*i*SPAN™ 5535 PRI
PCI ISDN Adapter
Users Guide

NOTE

See Appendix **I** for Regulatory Statements/Conditions that affect the operation of this product.
The CE Declaration of Conformity can be found at
www.iphase.com

Copyright Notice

Disclaimer

Trademark Acknowledgments

Assistance

Product Purchased from Reseller

Contact the reseller or distributor if:

- you need ordering, service or any technical assistance
- you received a damaged, incomplete or incorrect product.

Product Purchased Directly from Interphase Corporation

Contact Interphase Corporation directly for assistance with this, or any other Interphase Corporation product. Please have your purchase order and serial numbers ready.

Customer Service

United States:	Telephone:	(214) 654-5666
	Fax:	(214) 654-5500
	E-Mail:	intouch@iphase.com
Europe:	Telephone:	+ 33 (0) 1 41 15 44 00
	Fax:	+ 33 (0) 1 41 15 12 13

World Wide Web

http://www.iphase.com

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. Interphase Corporation 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 Interphase 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.

⚡ **WARNING**

■ **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.

⚡ *WARNING*

This equipment generates, uses, and can radiate electromagnetic energy. It may cause or be susceptible to electromagnetic interference (EMI) if not installed and used in a cabinet with adequate EMI protection.

END-USER LICENSE AGREEMENT
FOR INTERPHASE CORPORATION SOFTWARE

IMPORTANT NOTICE TO USER–READ CAREFULLY

THIS END-USER LICENSE AGREEMENT FOR INTERPHASE CORPORATION SOFTWARE ("AGREEMENT") IS A LEGAL AGREEMENT BETWEEN YOU (EITHER AN INDIVIDUAL OR SINGLE ENTITY) AND INTERPHASE CORPORATION FOR THE SOFTWARE PRODUCTS ENCLOSED HEREIN WHICH INCLUDES COMPUTER SOFTWARE AND PRINTED MATERIALS ("SOFTWARE"). BY INSTALLING, COPYING, OR OTHERWISE USING THE ENCLOSED SOFTWARE, YOU AGREE TO BE BOUND BY THE TERMS OF THIS AGREEMENT. IF YOU DO NOT AGREE TO THE TERMS AND CONDITIONS OF THIS AGREEMENT, PROMPTLY RETURN, WITHIN THIRTY DAYS, THE UNUSED SOFTWARE TO THE PLACE FROM WHICH YOU OBTAINED IT FOR A FULL REFUND.

The Software is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties. The Software is licensed, not sold.

Grant of License: You are granted a personal license to install and use the Software on a single computer solely for internal use and to make one copy of the Software in machine readable form solely for backup purposes.

Restrictions on Use: You may not reverse engineer, decompile, or disassemble the Software. You may not distribute copies of the Software to others or electronically transfer the Software from one computer to another over a network. You may not use the Software from multiple locations of a multi-user or networked system at any time. You may not use this software on any product for which it was not intended. You may not use this software on any non-Interphase product. LICENSEE MAY NOT RENT, LEASE, LOAN, OR RESELL THE SOFTWARE OR ANY PART THEREOF.

Ownership of Software: Interphase or its vendors retain all title to the Software, and all copies thereof, and no title to the Software, or any intellectual property in the Software, is being transferred.

Software Transfer: You may permanently transfer all of your rights under this Agreement, provided you retain no copies, you transfer all the Software, and the recipient agrees to the terms of this Agreement.

Limited Warranty: Interphase Corporation ("Seller") warrants that (i) the hardware provided to Buyer ("Products") shall, at the F.O.B. point, be free from defects in materials and workmanship for a period of one (1) year from the date of shipment to Buyer; (ii) the software and/or firmware associated with or embedded in the Products shall comply with the applicable specifications for a period of six (6) months from the date of shipment to Buyer; and (iii) its services will, when performed, be of good quality. Defective and nonconforming Products and software must be held for Seller's inspection and returned at Seller's request, freight prepaid, to the original F.O.B. point.

Upon Buyer's submission of a claim in accordance with Seller's Return and Repair Policy, Seller will, at its option either (i) repair or replace the nonconforming Product; (ii) correct or replace the software/firmware; (iii) rework the nonconforming services; or (iv) refund an equitable portion of the purchase price attributable to such nonconforming Products, software, or services. Seller shall not be liable for the cost of removal or installation of products or any unauthorized warranty work, nor shall Seller be

responsible for any transportation costs, unless expressly authorized in writing by Seller. This warranty does not cover damage to the Product resulting from accident, disaster, misuse, negligence, improper maintenance, or modification or repair of the Product other than by Seller. Any Products or software replaced by Seller will become the property of Seller.

