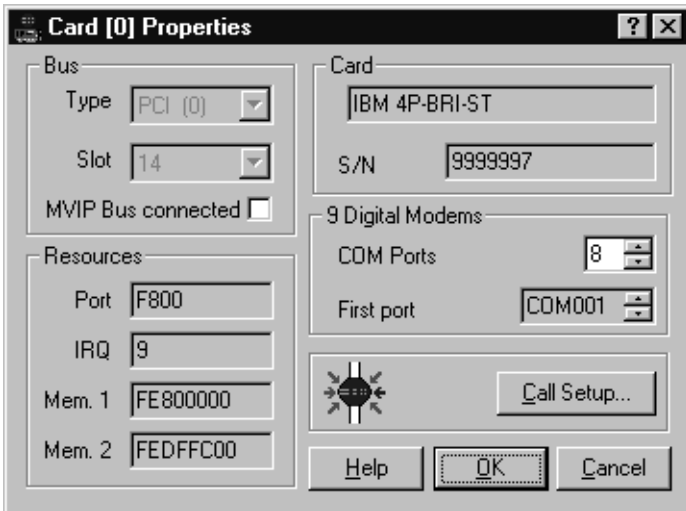
Figure 4-7. Card Properties Dialog Box

3. Enter a check mark in the MVIP Bus connected field (in the Bus section) by clicking on the checkbox.

Configuring ISDN Port Properties

ISDN port properties must always be configured for **both** Digital Modem and ISDN RAS support drivers. Configure ISDN port properties as follows:

1. In the WAN Adapters Setup dialog box, select the ISDN BRI port you want to configure and click **Properties.**

   The ISDN BRI Port Properties dialog box appears:
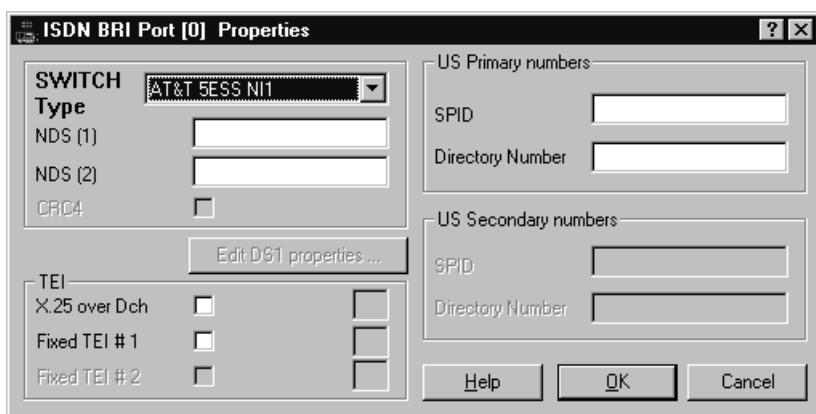
Figure 4-8. ISDN BRI Port Properties

2. In the Switch Type field, select the switch type that corresponds to your ISDN subscription. (See *Configuring the Switch Type* on page 5-10 for a description of switch type selections.)

WARNING

You must select the same switch type for all ports on a single adapter. Otherwise, the ports might not function properly.

---

3. Depending on your switch type, geographic location, and other considerations, enter information in the remaining fields, as needed.

   For detailed information about ISDN BRI port properties, see *Setting Up ISDN Port Properties* on page 5-9.

4. When you have completed the ISDN BRI port setup, click **OK.**

   If you changed the switch type, a pop-up message reminds you to validate all ISDN calling profiles with all applications using the profile. To validate the profiles, make sure to select the same switch type for all ISDN BRI ports. Also, reload the firmware after changing the switch type for all ports.

5. When the WAN Adapters Setup dialog box reappears, repeat steps **1** through **4** for remaining ISDN BRI ports.

Next, continue to *Configuring Digital Modem Port Properties* if you are (or will be) installing the Digital Modem RAS Support driver.

If you do not plan to install the Digital Modem RAS Support driver, or have already configured digital modem port properties, skip to *Completing the WAN Adapter Setup* on page 4-12.

Configuring Digital Modem Port Properties

If you are installing the Digital Modem RAS Support driver, configure corresponding digital modem ports as follows:

1. In the Cards section of the WAN Adapters Setup dialog box, select the digital modem port (*x* Digital Modems, where *x* is the number of digital modems on the adapter), and click **Properties.**

The Digital Modems Properties dialog box appears:

Figure 4-9. Digital Modems Properties Dialog Box

2. Use this dialog box configure the analog-to-digital speech
   channels coding law according to the geographic region.

   – For Europe, select **A Law.**

   – For the United States and Japan, select μ **Law** (*Mu Law*).

3. Click **OK.**

If you have not yet configured the adapter's ISDN port properties, do
so now, as described in *Configuring ISDN Port Properties* on page
4-10. Otherwise, continue to the next topic.

Completing the WAN Adapter Setup

When WAN adapter card and port properties are configured as
needed, do the following to complete the WAN adapter setup:

1. Click **OK** on the WAN Adapters Setup dialog box.

   The setup software automatically finds the firmware
   corresponding to the adapter. It updates the registry and
   dynamically installs the drivers.

2. When the following message informs you that the driver is
    running, click **OK.**

Figure 4-10. Successful Setup Message

Next, set up RAS support properties for the driver, as described in the
next section.

Setting Up RAS Support Properties

After you finish configuring port properties for RAS support drivers (or after you select the second RAS support driver to install), the RAS Support General dialog box appears:
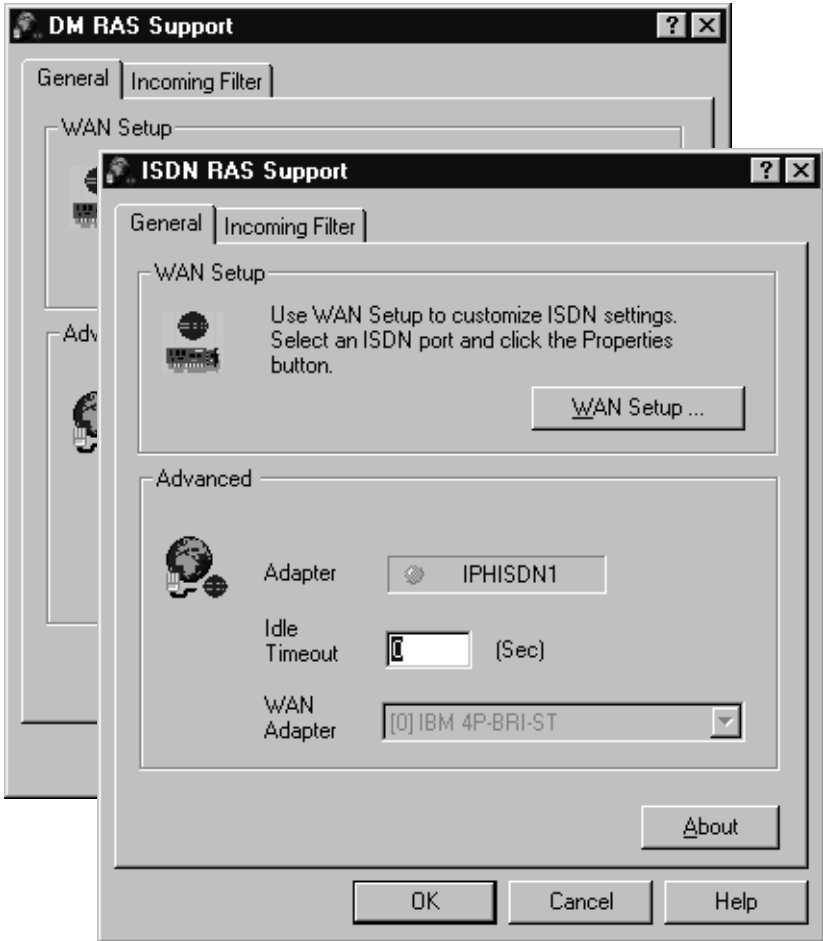
Figure 4-11. RAS Support General Dialog Box

For the Digital Modem RAS Support driver, the driver name in the title bar is *DM RAS Support.* For the ISDN RAS Support driver, the driver name in the title bar is *ISDN RAS Support*. The contents of the dialog box are the same for both drivers.

The RAS support setup is done automatically. The RAS Support General dialog box enables you verify RAS support properties for the driver you are configuring.

Note: If you need to set up additional WAN adapter card or port properties before continuing, click the **WAN Setup** button to access the WAN Adapters Setup dialog box. Then repeat the appropriate steps in the *Setting Up WAN Adapter Card and Port Properties* section beginning on page 4-8.

RAS support dialog boxes and setup procedures are described in detail in *Setting Up RAS Support Properties* on page 6-5.

To complete the RAS support setup:

1. If needed, change the Idle Timeout value from **0**, which disables the timeout function, to the number of seconds of inactivity to allow before ending a connection.

2. Click **OK** to confirm the displayed configuration.

   One of the following messages appears, depending on whether RAS is installed on your system:

   – If RAS *is not installed***,** a message informs you that RAS support setup is complete, and states that *Remote Access Services (RAS) setup must now be **installed**.*

      Click **OK.** Then continue to step 3.

   – If RAS *is installed***,** a message informs you that RAS support setup is complete, and states that *Remote Access Services (RAS) setup must now be **invoked**.*

      Click **OK.** Then skip to *Setting Up Channels as RAS Ports* on page 4-16.

3. When the following message informs you that Setup needs to copy Windows NT files, insert the Windows NT CD:

```
Windows NT Setup                                              [X]

  ┌─┐    Setup needs to copy some Windows NT files.           ┌──────────┐
  └─┘                                                         │ Continue │
         Setup will look for the files in the location specified below.  └──────────┘
         If you want Setup to look in a different place, type the        ┌──────────┐
         new location. When the location is correct, click              │  Cancel  │
         Continue.                                                      └──────────┘

         ┌──────────────────────────────────────────────────┐
         │ D:\I386                                            │
         └──────────────────────────────────────────────────┘
```
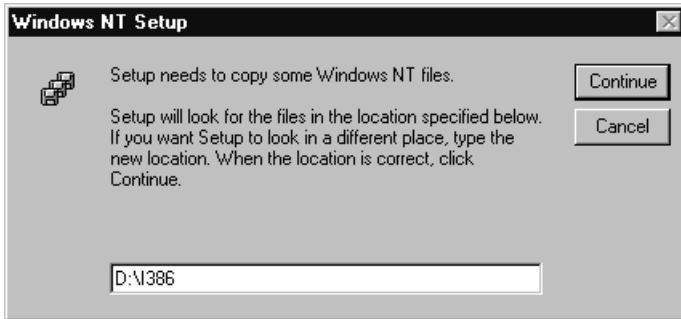
Figure 4-12. Windows NT Setup Message

4. If you want Setup to find the Windows NT files in a location other than the default, enter the complete path.

5. Click **Continue** to complete the RAS installation.

To continue the software installation, set up digital modem or ISDN channels as RAS ports, as described in the next section.

Setting Up Channels as RAS Ports

After you respond **OK** to the message that Remote Access Service must be invoked, or click **Continue** to complete the RAS installation, either the Remote Access Setup dialog box or Add RAS Device dialog box appears. This sequence depends on whether a RAS device has already been configured in the machine.

To continue with the ISDN or Digital Modem RAS support driver installation, set up ISDN or digital modem channels as RAS ports, as follows:

1. If a RAS device has not yet been configured, the Add RAS Device dialog box appears.

If a RAS device has been previously configured, the Remote Access Setup dialog box appears. Click **Add** to display the Add RAS Device dialog box.

2. The following illustration shows the Add RAS Device dialog box:
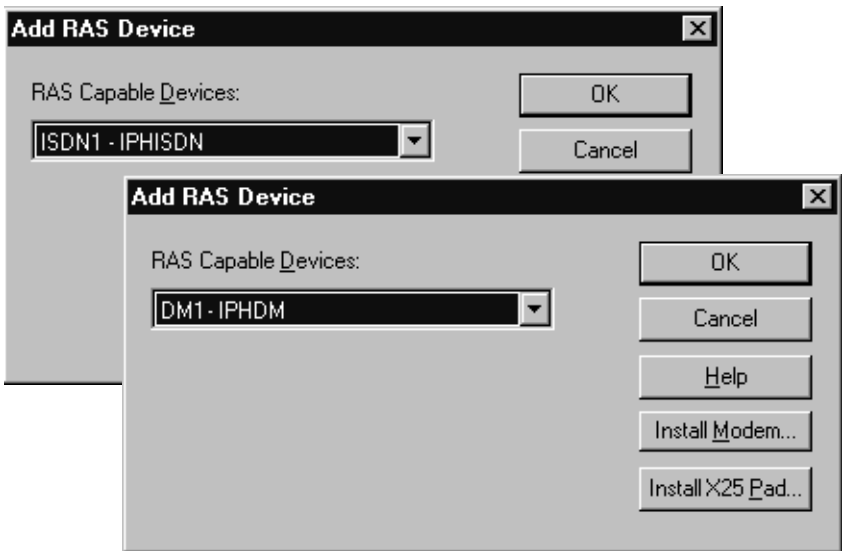
Figure 4-13. Add RAS Device Dialog Box

In the RAS Capable Devices field, the device name indicates the first available channel type and number. (For example, *ISDN1 - IPHISDN* indicates ISDN B channel 1, or *DM1-IPHDM* indicates digital modem channel 1.)

3. Click **OK** to select the first channel in the list to add as a RAS port. (Or select a different channel and click **OK.**)

The Remote Access Setup dialog box appears, with the selected channel listed as a RAS port, as follows:

Figure 4-14. Remote Access Setup Dialog Box

4. Select the port (if needed) and click **Configure** to set up its connection mode.

The Configure Port Usage dialog box appears:
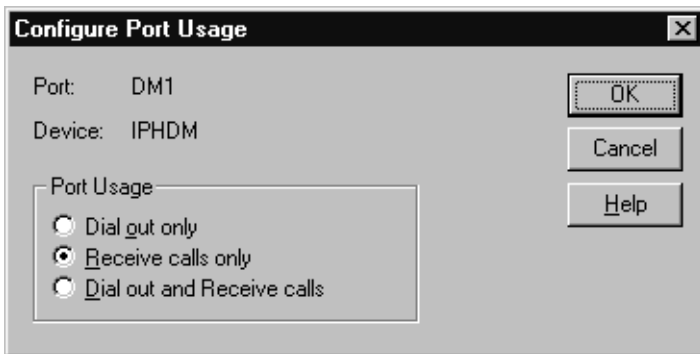
Figure 4-15. Configure Port Usage Dialog Box

5. Select a port usage option, and click **OK.**

   The **Remote Access Setup** dialog box reappears.

6. To quickly add and configure remaining channels as RAS ports with the same properties as a configured port, do the following:

   a. Select the port whose properties you want to copy, and click the **Clone** button.

      The Clone feature finds the next available channel and adds it to the list of ports in the Remote Access Setup dialog box. The port usage properties are copied from the port you selected to clone.

   b. Click the **Clone** button repeatedly until you have added and configured all the RAS ports you need.

   (Or to configure the channels' port usage properties one-by-one, click **Add** to display the Add RAS Device dialog box. Then select the next channel and repeat steps **4** through **5**.)

7. Next, do the following to select the protocols (NetBEUI, TCP/IP, or IPX) and other settings to be bound to the adapter:

   a. On the RAS Support Setup dialog box, click **Network** to display the Network Configuration dialog box:
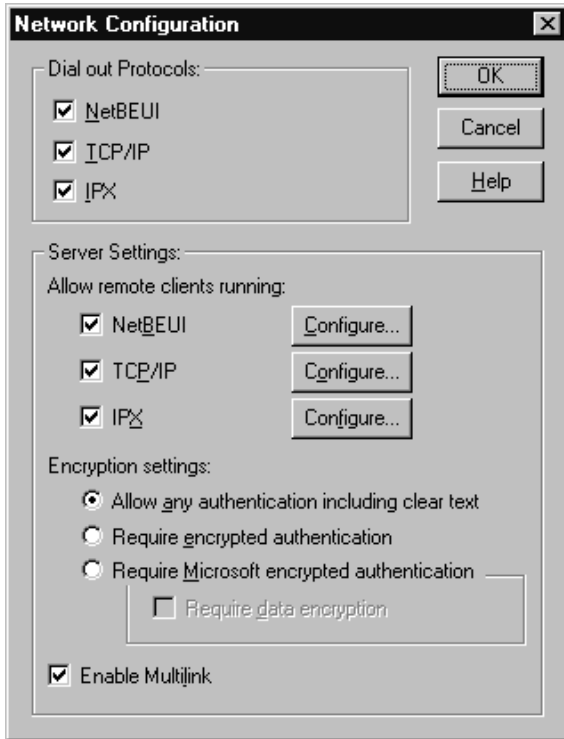
Figure 4-16. Network Configuration Dialog Box

For NT Servers, this dialog box includes the **Enable Multilink** option. The multilink function allows multiple digital modem or ISDN B channels to make one logical network connection. It aggregates B channels to increase the bandwidth of PPP links.

b. Configure network settings as needed for your system.

For detailed network configuration information, see Microsoft's online help for RAS.

c. Click **OK** to confirm your network configuration.

Depending on the network settings you configured, several dialog boxes may appear prompting you to confirm configuration options. Confirm the settings as needed.

d. When the Remote Access Setup dialog box reappears, click **Continue.**

e. If you are installing the first selected RAS support driver, and you installed RAS along with the driver, a message informs you that Remote Access Service has been successfully installed. It also reminds you to use Remote Access Admin or User Manager in the Administrative Tools Folder to assign RAS permissions to users.

Click **OK** to continue.

Next, either the Network Adapters dialog box or the Virtual Motion Remote Access Manager Suite Setup dialog box appears. This sequence depends on whether the Virtual Motion Manager suite has already been installed on your system.

• If the **Virtual Motion Remote Access Manager Suite Setup** dialog box appears, continue to the next section, *Installing The Virtual Motion Remote Access Manager Suite*.

• If the **Network Adapters** dialog box appears, do either of the following, depending on whether you need to install another RAS support driver.

– If you **do** need to install another RAS support driver, install it now.

Return to step **2** on page 4-3 of the *Installing the Drivers* section, and repeat the installation and configuration procedures for the second driver.

– If do **not** need to install another RAS support driver, skip to *Completing the Software Installation* on page 4-24.

Installing The Virtual Motion Remote Access Manager Suite

The Virtual Motion Remote Access Manager Suite is bundled with the IBM 4P BRI ST/U adapter software. (For an overview of the Remote Access Manager Suite, see *RAS Management Tool* on page 1-4.)

The Remote Access Manager Suite Setup program starts automatically after you install the first RAS support driver for the adapter. (If the suite is not installed with the first driver, the Setup program also starts after you install the second RAS support driver.)

The Remote Access Manager Suite requires Windows NT 4.0 and the NT Service Pack 3 or higher. It includes client and server components. Before installing the components, review the Virtual Motion Remote Access Manager PDF documentation on the IBM 4P BRI ST/U adapter installation CD for detailed recommendations.

Note: The installation procedure may differ from the steps described in this section, depending on the options you select.

Note: If you need to remove application components after installation, use the **Add/Remove Programs** function in the Windows NT Control Panel.

To install the Virtual Motion Remote Access Manager Suite, do the following:

1. On the Virtual Motion Remote Access Manager Suite Setup dialog box appears, click **Next** to continue.

2. On the Virtual Motion License Software Agreement dialog box, review the agreement and click **Yes** to accept the terms.

3. On the Choose Components dialog box, select the programs you want Setup to install, and click **Next.**

4. On the Enter License Key dialog box, enter the product license key. (Find the key on the Virtual Motion license page included in the adapter package.) Then click **Next.**

5. On the Choose Destination Directory dialog box, follow the instructions to install the Remote Access Manager in the appropriate directory. Then click **Next** to continue (or click **Cancel** to cancel and exit the installation).

6. On the Select Logging Type dialog box, select the type of dial-in session log you want the RAS Port Manager to create.

   – To create a comma-delimited text file with one record for each RAS session, select **Log to RPMSESS.LOG file.** The RAS Port Manager saves RPMSESS.LOG in the Windows SYSTEM directory on the RAS server.

   – To write the session log directly to your database manager using the ODBC interface, select **Log using ODBC datasource.** For this logging method, an ODBC datasource must be set up. See your Virtual Motion Remote Access Manager documentation and ODBC documentation for instructions.

7. When you are prompted to restart windows, select **No, I will restart later.**

WARNING

You must finish installing the adapter driver(s) before restarting the system, or the driver installation will be incomplete.

When the Network Adapters dialog box appears, do either of the following, depending on whether you need to install another RAS support driver:

- If you **do** need to install another RAS support driver, install it now. Return to step **2** on page 4-3 of the *Installing the Drivers* section, and repeat the installation and configuration procedures for the second driver.

- If you do **not** need to install another RAS support driver, continue to the next section, *Completing the Software Installation*.

Completing the Software Installation

After you have configured all of the adapter software you have chosen to install, the Network Adapters dialog box appears:
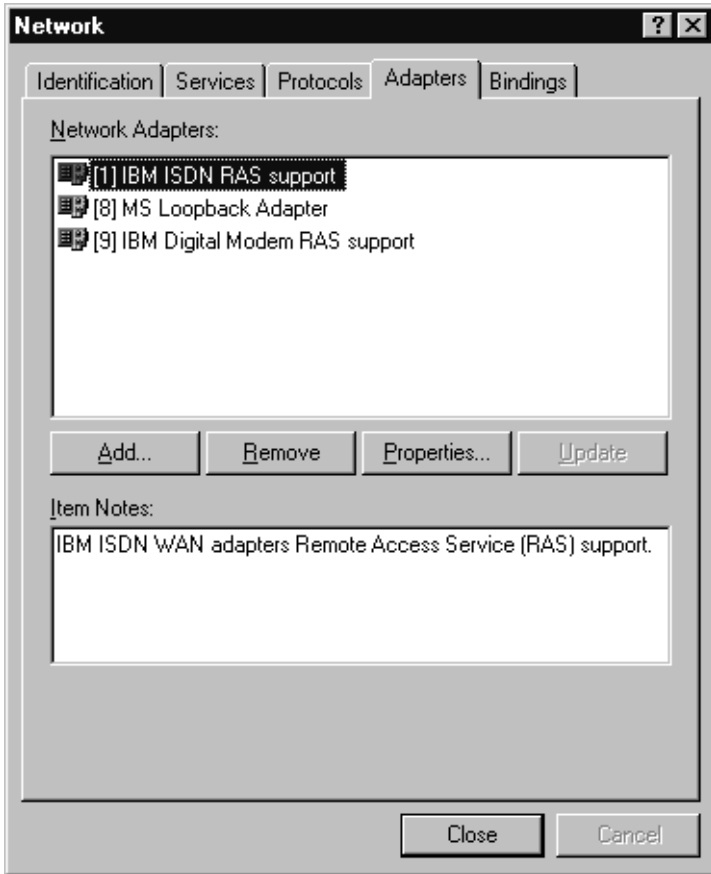
Figure 4-17. Network Adapters List

The Network Adapters list displays the driver(s) you installed (**IBM Digital Modem RAS support** and/or **IBM ISDN RAS support**).

Do the following to make the installation settings take effect:

1. On the Network Adapters dialog box, click **Close.**

   After the software is fully installed, a message informs you that you must shut down and restart your computer before the settings take effect.

2. Continue as follows:

   – If the system is a basic Windows NT system, without the Windows NT Service Pack installed, click **Yes** to restart the computer.

   – If the Windows NT Service Pack is installed, click **No.** Then reinstall the Service Pack. Restart the system when prompted after you complete the Service Pack installation.

WARNING

If a Windows NT Service Pack was installed on the system after the first Windows NT installation, you must reinstall it before restarting the computer. Service Pack version 3 or higher is recommended. For installation information, see the latest available version of your Service Pack help. If you do not reinstall the Service Pack, the Remote Access Service may fail to start or malfunction when connecting ISDN lines.

To determine whether a Service Pack is installed, see *Index of Common Tasks* on page E-1.

After the system restarts, check the ISDN line to make sure the adapter connects properly, as described in *Testing Your ISDN Line* on page C-2.

In addition, you may need to do one or all of the following, depending on your adapter and system configuration:

• If your adapter is connected to an MVIP Bus, the MVIP Bus connection must be enabled so the software recognizes the Bus connection. If you need to enable or disable the Bus connection, see *Setting Up Card Properties* on page 5-5.

- Upon completion of the adapter software installation, eight Serial driver COM ports are automatically assigned to the adapter's digital modems. If you need to change the number of COM ports assigned to the digital modems, see *Setting Up Card Properties* on page 5-5.

- If you need to change other adapter firmware, card, or port properties, see *Setting Up WAN Firmware and Hardware* on page 5-1.

- If you need to change default call setup properties for ISDN RAS support calls, digital modem RAS support calls, or digital modem serial driver calls, see *Setting Up Calls* on page 6-1.

- If you need to ensure that applications that use COM ports under Windows NT can detect the adapter's digital modems, see *Managing Serial Driver COM Ports* on page 7-1.

For an overview of using the adapter in the RAS environment, see *Index of Common Tasks* on page E-1. For detailed information about RAS Server or RAS Dial-Up Networking, see Microsoft RAS online help.

Removing the Drivers

If you no longer use the adapter, do the following to remove the Base driver (including the Serial Driver and utilities) and the RAS support driver(s) (Digital Modem and/or ISDN):

Note: As long as one of the RAS support drivers is still installed, the Base driver remains installed. The Base driver is automatically removed when you remove the second (and last) RAS support driver.

1. **Be sure you are logged on with administrator rights to the Windows NT 4.0 system**.

2. From the **Start** menu, select **Settings**, and then **Control Panel.** Then double-click the **Network** icon, and select the **Adapters** tab to display the Adapters dialog box:
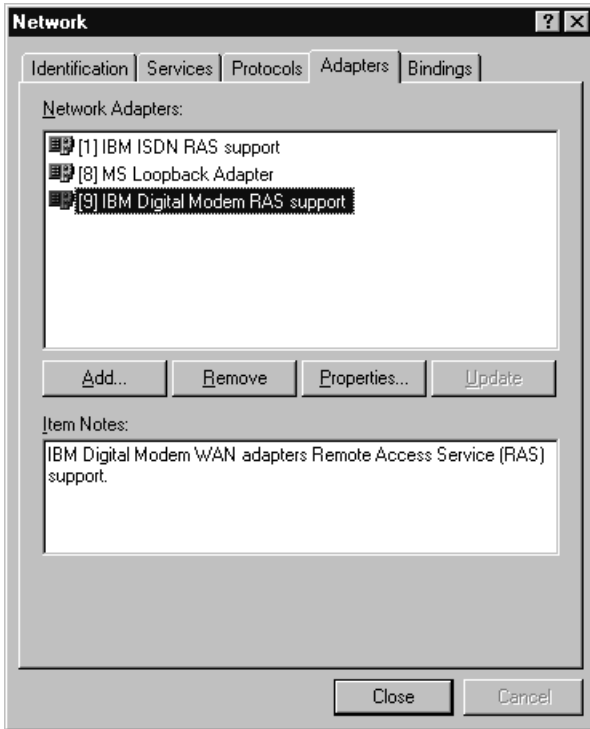
Figure 4-18. Removing a RAS Support Driver

3. Select the RAS support driver to remove, and click **Remove.** You can select either the IBM ISDN RAS support driver or the IBM Digital Modem RAS support driver first.

A warning message informs you that this action will permanently remove the component from the system, and asks if you want to continue.
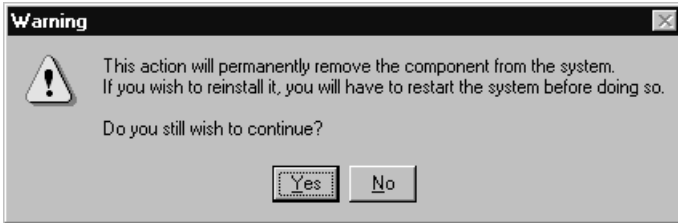
Figure 4-19. Remove Adapter Warning Message

4. Click **Yes** to continue the driver removal.

    –   If a remaining RAS support driver is still installed in the system, the Network Adapters dialog box reappears. If you need to remove the remaining driver, return to step **3**. If you do not, click **Close.**

    –   If you are removing the last (or only) installed IBM RAS support driver, the IBM Base driver dialog box appears. Continue to step **5**.

5. The IBM Base driver dialog box identifies the install path that will be deleted, and asks if you are sure you want to deinstall the software:
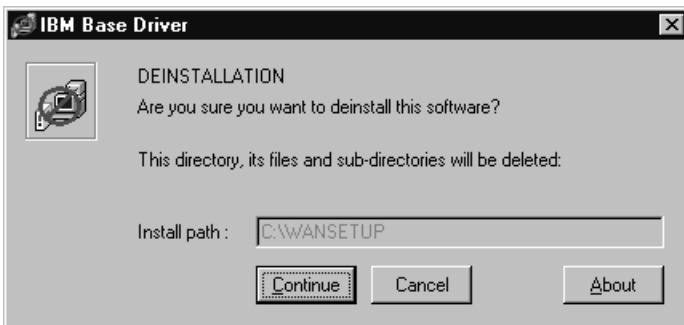
Figure 4-20. Base Driver Removal Dialog Box

To remove the remaining adapter software:

a. Click **Continue**.

The following pop-up prompts you to confirm the card(s) removal and driver deletion:

Figure 4-21. Removal Confirmation Message

b. To confirm the deletion, click **Yes.**

After you confirm the deletion, the system does the following:

– Deletes product files and the Base driver program group from the **Start** menu

– Dynamically unloads the drivers from memory

– Cleans up the registry

When the removal process is finished, the Network Adapters dialog box reappears.

6. Click **Close** to confirm the new network settings.

The Windows NT network updates network bindings.

7. **If the 4P BRI ST/U adapter was the only RAS-capable device,** a setup message informs you that you have an invalid RAS configuration. It also reminds you to configure RAS and add ports using the Network option in the Control Panel after restarting the system.

To prevent RAS errors from occurring:

a. Click **OK** to continue.

b. Remove the Virtual Motion Remote Access Manager. (In the Windows NT **Control Panel,** select **Add/Remove Programs,** then the **Install/Uninstall** tab. Follow online instructions to uninstall all program components.)

c. Remove Remote Access Service, as described in Microsoft documentation and online help.

8. After removing the adapter software, continue as follows when prompted to restart the computer:

   – If the system is a Windows NT basic system, with no Windows NT Service Pack installed, click **Yes.**

   – If the Windows NT Service Pack is installed, click **No.** Then reinstall the Windows NT Service Pack. Restart the system when prompted at the completion of the Service Pack installation.

5 Setting Up WAN Firmware and Hardware

Overview

The WAN Adapters Setup utility enables you to manage hardware and firmware for IBM WAN adapters, and make configuration changes after completing the software installation. Use this utility to add IBM 4P BRI ST/U adapters and their firmware to the operating system. Also use this utility to remove IBM WAN adapters or to make other changes to adapter card and port properties. If you need to enable or disable an adapter's MVIP Bus connection or change its digital modem COM port assignments, do so by editing card properties.

The chapter explains how to do the following WAN Adapter Setup tasks:

- Access online help
- Start the utility
- Manage adapter firmware
- Manage adapter hardware properties, including card properties, ISDN port properties, and digital modem port properties
- Load, save, and activate the WAN adapter setup after changing any firmware, card, or port properties

Accessing Online Help

For detailed information about the functions described in this chapter, see the WAN Adapter Setup online help. You can access online help in the following ways:

- Click **Help** to display the main online help.
- Press **F1** to display contextual help in a pop-up window.

Starting the WAN Adapters Setup Utility

Start the WAN Adapter Setup utility in either of the following ways:

- From the **Start** menu, select **Settings,** and then **Control Panel.** Then double-click the **WAN Setup** icon.
- From the **Start** menu, select **Programs,** then **IBM WAN Adapters,** and then **WAN Adapters Setup.**

When you start the utility, the WAN Adapters Setup dialog box appears:

Figure 5-1. WAN Adapters Setup Dialog Box

The WAN Adapters setup dialog box contains two sections:

- The **Firmware** section is for firmware management.
- The **Cards** section is for hardware management. Selecting a card in this section displays the IBM WAN adapters you have installed and their communication ports.

Firmware Management

The Firmware section of the WAN Adapters Setup dialog box displays firmware information for the WAN adapter selected in the Cards section. It displays the protocols you can use with the adapter, and their status. You can view the firmware status, reload the firmware, or change the firmware.

The firmware status is represented by a general LED color for the firmware and individual LEDs for each protocol, as follows:

LED Color	General Firmware	Individual Protocol LEDs
Red	No firmware is found on the disk for the current card.	N/A
Gray	Firmware is found but is not loaded into the card.	The protocol is inactive.
Yellow	Firmware is running on the card but is different from that found on the disk for this card.	N/A
Green	The firmware is running.	The protocol is active.

Table 5-1. Adapter Firmware LEDs

Use the following buttons to set up firmware information:

Click...	To do this...
Load	Download the current firmware to the selected adapter. **CAUTION: This option disconnects all current RAS-connected users and disables the RAS Server. After a firmware download, the RAS Server must be re-enabled, as follows:** 1. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **Remote Access Admin.** 2. From the **Server** menu, select **Stop Remote Access Service,** and then **Start Remote Access Service.**
New	Set alternate firmware as the current firmware.

Table 5-2. Firmware Section Buttons

Note: The Properties button in the Firmware section is disabled because this product has no configurable layers.

Note: If you load firmware, save changes and restart the system as described in *Saving WAN Adapter Setup Properties* on page 5-14.

Adapter Hardware Management

The Cards section of the WAN Adapters Setup dialog box displays all the IBM WAN adapters installed in the machine, their status, and their available communication ports. The Firmware section displays information about the adapter selected in the Cards section. You can use the buttons in the Cards section to add, remove, or configure WAN adapters.

Note: If you change any firmware, card, or port properties, you must apply changes, reload the firmware, save properties, and restart the system, as described in *Saving WAN Adapter Setup Properties* on page 5-14.

The adapter status is represented by its icon color:

LED Color	Meaning
Gray	The adapter is detected but is not working.
Yellow	The hardware configuration has been changed but not applied.
Green	The adapter is running.

Table 5-3. Adapter Status LED

Use the following buttons to set up adapter hardware:

Click...	To do this...
Add	Add a new adapter to the operating system. This option is enabled if one or more IBM WAN BRI adapters can be installed.
Remove	Remove an existing adapter from the operating system. This option removes an adapter and its drivers.
Properties	Configure an adapter's hardware or port properties. You can also use this button to access the Call Setup dialog box, as described in *Setting Up Calls* on page 6-1.

Table 5-4. Cards Section Buttons

Setting Up Card Properties

Use the Card Properties dialog box to view the adapter's hardware properties. Also, use this dialog box to enable or disable the adapter's MVIP Bus connection (if applicable) or to change the COM ports assigned to the digital modems on the adapter, if needed.

To display the Card Properties dialog box:

1. From the Cards section of the WAN Adapters Setup dialog box, select the adapter, as shown in the following illustration:
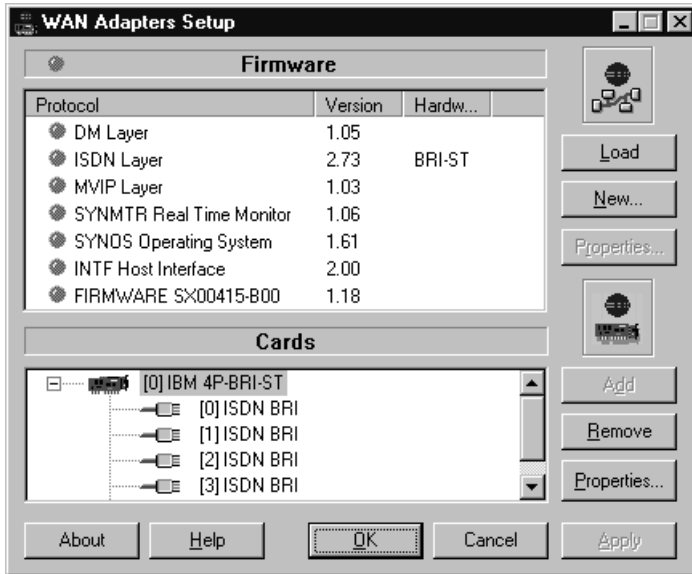
Figure 5-2. Selecting an Adapter in the Cards Section

2. Click the **Properties** button in the Cards section.

The Card Properties dialog box appears:
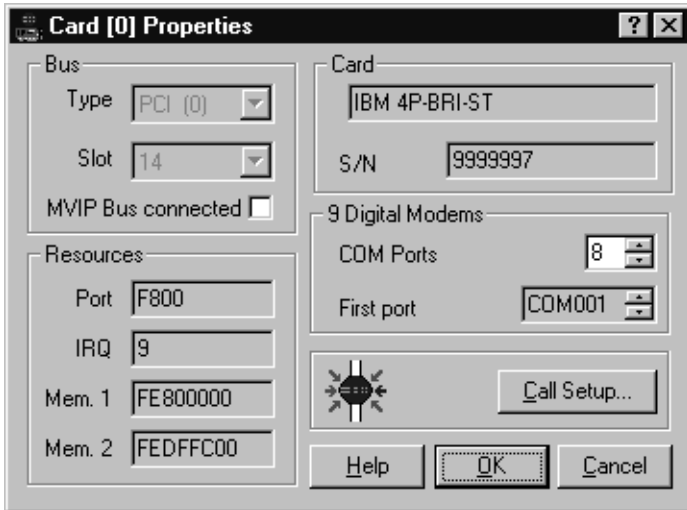
Figure 5-3. Card Properties Dialog Box

The fields in the Bus, Resources, and Card sections of the Card
Properties dialog box provide general information about the adapter
hardware. Most of these properties are determined by hardware
features and cannot be changed. Only the MVIP Bus connected field
and the Digital Modems fields can be changed.

Enabling or Disabling the MVIP Bus Connection

If the adapter is connected to an MVIP Bus, you must enable the
MVIP Bus connected setting on the Card Properties dialog box. This
allows the adapter software to recognize the MVIP Bus connection.

To enable the MVIP Bus connection setting, select the **MVIP Bus
connected** field. (To disable the Bus connection, deselect the field.)

Assigning Serial Modem COM Ports to Digital Modems

After the Serial driver has been installed along with the Base driver,
you can change the COM ports assigned to the adapter's digital
modems. Eight COM ports are automatically assigned to the digital
modems during the software installation. These are the COM ports

that the Serial driver can emulate. The Serial driver can emulate up to the same number of COM ports as there are digital modems on the adapter.

The fields in the *x Digital Modems* section (where *x* is the number of digital modems on the adapter) control the following properties:

- The number of COM ports that can be assigned to digital modems (defaults to *8*)
- The index of the first COM port (defaults to *COM 001*)

To assign COM ports to digital modems, do the following:

1. To specify the number of COM ports to assign, select the number in the **COM Ports** field.

   This should be the total number of COM ports for all digital modems. The value must be between 0 and the number of modems on the adapter.

   The Serial driver can emulate the number of COM ports chosen here, allowing the selected number of ISDN B channels to be used as COM ports.

2. In the **First Port** field, if you do not want to use the displayed port number as the first digital modem COM port, select the port number to be used instead.

   The Serial driver will emulate the number of COM ports specified in step **1**, starting with the selected first port, and assign them to the adapter's modems.

Note: To specify that **no** COM ports can be emulated, select **0** in the **Digital Modems** field. This selection removes the Serial driver.

Depending on the applications you use with modems, you might need to use Windows NT to identify (*declare*) Serial driver digital modems to the operating system so the modems can be detected when needed. For detailed information about declaring and verifying the digital modems in Windows NT, see *Managing Serial Driver COM Ports* on page 7-1.

Setting Up ISDN Port Properties

If the IBM ISDN RAS Support driver is installed on the machine, you can use the ISDN BRI Port Properties dialog box to set up the adapter's port properties.

Note: Before you configure your ISDN BRI line, first obtain the necessary information about your subscription from your ISDN provider.

To display the ISDN BRI Port Properties dialog box:

1. Select the ISDN port you want to configure in the Cards section of the WAN Adapters Setup dialog box.

2. Click the **Properties** button in the Cards section.

    The ISDN BRI Port Properties dialog box appears:
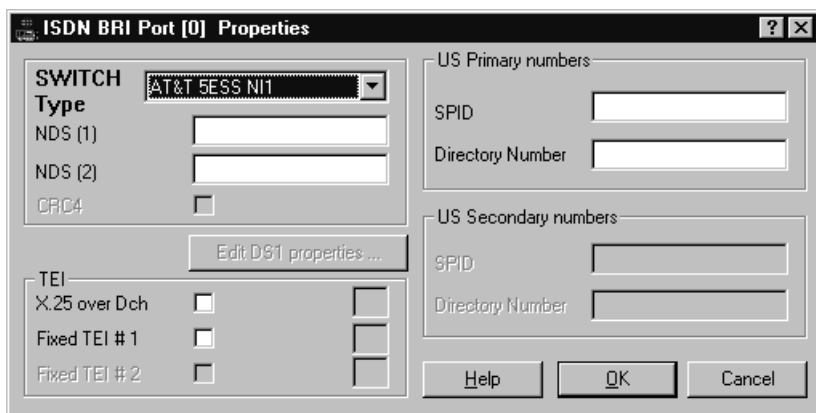
Figure 5-4. ISDN BRI Port Properties

Use the ISDN BRI Port Properties dialog box to view and set the ISDN port switch type. The following topics provide detailed information about the setup parameters available on this dialog box.

Configuring the Switch Type

In the ISDN BRI Port Properties dialog box, select the appropriate switch type setting from the SWITCH Type drop-down list.

The following table describes the available switch types:

Select...	If your telephone company uses...
ETSI EUROISDN	The ETSI EUROISDN switch type (available in Europe)
NT DMS100 NI1	A Northern Telecom DMS-100 switch that complies with the National ISDN 1 standard—sometimes referred to as *National* (available in North America)
AT&T 5ESS NI1	An AT&T 5ESS switch that complies with the National ISDN 1 standard (available in North America)
AT&T CUSTOM	An AT&T 5ESS Custom Point-to-Point switch or an AT&T 5ESS Custom Multipoint switch (available in North America)

Table 5-5. Switch Type Options

WARNING

You must select the same switch type for all ports on a single adapter. Otherwise, the ports might not function properly.

If you changed the switch type, a pop-up message reminds you to validate all ISDN calling profiles with all applications using the profile. To validate the profiles, make sure to select the same switch type for all ISDN BRI ports. Also, reload the firmware after changing the switch type for all ports. (Any time you change the signalling, which happens when you change the switch type, you must reload the firmware.)

Other Parameters

Following are additional ISDN port property parameters that are optional or required for particular ISDN networks:

Parameter	Description
NDS(1)	Optional; applicable only for certain ISDN networks (for example ETSI). Additional private number used behind a PBX. NDS(1) will be included in the outgoing call message (SETUP message) as an additional Calling Party Number Information Element for the first outgoing call (and for the second outgoing call if NDS(2) is unused).
NDS(2)	Optional; applicable only for certain ISDN networks (for example ETSI). Additional private number used behind a PBX. NDS(2) will be included in the outgoing call message (SETUP message) as an additional Calling Party Number Information Element for the first outgoing call (and for the second outgoing call if NDS(1) is unused).
Fixed TE#1	• In the checkbox, select this item if the switch does not auto-assign Terminal Endpoint Identifiers (TEIs), and requires one or two fixed TEIs. This selection validates the first TEI you are using. • In the text field, enter the first TEI value given by the telephone company at subscription time. For US switches supporting SPIDs, this TEI will be used to handle the SPID#1 negotiation.
Fixed TE#2	• In the checkbox, select this item if the US switch does not auto-assign Terminal Endpoint Identifiers (TEIs), and requires two fixed TEIs. This selection validates the second TEI you are using. • In the text field, enter the second TEI value given by the telephone company at subscription time. For US switches supporting SPIDs, this TEI will be used to handle the SPID#2 negotiation.

Table 5-6. Optional ISDN Port Properties

Parameter	Description
US Primary Numbers (SPID and Directory Number)	Enter the Primary Service Profile IDentifier (SPID) and corresponding Primary Directory Number if your telephone company provided you with one or more sets of these numbers. The SPID is a number that identifies ISDN equipment attached to your ISDN line. It is always associated with a Directory Number (DN). Depending on the switch type, your configuration may require zero, one, or two SPIDs and Directory Numbers. When you order ISDN service, the telephone company should provide you with the necessary SPID(s) and corresponding Directory Numbers.
US Secondary Numbers (SPID and Directory Number)	Enter the Secondary SPID and corresponding Secondary Directory Number if your telephone company provided you with two sets of these numbers.

Table 5-6. Optional ISDN Port Properties

Setting Up Digital Modem Port Properties

If the IBM Digital Modem RAS Support driver is installed on the machine, you can use the WAN Adapter Setup Utility to change the adapter's digital modem port properties.

To set up the digital modem properties:

1. Select the digital modem port in the Cards section of the WAN Adapters setup dialog box, as shown in the following illustration:

Figure 5-5. Digital Modem Port Selection

2. Click the **Properties** button in the Cards section.

    The Digital Modem Properties dialog box appears:

Figure 5-6. Digital Modem Properties Dialog Box

Use the Digital Modem Properties dialog box to set the speech coding law for your geographic location.

3. Select **A Law** for Europe, or select μ **Law** (*Mu* law) in the United States and Japan.

4. Click **OK.**

5. Repeat steps **1** through **4** for the digital modems of any other installed adapters.

Saving WAN Adapter Setup Properties

Save any changes to WAN adapter firmware, card, and port properties as follows:

1. Apply the changes by clicking the **Apply** button.

2. Reload the firmware on the card by clicking the **Load** button. Then follow the onscreen instructions.

3. After the properties have been loaded, click **OK** to save the reloaded configuration and close the WAN Adapters Setup dialog box.

   The configuration software automatically finds the relevant firmware for the adapter. It updates the registry and dynamically updates the drivers.

4. If the Microsoft Windows NT Service Pack is installed, reinstall the Service Pack. (Service Pack 3 or higher is recommended.)

5. To activate new settings, restart your computer. (If you reinstalled the Service Pack, restart the system when prompted at the end of the Service Pack installation.)

6 Setting Up Calls

Overview

This chapter provides detailed information about setting up the adapter's outgoing and incoming calls. It describes procedures for setting up RAS ports and RAS Support properties, and for setting up call properties. It provides information about the following call setup tasks:

- Setting up or removing ISDN and digital modem channels as RAS ports
- Setting up RAS support properties
- Setting up incoming call properties
- Setting up outgoing call properties

Setting Up or Removing Channels as RAS Ports

If you need to add ISDN or digital modem channels as RAS-capable devices after software installation, use the Remote Access Setup dialog box and the Add RAS Device dialog box to set up the channels as RAS ports. You can also use the Remote Access Setup dialog box to remove channels from the RAS device list so that the channels are no longer designated as RAS devices.

Setting Up RAS Port Designations

To set up ISDN or digital modem channels as RAS ports, do the following:

1. Validate the RAS support properties for the appropriate driver type, as follows:

   a. From the **Start** menu, select **Settings,** and then **Control Panel.** Then double-click the **Network** icon, and select the **Adapters** tab.

b. When the Network Adapters dialog box appears, select **IBM ISDN RAS support** to set up ISDN RAS ports, or select **IBM Digital Modem RAS support** to set up digital modem RAS ports.

c. Click the **Properties** button.

d. When the RAS Support General dialog box appears, click **OK** to confirm the general RAS support properties for the RAS ports being added.

2. When the Network Adapters dialog box appears, select the **Services** tab to display the Services dialog box.

3. Select **Remote Access Service** from the list of services, and click the **Properties** button.

The Remote Access Setup dialog box appears.

4. Click **Add** to add a channel as a RAS device.

The Add RAS Device dialog box appears:
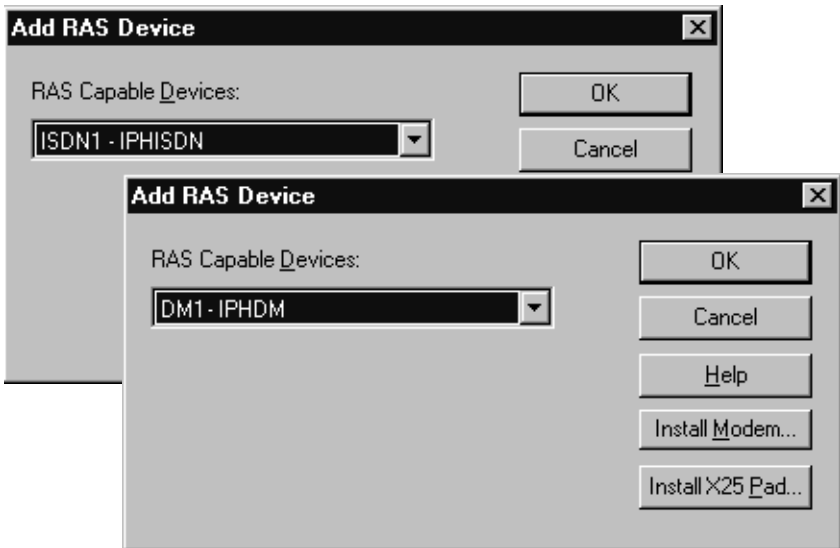
Figure 6-1. Add RAS Device Dialog Box

The RAS Capable Devices field lists the available RAS-capable ISDN or digital modem channels. Device names indicate the ISDN B or digital modem channel number and the RAS support driver type. (For example, *ISDN1 - IPHISDN* indicates ISDN channel 1, and *DM1-IPHDM* indicates digital modem channel 1.)

5. Select the channel to be configured as a RAS port and click **OK.** (Or just click **OK** to select the first channel in the list.)

The Remote Access Setup dialog box appears, with the selected channel listed as a RAS port, as follows:
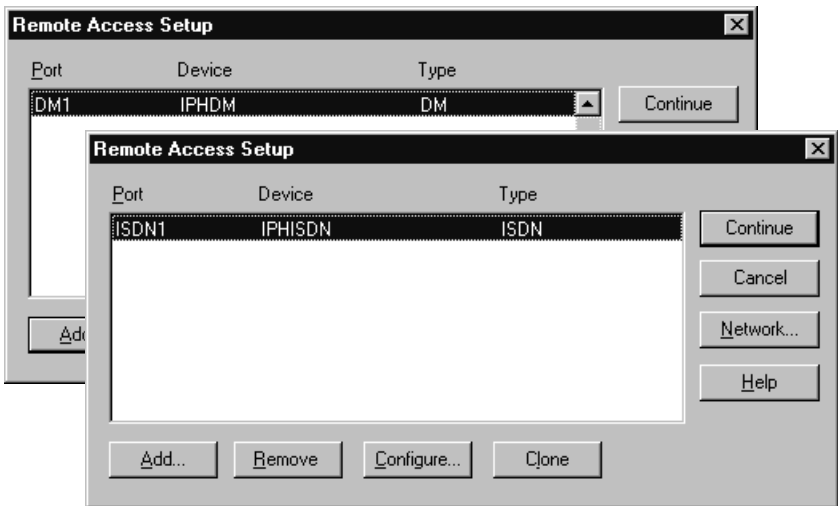
Figure 6-2. Remote Access Setup Dialog Box

6. Select the digital modem or ISDN RAS port and click **Configure** (if needed) to set up its connection mode.

The Configure Port Usage dialog box appears:
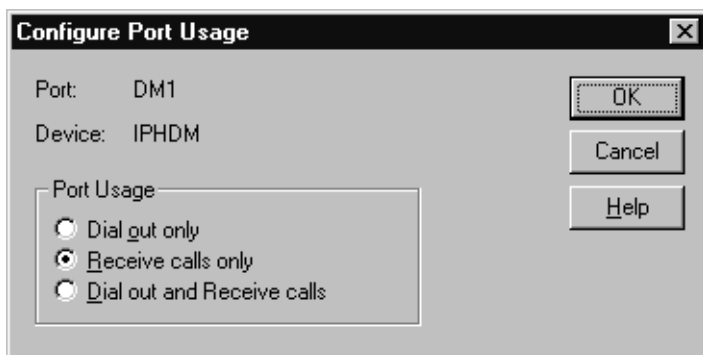
Figure 6-3. Configure Port Usage Dialog Box

7. Select a port usage option, and click **OK.**

   The **Remote Access Setup** dialog box reappears.

8. To quickly add and configure remaining channels as RAS ports with the same properties as a configured port, do the following:

   a. Select the port whose properties you want to copy, and click the **Clone** button.

      The Clone feature finds the next available channel and adds it to the list of ports in the Remote Access Setup dialog box. The port usage properties are copied from the port you selected to clone.

   b. Click the **Clone** button repeatedly until you have added and configure all the RAS ports you need.

   (Or to configure the channels' port usage properties one-by-one, click **Add** to display the Add RAS Device dialog box. Then repeat steps **5** through **7**.)

Removing RAS Port Designations

If you need to remove a channel from the RAS device list, do the following:

1. Access the Remote Access Setup dialog box, as described in steps **1** through **3** of *Setting Up RAS Port Designations* on page 6-1.

2. Select the channel in the list on the Remote Access Setup dialog box, and click **Remove.**

3. Click **Continue** when you are done removing RAS port designations.

4. After changing RAS Port settings, if the Microsoft Windows NT Service Pack is installed, reinstall the Service Pack.

5. To activate new settings, restart your computer. (If you reinstalled the Service Pack, restart the system when prompted at the end of the Service Pack installation.)

Setting Up RAS Support Properties

Using the IBM RAS support dialogs, you can set up general RAS support properties for incoming ISDN and digital modem RAS support calls. You can also configure incoming call filters for ISDN calls.

Setting Up General RAS Support Properties

To set up general RAS support properties for ISDN or digital modem RAS support calls:

1. From the **Start** menu, select **Settings**, and then **Control Panel.**

2. Double-click the **Network** icon, and then select the **Adapters** tab.

3. In the Adapters dialog box, select the driver for which you are configuring RAS support, as follows:

    –   If you are configuring the Digital Modem RAS Support driver, select **Digital Modem RAS support.**

    –   If you are configuring the ISDN RAS Support driver, select **ISDN RAS support.**

4. Click the **Properties** button.

    The RAS Support General dialog box appears. The driver name in the title bar identifies the driver being configured.

    Following is an illustration of the two versions of the General dialog box:
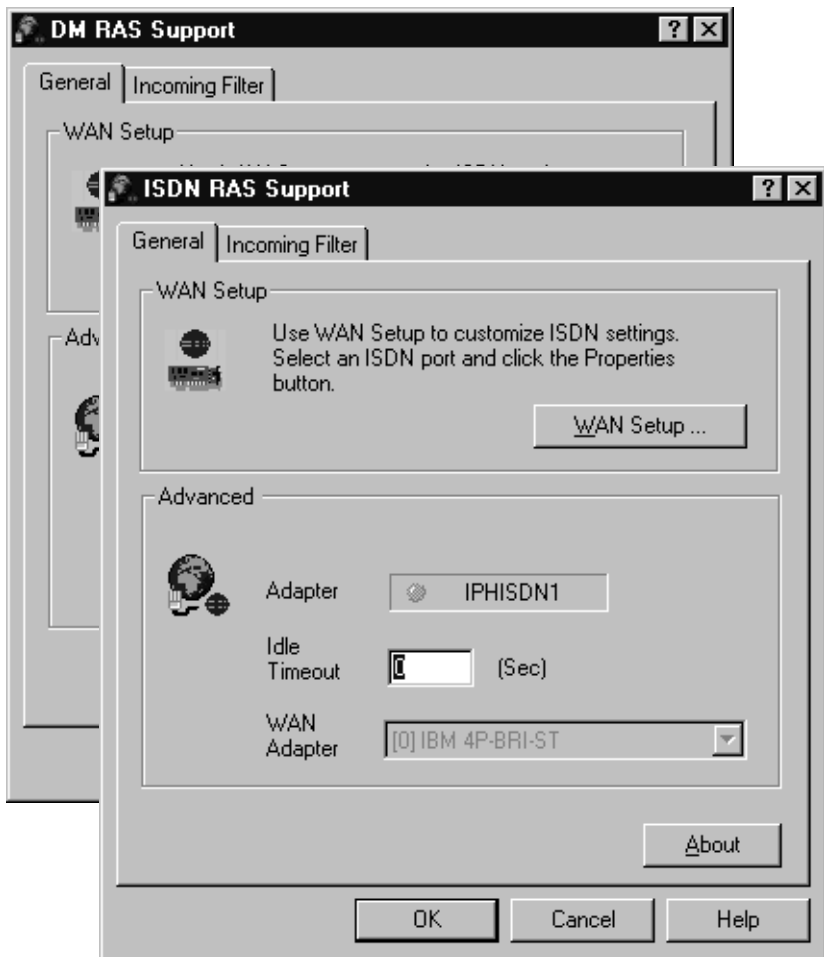
Figure 6-4. RAS Support General Dialog Box

5. View or configure general ISDN or Digital Modem RAS support parameters, as described in the following table:

Use this Parameter...	To do the following...
Adapter	Identify the status and the network name of the adapter. The LED beside the adapter name represents the adapter status. Green means that the driver is running, and gray means that it is not running. The numeric suffix in the name (in this case, *1*) is the logical network adapter number assigned by Windows NT.
Idle Timeout	Specify how many seconds of inactivity to allow before the Idle timer ends the connection. The Idle timer is an inactivity timer used to disconnect an ISDN connection when no data traffic is exchanged. This timer setting is attached to the displayed adapter. The setting is identical for all of the adapter's ISDN B channels. To disable the Idle Timeout, enter 0.
WAN Adapter	Displays the adapter name assigned by the system.

Table 6-1. RAS Support Parameters

6. After changing RAS support settings, if the Microsoft Windows NT Service Pack is installed, reinstall the Service Pack.

7. To activate new settings, restart your computer. (If you reinstalled the Service Pack, restart the system when prompted at the end of the Service Pack installation.)

Setting Up Filters for Incoming Calls

You can set up incoming filter properties for the ISDN RAS Support driver using the RAS Support Incoming Filter dialog box.

To access the Incoming Filter dialog box:

1. From the **Start** menu, select **Settings**, and then **Control Panel.**

2. Double-click the **Network** icon, and then select the **Adapters** tab.

3. In the Network Adapters dialog box, select **IBM ISDN RAS support.**

4. Click the **Properties** button.

5. When the RAS Support General dialog box appears, select the **Incoming Filter** tab.

    The Incoming Filter dialog box appears:

Figure 6-5. RAS Support Incoming Filter Dialog Box

Note: You can also access this dialog box for the Digital Modem
      RAS Support driver. However, the calling number and
      filtering list options are unavailable on the DM RAS Support
      version of the dialog box.

The Incoming Filter dialog box enables you to add, replace, move,
and remove the ISDN RAS incoming call numbers to be accepted by
the adapter. Call numbers to be accepted appear on the Filtering list.
This list can contain up to 1024 numbers.

If the Filtering list is blank, no filtering will be performed on the
calling number. If the list is not blank, all incoming numbers not
included in the Filtering list will be rejected.

Note: After changing RAS Incoming Filter settings, to activate new
      settings, restart your computer. (If the Microsoft Windows
      NT Service Pack is installed, reinstall the Service Pack before
      restarting the system. Then restart the system when prompted
      at the end of the Service Pack installation.)

Adding an Incoming Call Number

To add incoming calls to the Filtering list:

1. Type the incoming number in the New calling number field.

2. Click **Add.**

    The number appears in the Filtering list.

3. Repeat steps **1** through **2** for all other calling numbers you
    want to be accepted.

    The numbers appear in the list in chronological order.

Replacing an Incoming Call Number

To replace an incoming call number in the list:

1. In the Filtering list, highlight the number to replace.

2. Type the new number in the New calling number field.

3. Click **Replace.**

    The new number appears in the list, replacing the first one.

Moving an Incoming Call Number Up or Down

To rearrange the order of the incoming call numbers in the list:

1. In the Filtering list, select the number of the incoming call you want to move.

2. Click the **Up** or **Down** button. (You can move only one number at a time.)

    The numbers are rearranged accordingly.

Removing an Incoming Call Number

To delete a number from the list, select the number you want to delete from the list, and then click **Remove**. (You can remove only one number at a time.)

Setting Up Incoming Call Properties

Incoming calls are divided into the following categories:

*   ISDN RAS support calls, which are managed by the ISDN RAS Support driver
*   Digital Modem support calls, which are subdivided into the following categories:
    *   DM RAS support calls, which are managed by the Digital Modem RAS Support driver
    *   Serial Driver calls, which are managed transparently by the Serial driver, and use COM ports

Use the Call Setup dialog box to manage incoming calls.

Accessing the Call Setup Dialog Box

The Call Setup dialog box enables you to set up properties for filtering and routing incoming calls. You can set up properties of incoming calls from ISDN or digital modems toward RAS, or from Serial COM ports toward legacy applications.

You can access the Call Setup dialog box in the following ways:

- From the Cards section of the WAN Adapters Setup dialog box, first select the adapter for which you want to set up call properties.

  Then do either of the following:

  - Click the **Properties** button. Then in the Card Properties dialog box, click the **Call Setup** button.
  - Right-click and select **Call Setup** from the shortcut menu.

  (For information about the WAN Adapters Setup dialog box, see *Setting Up WAN Firmware and Hardware* on page 5-1.)

- From the RAS Support Incoming Filter dialog box, click the **Call Setup** button. (For information about the Incoming Filter dialog box, see *Setting Up RAS Support Properties* on page 6-5).
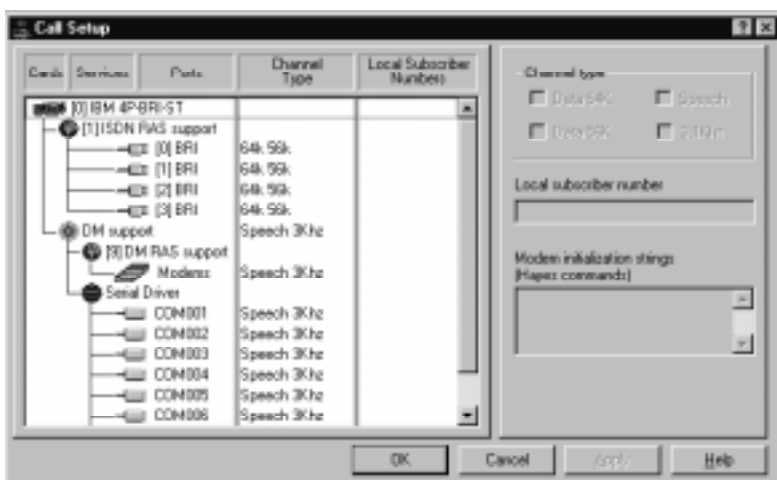
Following is the Call Setup dialog box.

Figure 6-6. Call Setup Dialog Box

This dialog box includes columns displaying adapter information on the left side and input fields to use for setting up call properties on the right side.

Call Setup Display Columns

On the left side of the Call Setup dialog box, a tree view graphically lists the IBM WAN adapters installed in the computer. These columns provide information about the driver services, ports, and channels set up for each adapter.

The following table provides information about the columns in the tree view.

Column	Function
Cards	Displays all of the IBM WAN adapters detected in the computer.
Services	Displays the list of driver services installed for each adapter. Available services include: • ISDN RAS Support driver • DM RAS Support driver • Serial driver
Ports	Displays all currently available ports: • ISDN RAS support ports (BRI) • Digital Modem RAS ports (one digital modem RAS port only) • Digital Modem Serial driver ports (*n* ports) The number of serial driver ports is identical to the number of COM ports assigned on the Card Properties dialog box. (For information about card properties setup, see *Setting Up WAN Firmware and Hardware* on page 5-1.)
Channel Type	Identifies the type of call the adapter accepts on a Port or a Service: • Data 64K or data 56K • Speech or 3Khz
Local subscriber number	Displays the local subscriber numbers corresponding to a port.

Table 6-2. Call Setup Columns

Call Setup Fields

The fields available on the right side of the Call Setup dialog box depend on the service or port selected on the left side.

You can select multiple ports of the same type in the tree view (that is, multiple ISDN or COM ports) and configure them together.

The following table provides information about Call Setup fields:

Field	Description

Channel type	The selected channel types determine the types of incoming calls the adapter accepts, and the ports to which the calls are connected.
	
	Data 64K and Data 56K channel types are available for:
	• ISDN RAS ports (*[0] BRI – [3] BRI* in the Ports column)
	• DM Support service (*DM support* in the Services column)
	• Serial Driver COM ports (*COM00x* in the Ports column)
	   Data channel types are available for COM ports only if selected for the DM Support service.
	
	Speech and 3.1Khz channel types are available for:
	• DM Support service (*DM support* in the Services column)
	• DM RAS modem port (*Modems* in the Ports column)
	   Speech and 3.1Khz channel types are available for the RAS Modem port only if selected for the DM Support service.
	• Serial Driver COM ports (*COM00x* in the Ports column)
	   Speech and 3.1Khz channel types are available for COM ports only if selected for the DM Support service.
	
	Speech or data channel types must be set up for both the DM RAS port and the Serial Driver COM ports.
	
	If two types of ports accept the same channel type, a Local subscriber number is also required to route an incoming call to a specific port.
	
	If you select Data 64K or Data 56K for a Serial Driver COM port, you **must** enter the **Local subscriber number** to use both ISDN and digital modem capabilities.

Table 6-3. Call Setup Property Fields

Field	Description
Local Subscriber Number	The Local Subscriber Number routes an incoming call to the associated port. It determines which port an incoming call connects to. This number is required if two types of ports accept the same channel type.
	If you leave this field blank for all ports, no filtering will be done on incoming call numbers, and all numbers will be accepted.
	This field is available only for ports. It is required or optional as follows:
	• Optional for ISDN RAS BRI ports
	• Optional for the DM RAS modem port
	• Required for DM serial driver COM ports
	WARNING: The local subscriber number(s) entered must match the subscription number(s) your local Telco operator has assigned to your line.
Modem Initialization Strings (Hayes Commands)	Use the Modem Initialization Strings field to enter initialization strings for outgoing calls.
	This field is available only for the DM RAS modem port and for DM serial driver COM ports. It is optional.

Table 6-3. Call Setup Property Fields

The way incoming calls are routed depends on the Channel type values selected and on the Local subscriber numbers entered.

Note: Make sure that each channel type selected for each digital modem port is also selected for the DM Support service. Otherwise, calls of that type will be rejected for the port. Filtering is first applied at the DM Support Service level. If this filtering is accepted, then filtering is applied at the digital modem port levels.

After changing call setup properties, you must save and activate the new settings as described in the next section, *Saving Call Setup Properties*.

Saving Call Setup Properties

After you finish setting up call properties, use either of the following options to save your changes:

- Click **Apply** to save the information for the next session without closing the dialog box, so that you can make other changes as required.

- Click **OK** to save information and close the Call Setup dialog box. You will see any information saved during the next session after you restart your computer.

Note: To activate new call settings, you must click **OK** and restart your computer. (If the Windows NT Service Pack is installed, reinstall the Service Pack before restarting the system. Then restart the system when prompted at the end of the Service Pack installation.)

Setting Up Outgoing Calls Properties

Outgoing calls handled by the adapter are configured using either RAS management or asynchronous application management. Both of these methods are standard Microsoft NT operations, and do not require customized configuration.

RAS Management

The Windows NT Dial-Up Networking feature handles outgoing calls using RAS. Dial-Up Networking is used for declaring the list of all remote computers and determining the port type to use (ISDN, digital modem, or COM ports). The Dial-Up Networking icon is located in the **My Computer** program group on your computer's desktop.

You can use the Call Setup dialog box to set up initialization modem strings for outgoing calls. This dialog box is described in *Setting Up Incoming Call Properties* on page 6-11.

Asynchronous Application Management

Some outgoing calls are managed directly by asynchronous legacy applications through COM ports. Applications such as fax software, BBS access (Hyperterminal) software, and remote applications control software are often set up to manage their own outgoing calls.

7 Managing Serial Driver COM Ports

Overview

The adapter's Serial driver software is automatically installed with the adapter's Base driver software. The Serial driver emulates COM ports (*serial* ports) connected to the digital modems on the adapter, which includes 9 digital modems. The Serial driver emulates COM ports on ISDN B channels. It enables systems to use the adapter's modems simultaneously with legacy applications that require COM port communications, such as fax software, remote applications control software, and BBS access (Hyperterminal) software.

The Serial driver emulates COM port connections for up to four IBM WAN adapters, provided that sufficient memory and CPU resources are available.

This chapter describes the following Serial driver COM port management tasks:

- Set up Serial driver COM ports
- Declare Serial driver modems in Windows NT
- Verify COM ports

Setting Up Serial Driver COM Ports

After the Serial driver is installed, you must identify COM port(s) to be assigned to the adapter's digital modems that are managed by the Serial driver. The Serial driver can emulate from 0 to 9 COM ports on the adapter. For information about assigning Serial driver COM ports to the digital modems on an adapter, see *Setting Up Card Properties* on page 5-5.

Declaring Serial Driver Modems in Windows NT

Depending on the applications you use with modems, you might need to use Windows NT to identify (*declare*) Serial driver digital modems to the operating system so the modems can be detected when needed.

To declare Serial driver modems using Windows NT:

1. From to the Windows NT **Start** menu, select **Settings,** and then **Control Panel.**

2. Double-click the **Modems** icon.
   – If no modems are already installed, the Install New Modems dialog box appears.
   – If the Modems Properties dialog box appears, click **Add** to display the Install New Modems dialog box.

3. On the Install New Modems dialog box, click **Next.**

4. Follow the online instructions in the next dialog boxes that appear. The modem manufacturer and model, and the relevant serial port are detected automatically.

   After you have configured your modem, a message informs you that the modem has been set up successfully.

5. Click **Finish** and follow the onscreen instructions to set up the modem(s).

The following illustration shows how the Modems Properties
dialog box appears after you have selected the list of digital
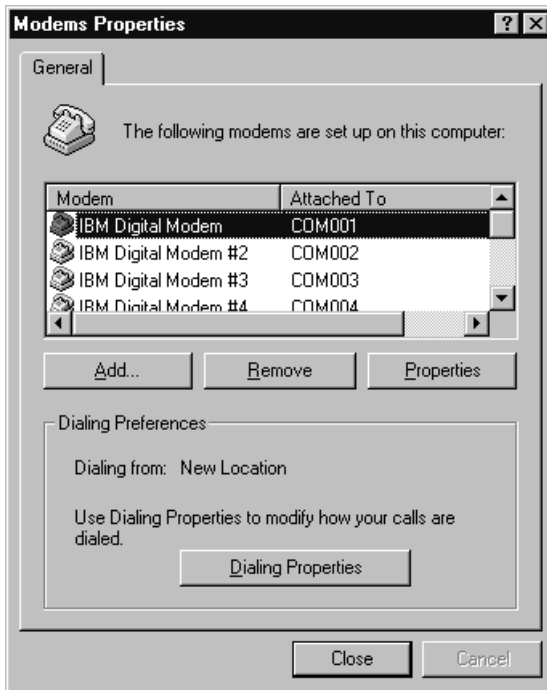modems you have installed and their associated COM ports.

Figure 7-1. List of Modems Installed

Verifying COM Ports

You can use HyperTerminal, provided by Windows NT, to verify
your Serial COM ports for digital modems. HyperTerminal enables
you to ensure that COM ports have been declared and are running
properly. HyperTerminal enables you to emulate various terminals,
such as VT100, TTY and ANSI.

To verify your COM ports:

1. From the Windows NT **Start** menu, select **Control Panel.**
   Then select **Programs, Accessories,** and **HyperTerminal.**

   The HyperTerminal window appears.

Note: HyperTerminal is a standard feature of Windows NT. If it is
not present in the Control Panel, it can easily be installed. To
install HyperTerminal, open the Control Panel. Select **Add-
Remove,** and **Windows NT Setup.** Then select
HyperTerminal in the Communications dialog box.

2. Run HyperTerminal.

   The Connection description dialog box appears.

3. Enter a name you want to use to save the file (the name must
   contain at least one character).

   The Connect To dialog box appears:

Figure 7-2. Choosing the COM Port to Verify

If the list of COM ports is blank, the Serial driver is not
installed.

4. Choose the COM port you want to verify and click **OK.**

The Port Settings dialog box appears.

5. Click **OK** to confirm the parameters. (The parameters are generally correct).

    The HyperTerminal window reappears, with the cursor is in the active mode.

6. Type **at** (lower or upper case) and press **Enter.**

OK appears below the command. The status bar at the bottom of the window indicates that you are connected and displays the duration of the connection, as shown in the following illustration:
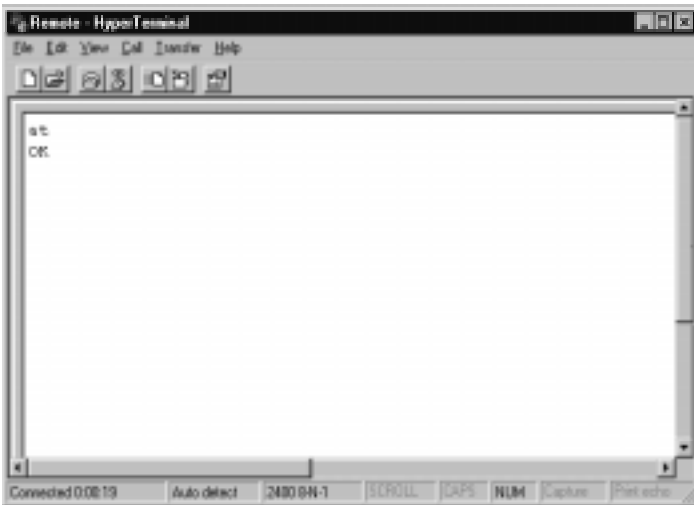

Figure 7-3. Correct Connection Status on HyperTerminal

If the window remains blank, you might be using a COM port that is not assigned to a digital modem. Verify you have selected a COM port connected to a digital modem.

If no connection is indicated in the status bar, verify that you selected a COM port connected to a digital modem.

Check your Windows NT documentation for assistance.

8 Troubleshooting

Overview

This chapter provides possible solutions for common problems you might encounter while installing and operating your adapter. Before proceeding with troubleshooting, make sure you have carefully followed the steps for installing and setting up the hardware and software, and have rebooted the system. Also, check the system log to see what kind of errors, if any, are being recorded.

If the information in this chapter does not resolve the problem, contact IBM Technical Support as instructed in *Help and Service Information* on page H-1.

Interpreting Adapter LEDs

The IBM 4P BRI ST/U adapter provides one set of four LEDs on either end of the adapter faceplate. There are two LEDs for each port, as shown in the following illustration:
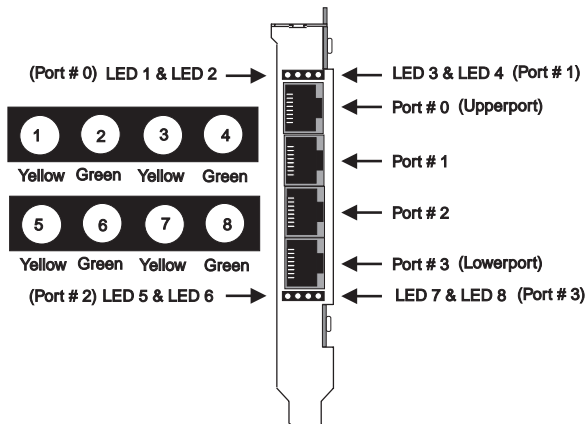

Figure 8-1. Adapter LED Arrangement

The state and function of LEDs is identical for each port, as described in the following table:

LED	Color	Meaning if the light is ON...
1	Orange	ISDN physical layer is active (LED 1, LED 3, LED 5 or LED 7, depending on the port).
2	Green	At least one ISDN B channel is established (LED 2, LED 4, LED 6, or LED 8 depending on the port).

Table 8-1. Adapter LEDS

Problems and Possible Solutions

Problem	Possible Solution(s)
Adapter is not detected during software installation	This problem occurs if the system does not detect the adapter after the setup program copies initial driver files to the installation directory. (The Cards list is empty on the WAN Adapters Setup dialog box.) When a message tells you to add a card: 1. Click **OK.** 2. Install (or reinstall) the adapter, as instructed in *Installing the Hardware* on page 2-1. When the adapter is installed, continue as follows: 1. From the **Start** menu, select **Programs**, then **IBM WAN Adapters,** and then **WAN Setup.** 2. Click **Add** on the WAN Adapters Setup dialog box to add the card to the system. 3. Begin the software installation process again, as instructed in *Installing the Software* on page 4-1.)

Table 8-2. Adapter Problems and Possible Solutions

Problem	Possible Solution(s)
Computer does not boot up *or* Host adapter not found	Your PCI bus automatically configures the hardware resources used by the adapter. Therefore, a resource conflict (address or IRQ) is probably not the problem. To resolve the problem: 1. Check to see whether the adapter is properly seated in the PCI slot. 2. Try a different PCI slot. 3. Contact IBM Technical Service.
LoopTest failed	1. Check the cable connection between the adapter and the ISDN network. 2. Check that the ISDN switch type configured for the adapter matches the switch the adapter is using. 3. Check the phone number. 4. For more detailed information, see *Understanding LoopTest Messages* on page C-6.
ISDN RAS Dial-out failed	The following possible solutions assume a successful LoopTest. (If you do not know how to check the following items, see *Index of Common Tasks* on page E-1.) 1. Check to see whether at least one ISDN RAS port is configured to make outgoing calls. 2. Check that the protocol(s) used by the remote user (IP, IPX/SPX, or NetBEUI) are configured in RAS dial-out protocols. 3. Check your user ID and password. 4. Use SynWatch to see if an ISDN connection problem exists. See *Using the SynWatch Utility on page B-1*. 5. Use SynWatch to see if a PPP negotiation problem exists.

Table 8-2. Adapter Problems and Possible Solutions

Problem	Possible Solution(s)
Digital modem RAS Dial-out failed	The following possible solutions assume a successful LoopTest. (If you do not know how to check the following items, see *Index of Common Tasks* on page E-1.)
	1. Check that the remote called number is equipped with a modem.
	2. Check that the correct speech coding law for digital modem channels is selected in the Digital Modems Properties dialog box. (See *Setting Up Digital Modem Port Properties* on page 5-12.)
	3. Check to see whether at least one digital modem RAS port is configured to make outgoing calls.
	4. Check that the protocol(s) used by the remote user (IP, IPX/SPX, or NetBEUI) are configured in RAS dial-out protocols.
	5. Check your user ID and password.
	6. Use SynWatch to see if an ISDN connection problem exists. See *Using the SynWatch Utility on page B-1*.
	7. Use SynWatch to see if a PPP negotiation problem exists.

Table 8-2. Adapter Problems and Possible Solutions

Problem	Possible Solution(s)
ISDN remote station failed to connect to the RAS Server	If you do not know how to check the following items, see *Index of Common Tasks* on page E-1: 1. Use the **Event Viewer** from Windows NT **Administrative Tools** to see if the Remote Access Service is successfully initialized. 2. Make sure at least one ISDN RAS port is allowed to accept incoming calls. 3. Use **Remote Access Admin** from Windows NT **Administrative Tools** to see if ISDN RAS incoming ports are active. 4. Make sure your system administrator has given the remote user the right to connect. 5. Check that the protocol(s) used by the remote user (IP, IPX/SPX, or NetBEUI) are configured in the RAS server. 6. Use SynWatch to see if an ISDN connection problem exists. See *Using the SynWatch Utility on page B-1*. 7. Use SynWatch to see if a PPP negotiation problem exists. Check the remote user ID and password.

Table 8-2. Adapter Problems and Possible Solutions

Problem	Possible Solution(s)
PSTN remote station failed to connect to the RAS Server	If you do not know how to check the following items, see *Index of Common Tasks* on page E-1:
	1. Check that the remote subscriber is equipped with a modem.
	2. Check that the correct speech-coding law for digital modem channels is selected in the Digital Modem Properties dialog box of the WAN Adapters Setup dialog box. (See *Setting Up Digital Modem Port Properties* on page 5-12.)
	3. Use the **Event Viewer** from Windows NT **Administrative Tools** to see if the Remote Access Service is successfully initialized.
	4. Make sure at least one digital modem RAS port is allowed to accept incoming calls.
	5. Use **Remote Access Admin** from Windows NT **Administrative Tools** to see if incoming digital modem RAS ports are active.
	6. Make sure your system administrator has given the remote user the right to connect.
	7. Check that IBM **Call Manager service** is started. (From the **Start** menu**,** select **Settings, Control Panel,** and then double-click the **Services** icon to display the services status.)
	8. Check that the protocol(s) used by the remote user (IP, IPX/SPX, or NetBEUI) are configured in the RAS server.
	9. Use SynWatch to see if an ISDN connection problem exists. See *Using the SynWatch Utility on page B-1*.
	10. Use SynWatch to see if a PPP negotiation problem exists. Check the remote user ID and password.
Multilink is not enabled in the RAS phonebook entry properties	Select the **Enable Multilink** option in the RAS **Network** Configuration. (See *Index of Common Tasks* on page E-1.)

Table 8-2. Adapter Problems and Possible Solutions

Problem	Possible Solution(s)
Multilink connection does not connect all ISDN channels required	1. Make sure that your ISDN subscription and the remote ISDN subscription offer as many B channels as the multilink requires. 2. Make sure that the number of free ISDN channels is sufficient for this multilink call. (Check both sides of the connection.)
RAS initialization failed in the driver-event log	Look up the failure cause in your Microsoft RAS documentation.
***No valid configuration* message in SynWatch configuration panel**	1. Check whether the adapter and the associated drivers are installed correctly. (See *Index of Common Tasks* on page E-1.) 2. In the **WAN Adapter Setup** utility, check that the ISDN Layer is present in the adapter microcode.

Table 8-2. Adapter Problems and Possible Solutions

A Digital Modem Monitor Utility

Overview

The Digital Modem Monitor Utility, or *DM Monitor* utility, enables you to monitor and control the connections your IBM 4P BRI ST/U adapter processes. This chapter explains how to do the following Digital Modem Monitor tasks:

- Start the Digital Modem Monitor
- Set up utility options
- Display connection properties

Starting the Digital Modem Monitor

To run the DM Monitor utility, from the **Start** menu, select **Programs,** then **IBM WAN Adapters,** and then **Digital Modem Monitor.**

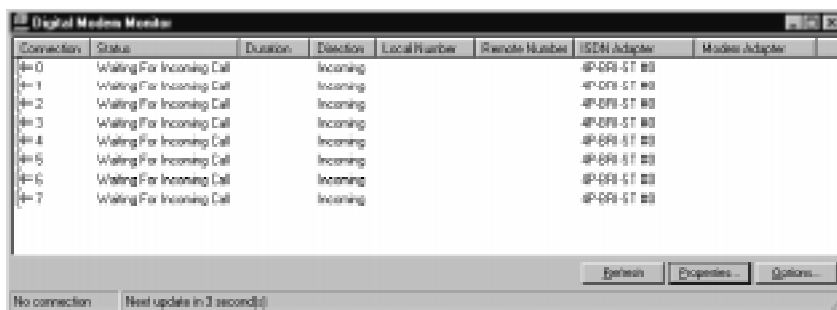The Digital Modem Monitor dialog box appears:

Figure A-1. Digital Modem Monitor Dialog Box

Viewing Digital Modem Monitor Information

The columns in the Digital Modem Monitor dialog box show the status and properties of the adapter's active connections. You can maximize the dialog box to view as much information as possible. You can also resize the columns by dragging the sliders between the columns.

Note: You can use the system menu (located in the top left-hand corner of the dialog box) to display online Help information.

You can sort connection information in ascending or descending order, according to column heading. Clicking a column heading toggles the sort order. In addition, you can select the columns you want to view and hide the others, using the **Display** tab of the Options dialog box. (See *Display Options* on page A-3.)

The status bar at the bottom of the dialog box displays the index number of the current connection and the next connection update.
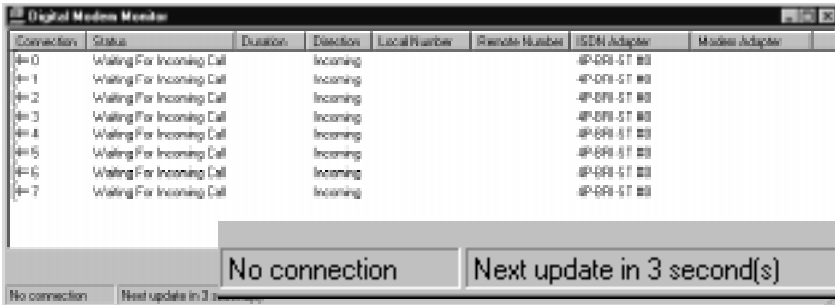

Figure A-2. Digital Modem Monitor Status Bar

Setting Up Digital Modem Monitor Options

Clicking the **Options** button on the Digital Modem Monitor dialog box enables you to set up display and timer options for the Digital Modem Monitor utility.

Display Options

Use the Display dialog box to select columns to be displayed on the Digital Modem Monitor dialog box.
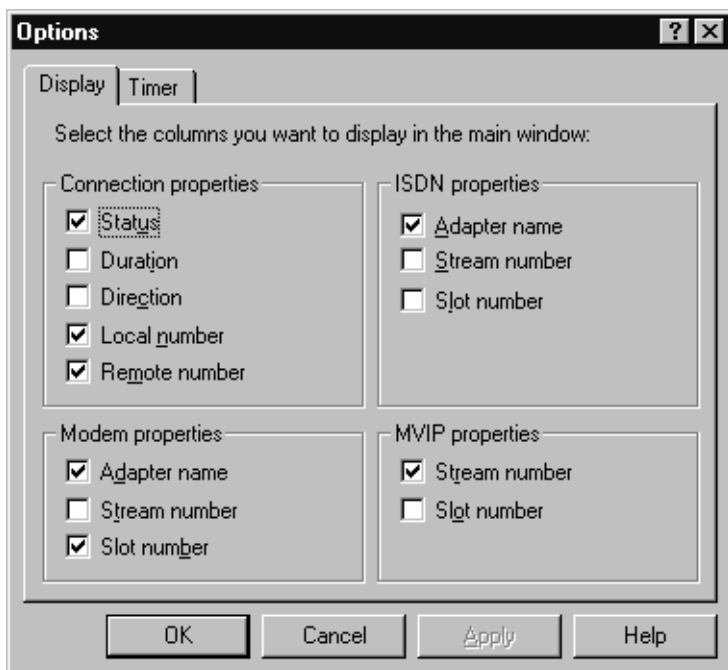

Figure A-3. Display Dialog Box

This dialog box contains four sets of properties associated with digital modem connections. Each set of properties is displayed as a column in the main Digital Modem Monitor dialog.

You can select to display the following connection information:

- Connection status
- Duration of the call
- Direction of the call
- Local number
- Remote number of the connection

- ISDN adapter used
- ISDN adapter stream number
- ISDN adapter slot number
- IBM 4P BRI adapter used by the connection
- Stream number used by the digital modem
- Slot number used by the digital modem
- MVIP stream number used
- MVIP slot number used

To select columns to be displayed, select or clear the appropriate check boxes. Then click **OK** to confirm your selections (or click **Apply** to preview the changes without closing the dialog box). Your selection is saved in the Windows NT registry as soon as you exit the program.

Timer Options

The **Timer** dialog box enables you to change the polling period, expressed in seconds. The polling period controls how often the screen information is updated. (The default value is 5 seconds.) This period must be a numeric value ranging from 1 to 3600 seconds.
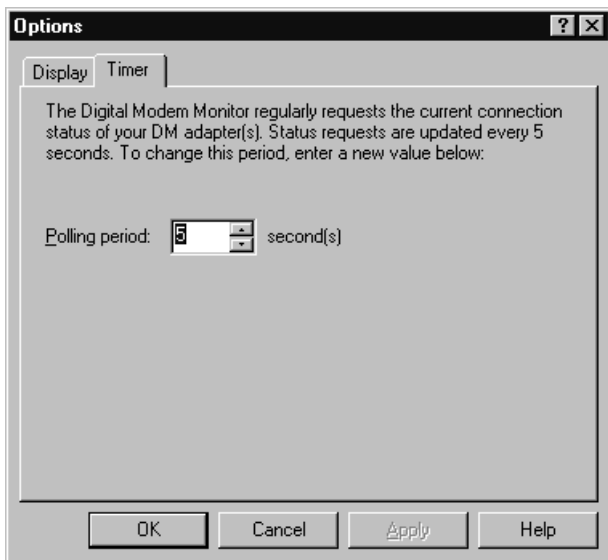
Figure A-4. Timer Dialog Box

To change the polling period value, either select a value using the up or down arrows in the Polling period field, or type in a new value.

Note: The numeric value that appears in the text *Status requests are updated every X seconds* is obtained from the current polling period used by the program. The polling period you select is taken into account as soon as you click **OK** (or **Apply**). It is saved in the Windows NT registry when you exit the program. The columns are refreshed accordingly.

Note: The **Refresh** button in the Digital Modem Monitor dialog box enables you to update the connection status without having to wait the duration specified in the Polling period field.

Displaying Connection Properties

You can view and select connection properties in the following ways:

- Select a connection and click the **Properties** button in the Digital Modem Monitor dialog box.

- Double-click on a connection line in the Digital Modem Monitor dialog box.

The properties of the selected connection appear in a message box. In the following example, connection 0 was selected.

Figure A-5. Example of Connection Properties

This message box appears for display purposes only; you cannot modify any of the properties.

Displayed information is refreshed while it is on the screen.

B Using the SynWatch Utility

Overview

The SynWatch utility is a protocol analyzer that enables you to watch frames exchanged between the adapter and the ISDN network. This powerful utility helps you track communication establishment on the ISDN D channel and data traffic on ISDN B channels. Each ISDN channel has a stand-alone configuration, and can be selected or deselected.

SynWatch provides diagnostics for ISDN connection failures. It helps you detect PPP connection failures (for example, PPP negotiation using Remote Access Service).

SynWatch interprets exchanged frames according to several protocols. (Remote Access Service uses the PPP protocol.) It displays these frames according to the appropriate protocol.

This appendix explains how to do the following SynWatch tasks:

- Access online help
- Start the utility
- Use mouse buttons to select SynWatch functions
- Watch ISDN channels
- Stop and freeze the display
- Change the watch mode
- Edit ISDN channel settings
- Save and edit frames.

Accessing Online Help

For detailed information about the functions described in this appendix, see the SynWatch online help. You can access online help in the following ways:

- Use the menu command **Help** to display the main online help.
- Press **F1** to display contextual help in a pop-up window.

Starting SynWatch

To start SynWatch, from the **Start** menu, select **Programs**, then **IBM WAN Adapters**, and then **SynWatch**. The main SynWatch dialog box appears:
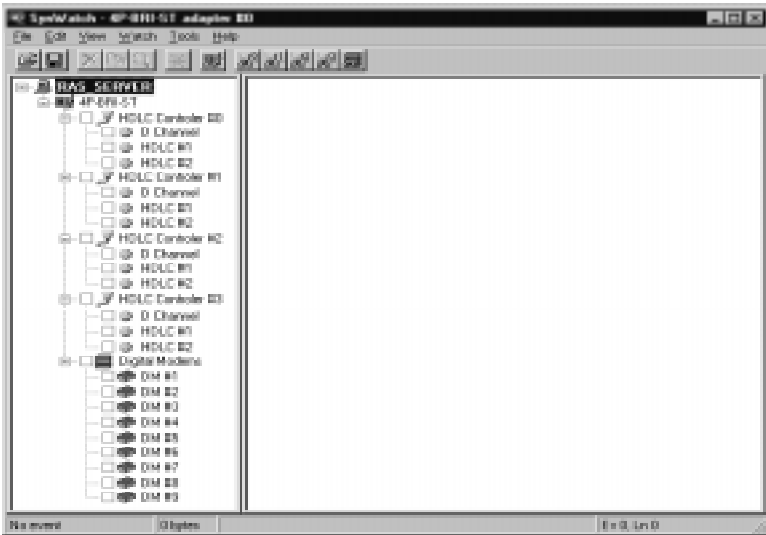

Figure B-1. Main SynWatch Dialog Box

The main SynWatch dialog box contains two sections:

- The left side is the *configuration panel.* It displays the adapter description. The configuration panel is used to activate or deactivate frame watching.
- The right side is the *monitor panel.* It displays exchanged frames.

The configuration panel displays the adapter description in a tree view with the following levels:

- **First level**: Name of the computer
- **Second level**: Adapter
- **Third level**: BRI and digital modem ports available on the adapter
- **Fourth level**: Channels available on a port

  Each BRI port has one ISDN D channel and 2 ISDN B channels. The digital modem port has as many channels as there are digital modems configured on the adapter.

Mouse Button Functions

SynWatch manages configuration panel mouse clicks as follows,
depending on whether the ISDN channel is selected or deselected.

Mouse Position	Function
	Left-click the check box beside the channel to activate or deactivate frame watching for that channel. To select or deselect all of a port's *channels*, left-click the check box beside the *port*. To select or deselect all of an adapter's *ports*, left-click the check box beside the *adapter*. When you choose to activate frame watching, a list of watch modes appears. After you select a mode, frame watching begins for the selected channel(s). For more information about watch modes, see the following sections.
	Right-click to change the watch mode of a currently selected channel. If a channel is not selected, right-clicking has the same effect as left-clicking.

Table B-1. SynWatch Mouse Buttons

Watching ISDN Channels

SynWatch provides options for watching one or all ISDN channels.

Watching the ISDN D Channel

The ISDN D channel is generally used to transmit signalling frames
such as call in progress, incoming call, or call accepted. Watching
this channel gives you diagnostic information about the ISDN
connection phase. For example, if a RAS connection fails (during
either dial-in or dial-out), the first channel to watch is the ISDN D
channel.

To activate watching on an ISDN D channel:

1. Select the channel in the configuration panel of the SynWatch dialog box.

   A list of watch modes appears:

Figure B-2. ISDN D Channel Watch Modes

2. To activate frame logging, select one of the watch modes:
   – Select **LAPD** to see detailed descriptions of signalling frames.
   – Select **LAPD (reduced)** to see brief descriptions of signalling frames.
   – Select **Raw data** to see a Hexadecimal dump of signalling frames. (In Raw data mode, frames are not analyzed).

Watching ISDN B Channels

Note: Before establishing a call, you cannot know which ISDN B channel will be used. Therefore, to capture complete call data, you must activate traces for all ISDN B channels.

ISDN B channels are used to transmit data frames after an ISDN connection is established. The first few data frames exchanged between local and remote sites correspond to a second connection phase to allow the establishment of the upper layer (for example, the PPP protocol).

1. To activate watching on *one* ISDN B channel, select that channel in the configuration panel of the SynWatch dialog box.

To activate watching on *all* ISDN channels, select the BRI port related to the adapter (Port #0 to Port #4) in the configuration panel of the SynWatch dialog box.
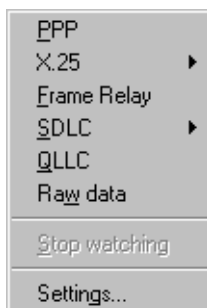
A list of watch modes appears:

Figure B-3. ISDN B Channel Watch Modes

2. To activate frame logging for the selected channel or port, select one of the watch modes (RAS uses the PPP Protocol):

   – PPP

   – X25

   – Frame Relay

   – SDLC

   – QLLC

   – Raw data

For detailed information about each watch mode, see SynWatch online help.

Stopping and Freezing the Display

To stop watching channels and discard frame information, do the following:

To stop watching…	Deselect this…
A channel	The channel in the configuration panel
All of a port's channels	The Port in the configuration panel
All of an adapter's ports	The adapter in the configuration panel

Table B-2. Stopping SynWatch Display

When you stop watching channels by deselecting the channel, port, or adapter, SynWatch discards all frame information for the affected channel(s).

To read the display more easily, you can also interrupt channel watching and freeze the frame information display in the monitor panel.

- To freeze the display, from the **Watch** menu, select **Freeze.**
- To resume the display at the point where it stopped, deselect **Freeze** from the **Watch** menu.

Changing the Watch Mode

SynWatch can reinterpret all frames displayed in the monitor panel into another protocol. Changing the watch mode enables SynWatch to reinterpret the frame protocol.

An example of when it is useful to change the watch mode is if the ISDN D channel is in *LAPD (reduced)* mode when an ISDN connection fails. **LAPD (reduced)** displays only an ISDN disconnection. Changing to **LAPD** mode displays more details about the cause of the disconnection (for example, *user busy* or *user not responding*).

Changing the watch mode is also useful if you are watching an ISDN frame in Raw Data mode while PPP frames are being exchanged. Reinterpreting associated information in **PPP Protocol** mode makes this information more meaningful and easier to read.

If you want SynWatch to reinterpret an ISDN channel's frame information, right-click on a channel, and change the watch mode as needed.

Editing ISDN Channel Settings

The monitor panel displays information about each exchanged frame listed in text lines in the monitor panel. You can define a different text color for each ISDN channel. You can also define a different font style for all the displayed text.

To change the color or font style settings:

1. In the configuration panel, right-click the ISDN channel whose display settings you want to change, and then select **Settings** from the menu.

2. When the SynWatch dialog box appears, select the **Colors** tab to display the Colors dialog box:
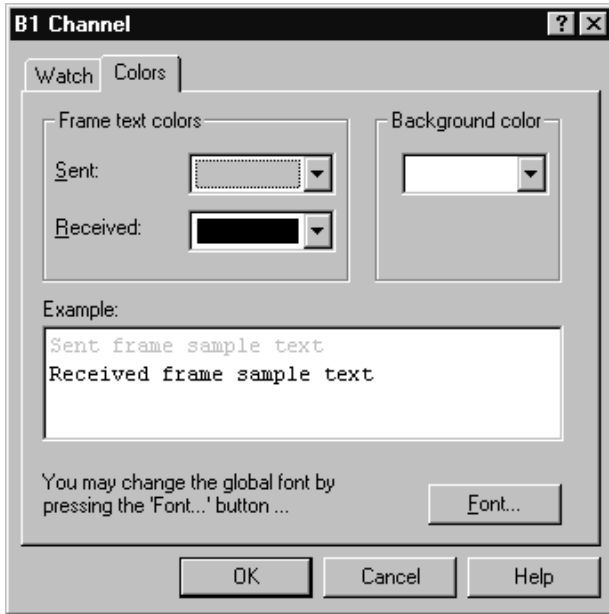
Figure B-4. ISDN Channel Settings

3. Choose the color(s) you want to use for this channel, and click
    OK.

4. To change the font for all display text, click the **Font** button,
    and select the font style you want to use.

SynWatch updates the monitor panel with your new settings
immediately.

Saving and Editing Frames

You can use the SynWatch **Save** option to save all frame information recorded in the monitor panel as an ASCII (text) or binary file.

You can read a text file using any text editor, but SynWatch cannot read or reinterpret the text file. SynWatch can read or reinterpret a binary file.

C LoopTest Utility

Overview

The LoopTest utility enables you to check your ISDN line quickly and easily. It checks for electrical, hardware connectivity, and ISDN compatibility problems.

This appendix explains how to do the following LoopTest tasks:

- Access online help
- Test your ISDN line
- Display and save events
- Specify the number of frames to send
- Understand LoopTest error messages

Accessing Online Help

For detailed information about the functions described in this appendix, see the LoopTest online help. You can access online help in the following ways:

- Use the **Help** menu command to display the main online help.
- Press **F1** to display contextual help in a pop-up window.

Testing Your ISDN Line

LoopTest tests the adapter's ISDN line by establishing 2 ISDN B channels in a loopback connection. One channel is set up to accept incoming calls, and the other channel calls the first channel. When the connection is established, the calling channel sends data, which is checked when it arrives at the receiving channel. At the end of the test, LoopTest stops the communication. If an error occurs during testing, LoopTest displays a warning and stops the communication at that point.

To check your ISDN line, do the following:

1. Before executing the LoopTest, *and to avoid incoming call conflicts*, disable the RAS Server, as follows:

   a. From the **Start** menu, select **Settings,** and then **Control Panel.** Then double-click the **Services** icon to display the Services dialog box.

   b. Select **Remote Access Server** from the list of services, and click **Stop.**

      After you stop the RAS Server, a pop-up message informs you that the Virtual Motion RAS Port Manager will also be stopped.

   c. Click **OK.**

      A message informs you that RAS is being stopped.

   When the Services dialog box reappears, click **Close.**

2. From the **Start** menu, select **Programs,** then **IBM WAN Adapters,** and then **LoopTest.**

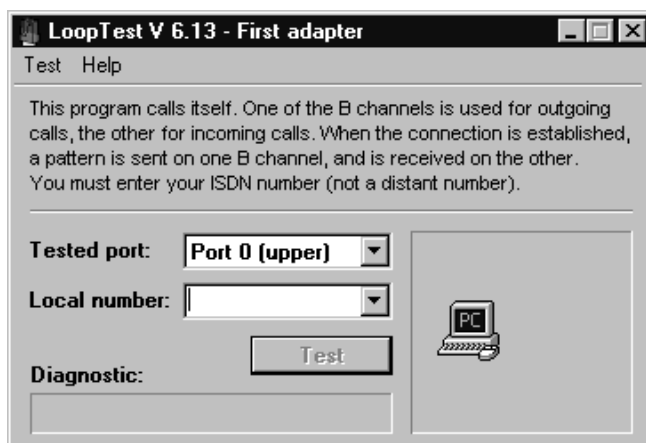The LoopTest dialog appears:

Figure C-1. LoopTest Main Dialog

3. Select the port to test from the drop-down list, and enter your local ISDN number.

4. Click **Test.**

   The Diagnostic field describes the test result. If the message *Test Passed* appears, your ISDN line is working and RAS dial-in or dial-out can be done.

   If an error occurred, LoopTest displays information in the Diagnostic field about the cause and circumstances of the error. For more detailed information about these messages, see *Understanding LoopTest Messages* on page C-6.

   If you want to view additional information about communication events, select **Display event list** from the **Test** menu.

Note: If you want to test more than two B channels or more than one port simultaneously, launch several instances of the utility and repeat steps **3** and **4** for each channel or port. (You can change the number of frames sent if you want a longer test. See *Specifying the Number of Frames to Send* on page C-4.)

5. After you have finished testing the ISDN line, re-enable the RAS Server and the Virtual Motion RAS Port Manager as follows:

   a. From the **Start** menu, select **Settings,** and then **Control Panel.** Then double-click the **Services** icon to display the Services dialog box.

   b. Select **Remote Access Server** from the list of services, and click **Start.**

   c. Select **Virtual Motion RAS Port Manager** from the list of services, and click **Start.**

   d. Click **Close.**

Displaying and Saving Events

The event list is an additional window at the bottom of the LoopTest main dialog that displays communication events, such as communication established between the two B channels, and data being sent on one B channel.

To show or hide the LoopTest event list:

1. Access the LoopTest main dialog, as described in *Testing Your ISDN Line* on page C-2.

2. Select **Display event list** from the **Test** menu.

To save the event list to an ASCII (text) file, select **Save** or **Save as** (to save a previously saved file with a different name) from the **Test** menu.

Specifying the Number of Frames to Send

To specify the number of frames you want LoopTest to send during communication, do the following:

1. Access the LoopTest main dialog, as described in *Testing Your ISDN Line* on page C-2.

2. Select the **Parameters** option from the **Test** menu to display the Test parameters dialog.
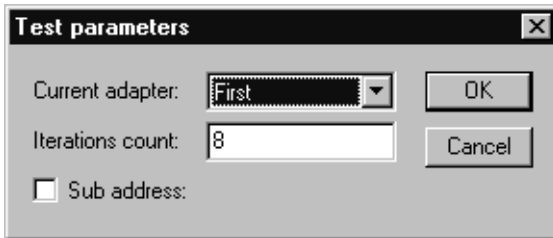

Figure C-2. LoopTest Parameters

3. Enter the number of frames in the **Iterations count** field. The higher the iterations count, the longer the test duration.

Note: You can specify a sub-address to avoid incoming call conflicts when several ISDN adapters are connected (for example, P05).

Understanding LoopTest Messages

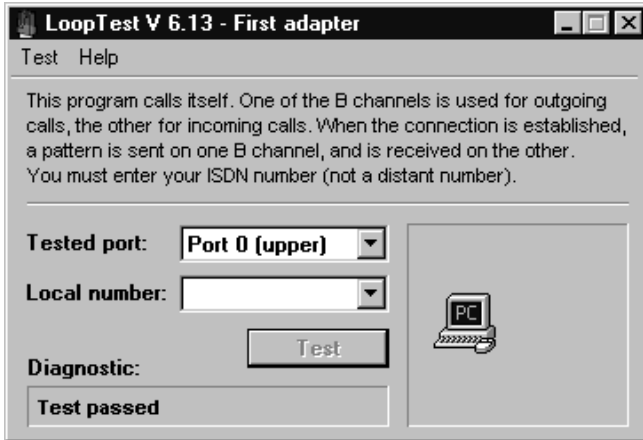The Diagnostic field in the main LoopTest dialog displays LoopTest test results:

Figure C-3. LoopTest Test Results

The following table describes diagnostic messages:

Message	Cause
Test passed	LoopTest detected no errors during testing.
Card missing or non-ISDN	An error occurred before accessing the network. Possible causes are: • The adapter is not installed. • The drivers are not properly installed. • LoopTest could not find an ISDN port on the adapter. To check for ISDN ports: a. From the **Start** menu, select **Programs,** then **IBM WAN Adapters,** and then **WAN Setup.** b. Make sure the firmware contains the ISDN layer.

Table C-1. LoopTest Diagnostic Messages

Message	Cause
Driver Not Loaded	The adapter driver was not in a working state when LoopTest was launched. Possible causes are: • The adapter is not installed. • The driver is not installed, or is improperly installed. • The firmware is invalid (ISDN layer not present) or not loaded. To check the firmware status: 　a. From the **Start** menu, select **Programs,** then **IBM WAN Adapters,** and then **WAN Setup.** 　b. See if the microcode is loaded (colored lights must be green), and check its characteristics (ISDN layers must appear).
Driver access denied	This error occurs in the following situations: • You are executing more than the maximum 15 instances of LoopTest. • The driver is not installed, or is improperly installed.
Connection failed	The connection cannot be established, and the ISDN network has not supplied a reason. This error generally occurs when the dialing number is wrong.
ERROR: Connection cut off	The connection was cut off during data exchange with no notification from or to the network. This error generally occurs when the ISDN cable is removed during testing.
Test failed	The connection between the two ISDN B channels could not be established before time-out because another application answered the call. The Remote Access Server was probably running when the test started. To restart the test: 1. From the **Start** menu, select **Programs**, then **Administrative Tools (Common),** and then **Remote Access Admin.** 2. From the **Server** menu, select **Stop Remote Access Service.** 3. Launch LoopTest again as described in *Testing Your ISDN Line* on page C-2.

Table C-1. LoopTest Diagnostic Messages

Message	Cause
ERROR: The pattern does not arrive on the other end *OR* **ERROR: A bad pattern has been received: frame \<number\>**	When the connection is established, the test sends a pattern on one B channel, and should receive it on the other B channel. This message occurs when the pattern is lost or invalid. Possible causes are: • The test application might be connected to another application. • The ISDN number might be wrong. • An incoming call from another application arrived and was answered by LoopTest. • The line or the network is defective.
Test aborted	This message is displayed with an ISDN standard clearing cause. The corrective actions depend on the displayed cause. (For example, check your ISDN number if *No user response* or *Incomplete Address* messages appear).
Other messages	You canceled the test in progress by clicking **Stop**.

Table C-1. LoopTest Diagnostic Messages

D RAS Utilities

Overview

To improve Microsoft Remote Access Service features, several RAS utilities have appeared on the market. This appendix provides a general description of the following popular RAS utilities:

- RAS Manager
- RasTracker
- Routing and Remote Access Service (RRAS)

RAS Manager

RAS Manager, from NTP Software, is a client/server application that provides full-time control, real-time monitoring, and session-by-session accounting for RAS connections on a user-by-user basis. RAS Manager enables you to:

- Establish and automatically enforce a RAS management policy
- Generate RAS use information for your corporate charge back system
- Allow or deny RAS access to users
- Control the length of RAS sessions
- Limit RAS access to specific servers
- Specify network peak- and off-hour time limits
- Create custom time-remaining online messages

For more information about RAS Manager, see the web site:
www.ntstorage.com

RasTracker

RasTracker, from Northern Technologies, is a client/server application that works in real-time to provide you a constantly accurate view of the use of resources. RasTracker logs all actions so that you can monitor which ports are used, when, by which accounts. RASTracker enables you to:

- Identify which users can connect to which ports
- Specify times during which a user is allowed access
- Set a maximum connection time for per connection for a user
- Set a maximum total time for all of a user's connections

For more information about RasTracker, see Windows NT products at the web site: www.optimus.co.uk

Routing and Remote Access Service

Routing and Remote Access Service (RRAS), from Microsoft Corporation, provides advanced routing and internetworking capabilities. Routing and Remote Access Service features include:

- A unified service for routing and remote access that's integrated with the operating system
- A full set of routing protocols for IP and IPX (including OSPF by Bay Networks)
- A graphical user interface and command line interface
- APIs for third party routing protocols, user interface, and management
- Demand-dial routing
- PPTP server-to-server for secure Virtual Private Networks
- RADIUS client support

For more information about RRAS, see the web site:
www.microsoft.com

E Quick Reference of Common Tasks

Overview

This section explains how to complete common tasks associated with the IBM 4P BRI ST/U adapter. For more detailed information about RAS tasks, see your RAS documentation.

Index of Common Tasks

For information about how to…	See page...
Determine which version of Windows NT Service Pack is installed	E-2
Determine the server name needed to start the Remote Access Server	E-2
Know which adapter's port is used when calling with an ISDN RAS port	E-3
See if the drivers are running	E-4
Open the Remote Access Setup dialog box	E-5
Bind a protocol to an ISDN or digital modem RAS Port	E-5
Configure a RAS port to accept incoming calls	E-5
Configure a RAS port to dial out	E-6
Manage incoming RAS ports	E-6
Determine how many remote users are connected	E-6
Determine how many ports are available	E-6
Make an outgoing RAS call	E-6

Table E-1. Index of Common Tasks

For information about how to…	See page...
Configure a multilink connection	E-7
Enable IPX routing	E-7
Enable IP routing	E-8
Allow a remote user to set a specific IP address	E-8
Supply an IP address from a static address pool to a remote user	E-9
Disconnect an ISDN port automatically when no data traffic occurs after a specified length of time	E-10
Disconnect a digital modem port automatically when no data traffic occurs after a specified length of time	E-10

Table E-1. Index of Common Tasks

Procedures

If you want to...	Do this...
Determine which version of the Windows NT Service Pack is installed	1. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **Windows NT Diagnostics.** 2. Select the **Version** tab. The Service Pack currently installed is displayed just after the Windows NT version.
Determine the server name needed to start the RAS Server	1. From the **Start** menu, select **Settings,** and then **Control Panel.** 2. Double-click the **Network** icon, and select the **Identification** tab. The displayed computer name is the server name needed by the RAS Server.

Table E-2. Common Procedures

If you want to...	Do this...
Know which adapter's port is used when calling with an ISDN RAS port	Note the following (assuming that the 4P BRI ST/U is the only ISDN RAS-capable device): • Port #0 is used to call from ISDN 1 to 2. • Port #1 is used to call from ISDN 3 to 4. • Port #3 is used to call from ISDN 5 to 6. • Port #4 is used to call from ISDN 7 to 8.

Table E-2. Common Procedures

If you want to...	Do this...
See if the drivers are running	1. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and **Event Viewer.** The following messages must appear: – *SynSV6 The Device \Device\SynSV6 has been successfully created. Its symbolic link name is \DosDevices\SynSV6.* – *SynSYS Adapter SynCard0 Opened.* – *SynSYS SynSys Driver Loaded.* 2. From the **Start** menu, select **Settings,** and then **Control Panel.** 3. Double-click the **Devices** icon. The following devices must appear in the Devices list with a status of *Started*: *Figure E-1. Devices List* – IBM Base Driver – IBM Base Driver API – IBM Digital Modem RAS support – IBM ISDN RAS support – IBM Serial Driver In addition, the software LEDs must be green in the WAN Adapters Setup dialog box and the RAS Support General dialog box.

Table E-2. Common Procedures

If you want to...	Do this...
Open Remote Access Setup dialog box	1. From the **Start** menu, select **Settings,** and then **Control Panel.** 2. Double-click the **Network** icon, and select the **Services** tab to display the Services dialog box: 3. From the Network Services list, select **Remote Access Service,** and then click **Properties.** *Figure E-2. Remote Access Setup*
Bind a protocol to an ISDN or digital modem RAS Port	1. Open the **Remote Access Setup** dialog box. (See *Open Remote Access Setup dialog box* on page E-5.) Then click **Network.** NetBEUI, IPX/SPX, and TCP/IP protocols are available. RAS allows you to configure them differently depending on the connection type: dial-in or dial-out. 2. Select the protocol(s) you want to bind to the adapter. **NOTE:** The more protocols you bind, the more memory RAS uses.
Configure a RAS port to accept incoming calls	1. Open the **Remote Access Setup** dialog box. (See *Open Remote Access Setup dialog box* on page E-5.) Then click **Configure.** 2. Enable either the **Receive calls only** or the **Dial out and Receive calls** option. 3. Confirm your choice by clicking **OK.**

Table E-2. Common Procedures

If you want to...	Do this...
Configure a RAS port to dial out	1. Open the **Remote Access Setup** dialog box. (See *Open Remote Access Setup dialog box* on page E-5.) Then click **Configure.** 2. Enable either the **Dial out only** or the **Dial out and Receive calls** option. 3. Confirm your choice by clicking **OK.**
Manage RAS incoming ports	1. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **Remote Access Admin.** 2. View online help for instructions.
Determine how many remote users are connected	1. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **Remote Access Admin.** 2. View online help for instructions.
Determine how many ports are available	1. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **Remote Access Admin.** 2. View online help for instructions.
Make a RAS outgoing call	1. From the **Start** menu, select **Programs,** then **Accessories,** and then **Dial-Up Networking.** 2. Create a new RAS phonebook entry if the phonebook is empty. (For more detailed information, see the RAS online help.) 3. Select an entry in the phonebook, and click the **Dial** button.

Table E-2. Common Procedures

If you want to...	Do this...

Configure a multilink connection	The Multilink PPP protocol aggregates several ISDN B channels to increase the bandwidth of PPP links. To enable this option, do the following:
	
	1. *In the Network configuration:*
	
	   a. From the **Start** menu, select **Settings,** and then **Control Panel.**
	
	   b. Double-click the **Network** icon, and select the **Services** tab to display the Services dialog box.
	
	   c. From the Network Services list, select **Remote Access Service,** and then click **Properties.**
	
	   d. In the Remote Access Setup dialog box, click **Network** to display the Network Configuration dialog box.
	
	   e. Select the **Enable Multilink** option.
	
	   f. Save these settings and restart your computer.
	
	2. *In the Phonebook entry:*
	
	During phonebook entry creation, select the **Multiple Lines** option.

Enable IPX routing	The **RIP for NWLink IPX Service** must be installed in the Windows NT Network Services list. 1. From the **Start** menu, select **Settings,** and then **Control Panel.** 2. Double-click the **Network** icon, and select the **Protocol** tab. 3. From the protocols list, select **NWLink IPX/SPX Compatible Transport,** and then click **Properties.** 4. Select the **Routing** tab, and enable the **Enable RIP Routing** option. **NOTE:** IPX routing is activated only if different IPX internal network numbers are assigned between the two network adapters. For more detailed information, see the Microsoft networking online help.

Table E-2. Common Procedures

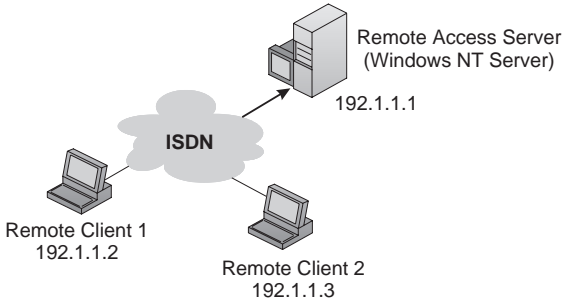| If you want to...	Do this...
Enable IP routing	1. From the **Start** menu, select **Settings,** and then **Control Panel.** 2. Double-click the **Network** icon, and select the **Protocol** tab. 3. From the protocols list, select **TCP/IP Protocol,** and then click **Properties.** 4. Select the **Routing** tab, and enable the **Enable IP Forwarding** option.
Allow a remote user to set a specific IP address	1. From the **Start** menu, select **Settings,** and then **Control Panel.** 2. Double-click the **Network** icon, and select the **Services** tab. 3. From the services list, select **Remote Access Service,** and then click **Properties.** 4. In the **Remote Access Setup** dialog box, click **Network.** 5. In the **Network** dialog box, click the TCP/IP **Configure** button. 6. In the RAS server TCP/IP Configuration dialog box, enable the **Allow remote clients to request a predetermined IP address** option.

Table E-2. Common Procedures

If you want to...	Do this...
Supply an IP address from a static address pool to a remote user	1. From the **Start** menu, select **Settings,** and then **Control Panel.** 2. Double-click the **Network** icon, and select the **Services** tab. 3. From the services list, select **Remote Access Service,** and then click **Properties.** 4. In the **Remote Access Setup** dialog box, click **Network.** 5. In the **Network** dialog box, click the TCP/IP **Configure** button. 6. In the RAS server TCP/IP Configuration dialog box, select the **Use static address pool** option. 7. Enter an IP pool address. Using this method, the first IP address of the pool is assigned to the server. For example, the following figure shows IP addressing with address pool 192.1.1.1 to 192.1.1.30: *Figure E-3. IP Addressing*

Table E-2. Common Procedures

If you want to...	Do this...
Disconnect an ISDN port automatically when no data traffic occurs after a specified length of time	1. From the **Start** menu, select **Settings,** and then **Control Panel.** 2. Double-click the **Network** icon, and select the **Adapters** tab. 3. From the adapter list, select **IBM ISDN RAS support,** and then click **Properties.** 4. On the RAS Support dialog box, enter an idle time-out value in the Idle Timeout field. **NOTE:** This inactivity time-out is assigned to all of the adapter's ISDN channels.
Disconnect a digital modem port automatically when no data traffic occurs after a specified length of time	1. From the **Start** menu, select **Settings,** and then **Control Panel.** 2. Double-click the **Network** icon, and select the **Adapters** tab. 3. From the adapter list, select **IBM Digital Modem RAS support,** and then click **Properties.** 4. In the RAS Support dialog box, enter an idle time-out value in the Idle Timeout field. **NOTE:** This inactivity time-out is assigned to all of the adapter's digital modem channels.

Table E-2. Common Procedures

F ISDN Technology Overview

Overview

Integrated Services Digital Network (ISDN) is an internationally agreed-upon standard for end-to-end digital communications over the public switched network. ISDN includes specifications for signalling, long-distance transmission, bulk subscriber lines, and individual subscriber lines.

Two types of ISDN service are currently available:

- Basic Rate Interface (BRI)
- Primary Rate Interface (PRI)

Both BRI and PRI ISDN services have two types of digital channels: one ISDN D channel and multiple ISDN B channels.

- The ISDN D channel is generally used to transmit signalling and control information such as call-in-progress, incoming-call, or call-accepted information. It transmits information at a rate of 16 Kbps.
- The ISDN B channels transfer data (voice, circuit-switched data, and packet-switched data) at a rate of 56 or 64 Kbps, depending on the local ISDN network.

Basic Rate Interface

The ISDN Basic Rate Interface consists of three digital channels: one D channel and two B channels. These channels can be used simultaneously, and are often referred to as *2B+D*.

Each ISDN B channel can be used separately to allow two different connected users at the same time. The ISDN B channels can also be combined to provide a total bandwidth of 128 Kbps.

Primary Rate Interface

The ISDN Primary Rate Interface, like BRI, has one D channel, but it has more than two B channels. The number of B channels for PRI differs from the United States to Europe.

- In the United States and Japan, PRI consists of 24 digital channels: one D channel and 23 B channels.
- In Europe, PRI consists of 31 digital channels: one D channel and 30 B channels.

These channels can all be used simultaneously, and are often referred to as *23B+D* (for the United States and Japan) or *30B+D* (for Europe).

Each ISDN B channel can be used separately to allow multiple connected users at the same time. The ISDN B channels can also be combined to provide a total bandwidth of 1920 Kbps for Europe, or 1472 Kbps for the United States and Japan.

G Specifications

Adapter Specifications

Item	Specification
Host Bus Interface	PCI Local Bus Revision 2.1
PCI Form Factor	Length: 352 mm Width: 106.7 mm Depth: 17.2 mm
Host Data Transfer	32-bit bus master DMA transfers to 132 MBps
Local Memory	8 MB dual port DRAM
Optional Functions	32-bit, 33-MHz local bus
Operating Power	4 A maximum @ 5.0 VDC

Table G-1. Hardware Specifications

Operating Environment

Temperature	32–131° F / 0–55° C
Relative humidity	10–95% noncondensing
Altitude	0–15,000 feet / 5,000 m

Table G-2. Operating Specifications

Storage Environment

This section assumes the adapter is stored in its original anti-static bag and box.

Temperature	-4–185° F / -20–85° C
Relative humidity	LAN and storage adapters: 10–95% noncondensing WAN adapters: 5–95% noncondensing
Altitude	0–50,000 feet / 0-16,500 m

Table G-3. Storage Environment Specifications

H Help and Service Information

Overview

This appendix provides information on contacting IBM for technical support, warranty information, and FCC and conformity statements.

Preparing to Call IBM Technical Support

Before calling for Technical Support, please prepare for your call by following these steps:

To assist the technical support representative, have available as much of the following information as possible:

- Computer manufacturer and computer model
- Options Part Name and Number
- Serial number (if available)
- Proof of purchase (including date and place)
- Exact wording of the error message (if any)
- Description of the problem
- Hardware and software configuration information for your system

If possible, be at your computer. Your technical support representative might want to walk you through the problem during the call.

Placing a Call to IBM Technical Support

Technical support is available during the warranty period to answer any questions about your new IBM OPTION. Support response time will vary depending on the number and nature of calls received.

Marketing, installation, and configuration support will be withdrawn from the PC Company HelpCenter 90 days after the option has been withdrawn from marketing.

If you call 90 days after the date of withdrawal or after your warranty has expired, you might be charged a fee. Additional support is available through the IBM PC Company automated Fax system, the PC Company Web Page, the PC Company Electronic Bulletin Board System and HelpWare offerings.

- The IBM web site at http://www.pc.ibm.com
- The IBM Fax system at (800) 426-3395 or (919) 517-0011
- The IBM BBS system at (919) 517-0001

For the support telephone and support hours by country, refer to the following table or to an optional enclosed technical support insert. If the number is not provided in the table or insert, contact your IBM reseller or IBM marketing representative.

Support 24 hours a day, 7 days a week	
Canada	1-800-426-7378
United States/Puerto Rico	1-800-426-7378

Product Warranty

The following warranty information applies to products purchased in the United States, Canada, and Puerto Rico. For warranty terms and conditions for products purchased in other countries, see the enclosed Warranty insert, or contact your IBM reseller or IBM marketing representative. International Business Machines Corporation Armonk, New York, 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 your reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them.

Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. If you have any questions, contact IBM or your reseller.

Production Status

Machine is manufactured from new parts, or new and used 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.

IBM Warranty for Machines

IBM warrants that each Machine:

1. Is free from defects in materials and workmanship and

2. Conforms to IBM's Official Published Specifications.

The warranty period for a Machine is a specified, fixed period commencing on its 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, if authorized by IBM, 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.

For IBM or your reseller to provide warranty service for a feature, conversion, or upgrade, IBM or your reseller may require that the Machine on which it is installed be:

1. For certain Machines, the designated, serial-numbered Machine, and

2. At an engineering-change level compatible with the feature, conversion, or upgrade.

Many of these transactions involve the removal of parts and their return to IBM.

You represent that all removed parts are genuine and unaltered. A part that replaces a removed part will assume the warranty service status of the replaced part.

If a Machine does not function as warranted during the warranty period, IBM or your reseller will repair it or replace it with one that is at least functionally equivalent, without charge. The replacement may not be new, but will be in good working order. If IBM or your reseller is unable to repair or replace the Machine, you may return it to your place of purchase and your money will be refunded.

If you transfer a Machine to another user, warranty service is available to that user for the remainder of the warranty period. You should give your proof of purchase and this Statement to that user. However, for Machines which have a life-time warranty, this warranty is not transferable.

Warranty Service

To obtain warranty service for the Machine, you should contact your reseller or call IBM.

In the United States, call IBM at	**1-800-426-7378**
In Canada, call IBM at	**1-800-426-7378**
You may be required to present proof of purchase.	

IBM or your reseller will provide certain types of repair and exchange service, either at your location or at IBM's or your reseller's service center, to restore a Machine to good working order.

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.

You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item. Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service. You also agree to ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange.

You agree to:

1. Obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and

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.

IBM is responsible for loss of, or damage to, your Machine while it is

1. In IBM's possession.

2. In transit in those cases where IBM is responsible for the transportation charges.

Extent of Warranty

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

The warranties may be voided by misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, removal or alteration of Machine or parts identification labels, or failure caused by a product for which IBM is not responsible.

THESE WARRANTIES REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Limitation of Liability

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

1. Damages for bodily injury (including death) and damage to real property and tangible personal property; and

2. The amount of any other actual direct damages or loss, up to the greater of U.S. $100,000 or the charges (if recurring, 12 months' charges apply) 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;

3. SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS OR SAVINGS), EVEN IF IBM OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU.

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Other company, product, and service names, which may be denoted by a double asterisk (**), may be trademarks or service marks of others.

Telecommunication Notices

4P BRI ST

FCC Part 68 Regulatory Compliance

This ISDN adapter complies with Part 68 of the FCC Rules. The card includes a label that contains, among other information, the FCC registration number for this equipment. If requested, this information must be provided to the telephone company.

The FCC Digital Interface Code of this equipment is 02IS5. The FCC Service Order Code is 6.0N.

The USOC jack for this equipment is RJ48X.

An FCC compliant telephone cable and modular plug are provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack, which is Part 68 compliant.

This equipment cannot be used on telephone company-provided coin service. Connection to Party Line Service is subject to state tariffs.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice so you can make necessary modifications to maintain uninterrupted service.

If you experience trouble with this equipment, please contact IBM Corporation for warranty information. If the trouble causes harm to the telephone network, the telephone company may request the removal of the equipment from the network until the problem is resolved.

No repairs may be performed by the customer.

It is recommended that the customer install an AC surge arrester in the AC outlet to which this device is connected. This is to avoid damaging the equipment caused by local lightening strikes and other electrical surges.

Industry Canada CS-03 Notice

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunication company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent deterioration of service in certain situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunction, may give the telecommunication company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric authority, or electrician, as appropriate.

- Standard Connecting Arrangement: CB-1D
- The Ringer Equivalence Number: not applicable.

Notice: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

Regulatory Information for Europe

This equipment displays the CE 165 X or CE mark to show that it has been tested and found to be in full compliance with the requirements of the Terminal Equipment, ISDN Directive (CTR3), EMC and Low Voltage Directives (91/263/EEC, 89/336/EEC and 73/23/EEC, as amended by Directive 93/68/EEC).

4P BRI U

FCC Part 68 Regulatory Compliance

This ISDN adapter complies with Part 68 of the FCC Rules. The card includes a label that contains, among other information, the FCC registration number for this equipment. If requested, this information must be provided to the telephone company.

The FCC Digital Interface Code of this equipment is 02IS5. The FCC Service Order Code is 6.0F.

The USOC jack for this equipment is RJ49C.

An FCC compliant telephone cable and modular plug are provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack, which is Part 68 compliant.

This equipment cannot be used on telephone company-provided coin service. Connection to Party Line Service is subject to state tariffs.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice so you can make necessary modifications to maintain uninterrupted service.

If you experience trouble with this equipment, please contact IBM Corporation for warranty information. If the trouble causes harm to the telephone network, the telephone company may request the removal of the equipment from the network until the problem is resolved.

No repairs may be performed by the customer.

It is recommended that the customer install an AC surge arrester in the AC outlet to which this device is connected. This is to avoid damaging the equipment caused by local lightening strikes and other electrical surges.

Industry Canada CS-03 Notice

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunication company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent deterioration of service in certain situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunction, may give the telecommunication company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric authority, or electrician, as appropriate.

- Standard Connecting Arrangement: CB-1D
- The Ringer Equivalence Number: not applicable.

Notice: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

Regulatory Information for Europe

This equipment displays the CE mark to show that it has been tested and found to be in full compliance with the requirements of the Terminal Equipment, EMC and Low Voltage Directives (91/263/EEC, 89/336/EEC and 73/23/EEC, as amended by Directive 93/68/EEC).

Electronic Emission Notices

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. 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 A Emission Compliance Statement

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

Avis de conformitè à la réglementation d'Industrie Canada

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

Deutsche EMV-Direktive (electromagnetische Verträglichkeit)

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG vom 9.Nov.92 das EG-Konformitätszeichen zu führen.

Der Aussteller der Konformitätserklärung ist die IBM UK, Greenock.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse A. Für diese Klasse von Geräten gilt folgende Bestimmung nach dem EMVG:

Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesministers für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind.

(Auszug aus dem EMVG vom 9.Nov.92, Para.3. Abs.4)

> **Hinweis:** Dieses Genehmigungsverfahren ist von der Deutschen Bundespost noch nicht veröffentlicht worden.

European Union - EMC Directive

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 any 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 A Information Technology Equipment according to CISPR 22 / European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

> **Warning:** This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Union Européenne - Directive Conformité électromagnétique

Ce produit est conforme aux exigences de protection de la Directive 89/336/EEC du Conseil de l'UE sur le rapprochement des lois des États membres en matière de compatibilité électromagnétique.

IBM ne peut accepter aucune responsabilité pour le manquement aux exigences de protection résultant d'une modification non recommandée du produit, y compris l'installation de cartes autres que les cartes IBM.

Ce produit a été testé et il satisfait les conditions de l'équipement informatique de Classe A en vertu de CISPR22 / Standard européen EN 55022. Les conditions pour l'équipement de Classe A ont été définies en fonction d'un contexte d'utilisation commercial et industriel afin de fournir une protection raisonnable contre l'interférence d'appareils de communication autorisés.

> **Avertissement** : Ceci est un produit de Classe A. Dans un contexte résidentiel, ce produit peut causer une interférence radio exigeant que l'utilisateur prenne des mesures adéquates.

Union Eurpea - Normativa EMC

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Glossary

2B+D ◆ See *BRI (Basic Rate Interface)*.

23B+D ◆ See *PRI (Primary Rate Interface)*.

30B+D ◆ See *PRI (Primary Rate Interface)*.

802.2 IEEE ◆ Standards that govern the LLC within the Data Link layer of the OSI model. LLC frames carry user information between the nodes on a network and define the transmission of a frame between two stations. These standards are common across the various lower level standards within the Data Link and the Physical layers.

802.3 IEEE ◆ Standards that govern the use of the CSMA/CD (Carrier Sense Multiple Access/Collision Detection) network access method used by Ethernet networks.

802.5 IEEE ◆ Standards that govern the use of the token ring indicator and frame priority.

Adapter ◆ A device, usually a user interface card, that physically connects an end station to the network medium (for example, twisted pair, coaxial, fiber).

Advanced program-to-program communication ◆ See *APPC*.

AIS (Alarm Indication Signal) ◆ PRI alarm, also known as *Keep Alive* or *Blue* signal.

AMI (Alternate Mark Inversion) ◆ A method of digitally encoding data as electrical signals on a link.

ANSI (American National Standards Institute) ◆ An organization which coordinates, develops, and publishes standards used in the United States.

APPC ◆ Advanced Program-to-Program Communications.The general facility characterizing the LU 6.2 architecture and its various implementations in products. 2. Sometimes used to refer to the LU 6.2 architecture and its product implementations as a whole, or to an LU 6.2 product feature in particular, such as an APPC application programming interface.

Asynchronous transmission ◆ Method of sending data in which the interval between characters may be of unequal length. The characters transmitted include a start bit and one or more stop bits, which define the beginning and ending of the character. No synchronizing or timing signals need to be sent. Contrast with *synchronous transmission*.

AT&T® 5ESS ◆ The name of a central office switch manufactured by AT&T. These switches use Custom (proprietary) or National ISDN-1 (NI-1) software. ESS stands for *Electronic Switching System*.

Attenuation ◆ Signal power lost in a transmission medium as the signal travels from sender to receiver.

B8ZS (Bipolar with 8 Zeros Substitution) ◆ A method of digitally encoding data on a link. A modified form of AMI used in USA.

Backward explicit congestion notification (BECN) ◆ A bit set by a frame relay network to notify an interface device (DTE) that congestion avoidance procedures should be initiated by the sending device.

Bandwidth ◆ Capacity for transmitting data through a given circuit. Generally, the greater the bandwidth, the more information can be sent through a circuit during a given amount of time.

Basic transmission unit (BTU) ◆ In SNA, the unit of data and control information passed between control components. A BTU can consist of one or more patch information units (PIUs).

Bc (committed burst size) ◆ For Frame relay, the maximum amount of data in bits that a network agrees to transfer under normal conditions over a measurement interval (T). Data may or may not be contiguous. Bc is negotiated with the carrier provider.

B channel ◆ A 56 Kbps or 64 Kbps bearer channel. Typically used for delivering data or voice over ISDN.

Be ◆ See *Excess Burst Size*.

BECN ◆ See *backward explicit congestion notification*.

Bearer Service ◆ A type of telecommunications service that provides the capability to transmit a specific type of data such as voice or fax.

Bonding ◆ Bonding is the act of combining two 64Kbps B-channels to derive a 128 Kbps channel. This is done by establishing two B-channel circuit switched calls and combining them in the customer's equipment (using Multilink PPP or the bonding specification) or by associating multiple B-channels in the network (multirate services).

BRI (Basic Rate Interface) ◆ A defined ISDN interface that includes two B channels and one D channel. Also known as 2B+D. B channels are used for voice and data while the D channel is generally used only for signalling within the telephone network.

Broadcast ◆ LAN transmission method used in bus topology networks that sends messages to all stations even though the messages are addressed to specific stations.

BTU ◆ See *basic transmission unit*.

CALC (Customer Access Line Charge) ◆ A Federal tariff charge, also referred to as an End User Common Line Charge (EUCL), or Subscriber Line Charge (SLC). Every ISDN line is charged one CALC or EUCL.

Call bumping ◆ The ability to receive an incoming call during a bonded outbound call.

CCITT (International Telephone and Telegraph Consultative Committee) ◆ See *ITU (International Telecommunication Union)*.

CD (Carrier Detect) ◆ RS-232 (V.24) control signal (on pin 8) that indicates that the local data communications equipment is receiving a signal from the remote DCE. (See *RS-232 u*.) Also called Received Line Signal Detector (RLSD) and Data Carrier Detect (DCD).

Centrex ◆ Local Public Exchange incorporating PBX facilities.

Channel ◆ 1) A path along which signals can be sent, for example data channel, output channel. 2) In data communication, a means of one-way transmission. 3) A function unit, controlled by the processor, that handles the transfer of data between processor storage and local peripheral equipment.

Channel aggregation ◆ Channel aggregation combines multiple physical channels into one logical channel of greater bandwidth. With BRI ISDN connections, channel aggregation would combine the two 64 Kbps B channels into a single, logical 128 Kbps channel.

Circuit-switching ◆ Technique in which physical circuits (as opposed to virtual circuits) are transferred to complete connections. Contrast with packet-switched networks.

Clock ◆ Timing signal used in synchronous transmission.

CO (Central Office) ◆ The site where the local Telco switches reside for the telephone system's call routing and all other functions. This is the Telco side of the local loop. If the distance between your location and the central office switch exceeds 18,000 feet and/or the signal loss exceeds 35.0 dB, a repeater must be installed to allow ISDN service.

Configuration cycle ◆ A type of I/O cycle provided on the PCI bus to facilitate system configuration.

CPE (Customer-Premises Equipment) ◆ All equipment that resides past the telephone service demarcation point. In the U.S. This typically includes the NT1 and all ISDN devices. Customer equipment may also include inside wiring as well as telephone modems, and ISDN equipment.

CRC (Cyclic Redundancy Check) ◆ A bit errors detection technique that employs an algorithm to calculate a value for the information bits in a packet. The receiver, using the same algorithm, recalculates that value and compares it to the value received. If the two values do not agree, the transmitted packet is considered to be in error.

CSD (Circuit Switched Data) ◆ A dial-up data communications channel which, once established, looks like a transparent data pipe. Also, the type of ISDN service required to utilize this capability of an ISDN circuit. In contrast to *CSV*.

CSU/DSU (Channel Service Unit/ Data Service Unit) ◆ A device that incorporates the functions of a CSU and a DSU, and interfaces between a Switched-56 (or Dedicated Digital Service) line and a user's data equipment.

CSV (Circuit Switched Voice) ◆ A dial-up communications circuit for voice grade communication. Also, the type of ISDN service required to use this capability of an ISDN circuit. In contrast to *CSD*.

CTS (Clear To Send) ◆ RS-232 (V.24) interface control signal (sent from the data communications equipment to the data terminal equipment on pin 5) indicating that the attached DTE may begin transmitting. Issued in response to the DTE's request-to-send. (See *RS-232 u*.)

Data link control (DLC) ◆ A set of rules used by nodes on a data link (such as an SDLC link or a token ring) to accomplish an orderly exchange of information.

Data link control identifier (DLCI) ◆ The numeric identifier of a frame-relay subport or PVC segment in a frame-relay network. Each subport in a single frame-relay port has a unique DLCI. The following table, excerpted from the American National Standards Institute (ANSI) Standard T1.618 and the International Telegraph and Telephone Consultative Committee (CCITT) Standard Q.922, indicates the functions associated with certain DLCI values:

DLCI Values	Function
0	In-channel signalling
1-15	Reserved
16-991	Assigned using frame-relay connection procedures
992-1007	Layer 2 management of frame-relay bearer service

DLCI Values	Function
1008-1022	Reserved
1023	In-channel layer management

DCD (Data Carrier Detect) ◆ See *CD (Carrier Detect)*.

DCE (Data Communications Equipment, Data Circuit-terminating Equipment) ◆ Equipment that provides the functions required to establish, maintain, and terminate a connection (including signal conversion) for communications between the data terminal equipment and the telephone line or data circuit. Also, interface signals typically presented by this equipment.

D channel ◆ Standard channel on an ISDN PRI or BRI line. At 16 Kbps, a D channel carries all signalling information and can carry low-speed packet data such as X.25 packet switching.

DE ◆ See *discard eligibility*.

Demarc (demarcation point) ◆ The point on a customer's premises where the line from the telephone company meets the customer's wiring at the customer's premises.

DFT ◆ See *Distributed Function Terminal*.

Directory Number ◆ Your seven-digit telephone number (without the area code), as found in the telephone directory.

Discard eligibility (DE) ◆ A bit indicating that a frame may be discarded in preference to other frames if congestion occurs to maintain the committed information rate. See also *excess burst size (Be)* and *CIR*.

Distributed Function Terminal (DFT) ◆ 1) A protocol used for communication between a terminal and an IBM 3270 or IBM 3174 control unit that allows multiple concurrent logical terminal sessions. 2) A mode of operation that uses this protocol.

DLC ◆ See *data link control*.

DLCI ◆ See *data link control identifier*.

DMA (Direct Memory Access) ◆ A fast method of moving data between two subsystems without processor intervention.

DMS/DMS100 ◆ The name of a central office switch manufactured by Northern Telecom. These switches use Custom (proprietary) or National ISDN-1 (NI-1) software.

DSR, data set ready ◆ RS-232 (V.24) interface control signal, sent from the data communications equipment to the data terminal equipment on pin 6. Indicates that the DCE is connected to the telephone circuit. Usually a prerequisite to the DTE issuing request-to-send. (See *RS-232 u*.)

DSU ◆ See *CSU/DSU (Channel Service Unit/ Data Service Unit)*.

DTE (Data Terminal Equipment) ◆ Equipment serving as the data source, the data sink, or both. Refers to terminals, computer ports, and printers. Also interface signals typically presented by this equipment.

DTR (Data Terminal Ready) ◆ RS-232 (V.24) interface control signal, sent from the data terminal equipment to the data communications equipment on pin 20. Indicates the DTE is ready for data transmission and requesting connection of the DCE to the telephone circuit. (See *RS-232 u*.)

EIR ◆ Excess Information Rate

EIS ◆ The SNA Server Emulator Interface Specification.

Encapsulation ◆ Process by which an interface device places an end device's protocol-specific frames inside a Frame Relay,X.25 or PPP frame to a frame relay network must perform encapsulation.

ETS ◆ European Telecommunications Standard from ETSI

ETSI ◆ The European Telecommunications Standards Institute

EuroISDN ◆ The European implementation of Q.931, providing a common standard for ISDN signalling within Europe. Issued by ETSI under the ETS 300 series standards. Net3(BRI) and Net5(PRI). See *NET (Normes Europeennes de Telecommunication)*.

Excess burst size ◆ (Be) The maximum amount of uncommitted data (in bits) in excess of Bc that a frame relay network can attempt to deliver during a time interval Tc. This data (Be) generally is delivered with a lower probability than Bc. The network treats Be data as discard eligible. See also *committed burst size* (Bc).

Exchange identification (XID) ◆ A specific type of basic link unit that is used to convey node and link characteristics between adjacent nodes. XIDs are exchanged between link stations before and during link activation to establish and negotiate link and node characteristics. They are exchanged after link activation to communicate changes in these characteristics.

FCC (Federal Communication Commission) ◆ The U.S. government agency that regulates the telephone industry.

FECN ◆ See *Forward explicit congestion notification (FECN)*.

Firmware ◆ A computer program or software stored permanently in flash memory, read-only memory (ROM), programmable read-only memory (PROM), or stored semi-permanently in erasable programmable read-only memory (EPROM).

Forward explicit congestion notification (FECN) ◆ A bit set by a frame relay network to notify an interface device (DTE) that congestion avoidance procedures should be initiated by the receiving device. See also *BECN*.

Frame Relay ◆ A wide area networking connection to leased lines, providing multiple permanent virtual circuits or data link connections within the same physical access line.

Gateway ◆ Equipment that provides interconnection between two networks with different communications protocols. Two examples are packet assembler/disassemblers and protocol converters. Gateways operate at the 4th through 7th layers of the Open Systems Interconnection model. Contrast with *bridge*, *router*, *repeater.*

HDB3 (High Density Bipolar 3) ◆ A method of digitally encoding data on a link. A modified form of AMI used in Europe.

HDLC (High-level Data Link Control) ◆ A International standard communications bit oriented protocol developed by the International Standards Organization. HDLC manages synchronous, code transparent, serial information transfer over a link connection.

host name ◆ A unique name that identifies each host machine on a network.

IEC ◆ International Electrotechnical Commission.

IEEE (Institute of Electrical and Electronic Engineers) ◆ An information exchange organization. Among other functions, it coordinates, develops, and publishes network standards for use in the United States, following ANSI rules.

IETF (Internet Engineering Task Force) ◆ Organization responsible for all Internet protocols (for example, IP, TCP, FTP).

IP (Internet Protocol) ◆ A networking protocol for providing a connectionless (datagram) service to the higher transport protocol. It is responsible for discovering and maintaining topology information and for routing packets across homogeneous or heterogeneous networks. Combined with TCP, it is commonly known as the TCP/IP platform.

IPX (Internetwork Packet eXchange Protocol) ◆ A connectionless Network layer protocol similar to IP.

IPX/SPX ◆ Novell's proprietary LAN protocol.

ISDN (Integrated Services Digital Network) ◆ An early, CCITT-adopted protocol reference model intended to provide a ubiquitous, end-to-end, interactive digital service for data, audio, and video. Synonym: *narrowband ISDN*.

ISO (International Standards Organization) ◆ An international body that creates networking standards, including the OSI model.

ITC (Independent Telephone Company) ◆ Any telephone company that was not originally part of AT&T.

ITU (International Telecommunication Union) ◆ The international standards organization for telecommunications, previously known as the CCITT (International Telephone and Telegraph Consultative Committee). For more information, see http://www.itu.ch

KB (Kilobytes) ◆ One kilobyte is equivalent to 1024 bytes when referring to memory size, and 1000 bytes when referring to speed.

Kbps ◆ (Kilobits per second)

KBps ◆ (Kilobytes per second)

LAN (Local Area Network) ◆ A data communications system designed to operate over a limited geographic distance, such as a single building.

LAP-B (Link Access Procedure Balanced) ◆ For Frame relay, the balanced-mode, enhanced version of HDLC. Used in X.25 packet-switching networks. Contrast with *LAP-D*.

LAP-D (Link Access Procedure-D) ◆ For ISDN, Data Link layer procedure using D channel communications. For Frame relay, a protocol that operates at the data link layer (layer 2) of the OSI architecture. LAPD is used to convey information between layer 3 entities across the frame relay network.

LATA (Local Area Transport Area) ◆ The territory covered by an individual local telephone operating company.

LEC (Local Exchange Carrier) ◆ The local phone companies—either a Regional Bell Operating Company (RBOC) or an independent phone company—that provide local transmission services.

LED (Light Emitting Diode) ◆ Semiconductor device used for display purposes in electronic equipment.

LLC (Logical Link Control) ◆ The upper half of the Data Link layer in LANs. Performs error control, broadcasting, multiplexing, and flow control functions. See *MAC (Medium Access Control)*.

Leased Line ◆ Telephone line reserved for the exclusive use of a leasing customer without interexchange switching arrangements. A leased line may be point-to-point or multipoint. Also called *dedicated* or *private* line.

LLC/SNAP ◆ Logical Link Control/SubNetwork Attachment Point

Local ◆ Describes files and devices, such as disk drives, that are attached to your machine.

Logical unit (LU) ◆ A type of network accessible unit that enables users to gain access to network resources and communicate with each other.

Loop Qualification ◆ This is a test done by the phone company to make sure the customer is within the maximum distance of 18,000 feet from the central office that services that customer. Note, however, that ISDN service could be available at a longer distance than that with a repeater.

LOS (Lost Of Signal) ◆ PRI alarm.

LT (Line termination) ◆ The equivalent of the NT1 function at the CO.

LU ◆ See *logical unit*.

MAC (Medium Access Control) ◆ A set of protocols that are the lower part of the Data Link layer and comprise the basis of the IEEE LAN specifications. In general, MAC determines the way devices can transmit in a broadcast network. See *LLC (Logical Link Control)*.

Mbps (Megabits per second) ◆ Transmission speed or rate of one million bits per second.

MBps (Megabytes per second) ◆ Transmission speed or rate of one million bytes per second or 8 Mbps.

Medium ◆ Physical means used to carry transmissions. Examples include coaxial cable, fiber optics, microwave, satellite, or twisted pair.

MIB (Management Information Base) ◆ The specification that defines objects for referencing variables such as integers and strings. In general, it contains information about the network's management and performance (for example, traffic parameters). See *IP (Internet Protocol)*.

Modem (MODdulator-DEModulator) ◆ Device that converts serial digital data from a transmitting terminal to a signal suitable for transmission over a telephone channel (analog), and then reconverts the signal to serial digital data for the receiving terminal.

MTU (Maximum Transmission Unit) ◆ The largest packet that can be sent over a given medium.

Multicast ◆ A technique that allows copies of a single packet or cell to be passed to a set of destinations.

Multi-link PPP ◆ Allows you to combine two or more B-channels into a single, faster PPP connection. With Multi-link PPP, you can have a 128 Kbps PPP connection over a Basic Rate ISDN line.

NDIS ◆ See *Network Driver Interface Specification*.

NET (Normes Europeennes de Telecommunication) ◆ European standards for approving and testing equipment.

Network ◆ An interconnection of multiple stations or systems that are able to send messages to and receive messages from one another.

Network driver interface specification (NDIS) ◆ An application programming interface (API) definition that allows DOS, OS/2, or Windows systems to support one or more network adapters and protocol stacks.

NDIS defines a specific way for writing drivers for layers 1 and 2 of the OSI model. NDIS also handles the configuration and binding of these network drivers to multiple protocol stacks.

NI-1 (National ISDN1) ◆ A specification for a standard ISDN phone line. National ISDN 1 is intended to be a set of standards to which every manufacturer's equipment should conform for maximum interoperability. NI-2 and NI-3 are future standards currently under development.

NRZI (Non Return to Zero Inverted) ◆ Encoding technique in which a change in state represents 0. Also known as invert-on-zero coding.

NSAP (Network Services Access Point) ◆ In the OSI environment, it is the SAP between the network and the transport layers. It identifies a Data Terminal Equipment by a unique address.

NT1 (Network Termination 1) ◆ The device that connects to your ISDN hardware and also works as a converter between an ISDN U-interface and an ISDN S/T-Interface. An NT1 converts a line from a 2-wire to a 4-wire connection. Some ISDN adapters have a NT1 already built into them.

NT2 (Network Termination 2) ◆ An NT2 handles termination for multiple B channels on a PRI line. NT2s are typically found embedded into PBXs or switches on network servers which support Primary Rate Interface (PRI).

OSI (Open Systems Interconnection) Model ◆ The 7-layer protocol model defined by the ISO for data communications.

PABX ◆ Private Automatic Branch eXchange.

PBX (Private Branch eXchange) ◆ PBX is a private telephone switch. It is connected to groups of lines from one or more central offices and to all of the telephones at the location served by the PBX.

PCI (Peripheral Component Interconnect) ◆ Bus A high-performance multiplexed address and data bus. Supporting 32-bit with optional 64-bit data transfers, the PCI bus is intended to be an interconnect between peripheral controllers, peripheral add-in boards, and processor/memory systems. The PCI bus operates at up to 66 MHz, providing burst transfer rates up to 264 MBps 32 bits wide, or up to 528 MBps 64 bits wide.

PDU (Protocol Data Unit) ◆ Data in a highly-structured format for the purpose of transmission. *Frame*, *packet*, and *PDU* are equivalent in most contexts.

PHY (Physical Layer) ◆ Layer 1 of the OSI model. Defines and handles the electrical and physical connections between systems. The Physical layer can also encode data in a form that is compatible with the medium (coaxial, twisted pair, fiber, and so on).

PMC (PCI Mezzanine Card) ◆ A daughtercard form factor implementation of the PCI bus specification.

POTS (Plain Old Telephone Service) ◆ Conventional voice grade service and cabling infrastructure.

PPP (Point-to-Point Protocol) ◆ A dial-up protocol that allows a computer to use TCP/IP networking to connect remote access devices, such as modems, to the Internet or other TCP/IP based networks.

PPP/MP (Point-to-Point Protocol/Multilink Protocol) ◆ See *Multi-link PPP*.

PRI (Primary Rate Interface) A type of ISDN service that offers 23 B-channels at 64 Kbps and one D-channel at 64 Kbps (23B+D). In Europe, PRI provides for 30 B-channels and two D-channels (30B+1D).

Private Line ◆ Synonym for a leased line. Dial voice line that does not terminate at the voice private automatic branch exchange or that does not appear on other sets in a key system.

Protocols ◆ A set of rules that define how different computer systems and other devices interoperate with each other.

PSTN ◆ Public Switched Telephone Network.

PVC (Permanent Virtual Circuit) ◆ A logical link whose endpoints and class of service are defined by network management.

For Frame relay, analogous to an X.25 permanent virtual circuit, a PVC consists of the originating frame relay network element address, originating data link control identifier, terminating frame relay network element address, and termination data link control identifier. Originating refers to the access interface from which the PVC is initiated. Terminating refers to the access interface at which the PVC stops. Many data network customers require a PVC between two points.

QLLC (qualified logical link control) ◆ An X.25 protocol that allows the transfer of data link control information between two adjoining SNA nodes that are connected through an X.25 packet-switching data network. The QLLC provides the qualifier *Q* bit in X.25 data packets to identify packets that carry logical link protocol information.

Q.921 ◆ This is the link layer protocol for ISDN.

Q.931 ◆ This is the network layer protocol for ISDN. Q.931 was developed for out-of-band call control.

RAI (Remote Alarm Indication) ◆ PRI alarm, also known as Yellow signal. This alarm indicates a carrier failure.

RBOC (Regional Bell Operating Company) ◆ There are seven regional telephone companies created by the AT& T divestiture: Nynex, Bell Atlantic, Bell South, Southwestern Bell, US West, Pacific Telesis and Ameritech.

RD (Received Data) ◆ RS-232 (V.24) data signal, sent from the data communications equipment to the data terminal equipment on pin 3. See *RS-232 u.*)

REN (Ringer Equivalence Number) ◆ A standard requirement of the FCC. For devices such as a telephone or answering machine. The REN requirement can be found on a label on the bottom of the analog device.

Repeater ◆ Device that acts as an amplifier. Also known as a Line Extender. This device is needed when the distance between the phone company's Central Office and your premises exceeds distance or dB loss limits.

RFC (Request for Comment) ◆ IETF documents that contain proposed standards and specifications. RFCs can be either approved, or simply archived as historical recommendations.

RI (Ring Indicator) ◆ RS-232 (V.24) control signal, sent from the data communications equipment to the data terminal equipment on pin 22. Indicates an incoming call is present. (See *RS-232 u.*)

RIP (Routing Information Protocol) ◆ Within IP networks, RIP is an interior gateway protocol used by routers and host systems to exchange information about reachable networks. RIP uses a distance-vectoring algorithm to establish and maintain network routes.

RJ-45 ◆ Standard 8-wire connector for IEEE 802.3 networks and some telephone applications.

Router ◆ Hardware device that connects two or more networks. A router determines where the destination computer is located, and then finds the best way to get there.

Routing ◆ Selecting the path to be taken by packets as they traverse the network.

Routing tables ◆ Stored in voice/data switches or routers to determine which of several possible paths will be taken through the network.

RS-232 ◆ Universally accepted Electronics Industries Association standard that defines the signals between data terminal equipment and data communications equipment. Uses a 25-pin connector; theoretically limited to distances of 50 feet; functionally identical to standards V.24/V.28.

RS-422 ◆ Electronics Industries Association standard for balanced transmission at distances greater than 50 feet. Compatible with V.11.

RTS (request to send) ◆ RS-232 (V.24) control signal, sent from the data terminal equipment to the data communications equipment on pin 4. Indicates that the DTE has data to transmit. (See *RS-232 u*.)

Rx ◆ Abbreviation meaning *receive*, *receiver,* or *reception*.

SAPI (Service Access Point Identifier) ◆ Part of the address in an ISDN signalling frame. Identifies the service that the signalling frame is intended for.

SDLC ◆ See *Synchronous Data Link Control*.

Serial transmission ◆ Technique in which each bit of information is sent sequentially on a single channel. Serial transmission is the normal mode for data communications. Contrast with parallel transmission.

SDU (Service Data Unit) ◆ User data passed through a SAP between the layers of the OSI or a similar model.

Signalling ◆ An ATM connection procedure that dynamically implements explicit routes through switches to establish a communication link with another station on the network.

S Interface ◆ The interface point between an ISDN device and the user premises network termination.

SDLC ◆ See *Synchronous Data Link Control*.

SNA ◆ IBM's Systems Network Architecture. The part of a user-application network that conforms to the formats and protocols of Systems Network Architecture. It enables reliable transfer of data among users and provides protocols for controlling the resources of various network configurations. The SNA network consists of network accessible units (NAUs), boundary function, gateway function, and intermediate session routing function components, and the transport network.

SNMP (Simple Network Management Protocol) ◆ A high-level, standards-based protocol for network management, usually used in TCP/IP networks. An SNMP manager controls and measures the activities of SNMP agents that are embedded in nodes and network devices on the network. SNMP relies on MIBs embedded in the network resources to monitor and control the network.

SPID (Service Profile IDentifier) ◆ An alphanumeric string that uniquely identifies the service capabilities of an ISDN terminal. This is an identifier that points to a particular location in the Telco's central office switch memory where relevant details about the device are stored. Each BRI connection can have up to two SPIDs, one for each B channel.

SS7 (signalling System 7) ◆ This is a common channel signalling system used to establish ISDN call functions.

SVC (Switched Virtual Circuit) ◆ Used in packet data networking technology. Temporary virtual circuit between two users.

Switch Type ◆ The type of equipment that the telephone company uses to provide you with ISDN service.

Synchronous Data Link Control (SDLC) ◆ A discipline conforming to subsets of the Advanced Data Communications Control Procedures (ADCCP) of the American National Standards Institute (ANSI) and High-level Data Link Control (HDLC) of the International Organization for Standardization.

Used for managing synchronous code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex or half-duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multi-point, or loop.

Contrast with *binary synchronous communication*.

Synchronous transmission ◆ A data transmission scheme where the interval between transmitted characters is fixed so that start and stop bits are not required. In contrast with asynchronous transmissions, synchronous transmissions are guaranteed a specific percentage of bandwidth on the network medium.

TCP/IP (Transmission Control Protocol/Internet Protocol) ◆ Protocol for internetwork routing and reliable message delivery. TCP/IP functions at the 3rd and 4th layers of the Open Systems Interconnection model.

IP is the low level protocol for the TCP/IP protocol set. IP provides packet delivery services between nodes. On the same level as IP are ARP and RARP.

TCP is a reliable stream-delivery, virtual circuit connection-oriented protocol that runs on top of IP. Telnet, FTP, and login use TCP connections.

TEI (Terminal Endpoint Identifier) ◆ The Terminal Endpoint Identifier is used to identify a specific piece of equipment on an ISDN connection.

Telco ◆ Telco is a popular abbreviation for telephone company. The RBOCs are a subset of all telcos.

T Interface ◆ The interface point between the user premises network termination (NT1) and a switching or concentration point (NT2) such as PBX.

Tx ◆ Abbreviation meaning *transmit*, *transmitter,* or *transmission*.

U Interface ◆ The interface point between the user premises network termination (NT1) and the local digital exchange.

UNI ◆ See *user to network interface*.

User to network interface (UNI) ◆ The interface between the ATM end system (user) and the ATM network.

V.11 ◆ International interface recommendation electrically similar to RS-422.

V.24 ◆ International interface recommendation that defines interchange circuits. Similar to and operationally compatible with RS-232. (See *RS-232 u*.)

V.25 ◆ International interface recommendation for dial lines.

V.25 bis ◆ International interface recommendation for dial lines that includes an auto-dial command and response language.

V.28 ◆ International interface recommendation that defines electrical characteristics for the interchange circuits defined by V.24. Similar to and operationally compatible with RS-232. (See *RS-232 u.*)

V.35 ◆ International recommendation for a wide-band interface modem.

VN3/VN4 ◆ VN3 and VN4 are the French ISDN standards.

WAN (Wide Area Network) ◆ A network spanning a large geographical area that provides communications among devices on a regional, national, or international basis.

Workstation ◆ A networked computer typically reserved for end-user applications.

X.21 ◆ (Packet-switched networks) International recommendation that defines a physical interface for X.25, using a 15-pin connector equivalent to V.11.

X.21 bis ◆ (Packet data networking) International recommendation that defines the most popular physical interface for X.25. Equivalent to RS-232 and V.24.

X.21 (bis) link ◆ Commonly used in European countries, this is a *pay as you go* link. When a signal is raised, the network automatically establishes a link to the remote unit.

X.25 ◆ Packet switching protocol that lets computers communicate via wide area packet switched data networks

XID ◆ See exchange identification.

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