REMEDIES AND EXCLUSIONS. THE SOLE LIABILITY OF SELLER AND BUYER'S SOLE REMEDY FOR BREACH OF THESE WARRANTIES SHALL BE LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCTS OR CORRECTION OF THAT PART OF THE SOFTWARE, WHICH FAILS TO CONFORM TO THESE WARRANTIES. EXCEPT AS EXPRESSLY STATED HEREIN, AND EXCEPT AS TO TITLE, THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, IN CONNECTION WITH OR ARISING OUT OF ANY PRODUCT OR SOFTWARE PROVIDED TO BUYER.

IN NO EVENT SHALL SELLER HAVE ANY LIABILITY FOR INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, ARISING OUT OF THESE WARRANTIES, INCLUDING BUT NOT LIMITED TO LOSS OF ANTICIPATED PROFITS, LOSS OF DATA, USE OR GOODWILL, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. (IC-199, 1/97)

Limitation of Liability: NEITHER INTERPHASE NOR ITS LICENSORS SHALL BE LIABLE FOR ANY GENERAL, INDIRECT, CONSEQUENTIAL, INCIDENTAL, OR OTHER DAMAGES ARISING OUT OF THIS AGREEMENT EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Confidentiality: The Software is copyrighted and contains proprietary and confidential trade secret information of Interphase and its vendors. Licensee agrees to maintain the Software in confidence and not to disclose the Software to any third party without the express written consent of Interphase. Licensee further agrees to take all reasonable precautions to prevent access to the Software by unauthorized persons.

Termination: Without prejudice to any other rights, Interphase may terminate this Agreement if you fail to comply with any term or condition of the Agreement. In such event you must destroy the Software together with all copies, updates, or modifications thereof.

Export: You agree to comply with all export and re-export restrictions and regulations of the U.S. Department of Commerce or other applicable U.S. agency. You must not transfer the Software to a prohibited country or otherwise violate any such restrictions or regulations.

U.S. Government Restricted Rights: Use, duplication, or disclosure of the Software to or by the U.S. Government is subject to restrictions as set forth in the applicable U.S. federal procurement regulations covering commercial/restricted rights software. You are responsible for complying with the notice requirements contained in such regulations.

General: You acknowledge that you have read and understand this Agreement, and by installing and using the Software you agree to be bound by the terms and conditions herein. You further agree that this is the complete and exclusive Agreement between Interphase and yourself. No variation of the terms of this Agreement or any different terms will be enforceable against Interphase unless agreed to in writing by Interphase and yourself. The validity of this Agreement and the rights, obligations, and relations of the parties hereunder shall be determined under the substantive laws of the State of Texas. If

any provision of this Agreement is held invalid, illegal, or unenforceable, the remaining provisions shall in no way be affected or impaired thereby. All rights in the Software not specifically granted in this Agreement are reserved by Interphase.

Contents

CHAPTER 4   Installing the Software

CHAPTER 5   Setting Up WAN Firmware and Hardware

Using This Guide

Audience

This manual 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/tips/glossary.htm
  ```

Icon Conventions

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

NOTE

The Note icon indicates important points of interest related to the current subject.

⚠ *CAUTION*

The Caution icon brings to your attention those items or steps that, if not properly followed, could cause problems in your machine's configuration or operating system.

⚡ *WARNING*

The Warning icon alerts you to steps or procedures that could be hazardous to your health, cause permanent damage to the equipment, or impose unpredictable results on the surrounding environment.

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` ↵ **`Return`**

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

Documentation Updates

The latest documentation (in Adobe® Acrobat® pdf) for our current products are available on our WWW site. Interphase recommends our customers visit the web site to verify that they have the latest version of the documentation.

1. Access the following web page:

    http://www.iphase.com

2. Move the mouse (or other pointer) and click on the `Products` option. A menu will appear on the left side with **Telecom Solutions**, **Enterprise Solutions**, and **Services** options. Choose the appropriate menu item (such as **PowerSAN Fibre Channel HBAs**).

3. A new web page with a list of the currently offered products will appear. Choose your product by clicking on the product number (i.e. 4532, 5540, 4575, etc.).

4. The Product Description page appears for the product selected. At the left side of the page is a list showing additional information web pages for that product. Choose the **User Guides** item.

5. A new web page appears with a list of the latest released user guides available for the product. Click on the document you require.

Driver Updates

Contact our Technical Support Department at swlib@iphase.com to determine if updated drivers are available for your product.

When contacting technical support, please be sure to provide your name, company name and address, phone number, product name, driver version (if applicable), OS and version (if applicable) and serial number. Providing this information will help speed up our response.

Introduction

<div style="float:right">

1

</div>

Adapter Overview

The *i*SPAN™ PRI (Primary Rate Interface) adapter is a Peripheral Component (PCI) add-on board for PCI-based PCs, servers, and workstations. It enables systems to connect to one or two ISDN primary rate interfaces.

The single-PRI version is powered by the IBM® PowerPC™ 403GA 32-bit RISC processor at 33 MHz.

The dual-PRI version is powered by the IBM PowerPC 403GCX 32-bit RISC processor at 66 MHz, and combined with a 32-bit/33-MHz PCI interface. It provides a fast pathway to enterprise communication server applications.
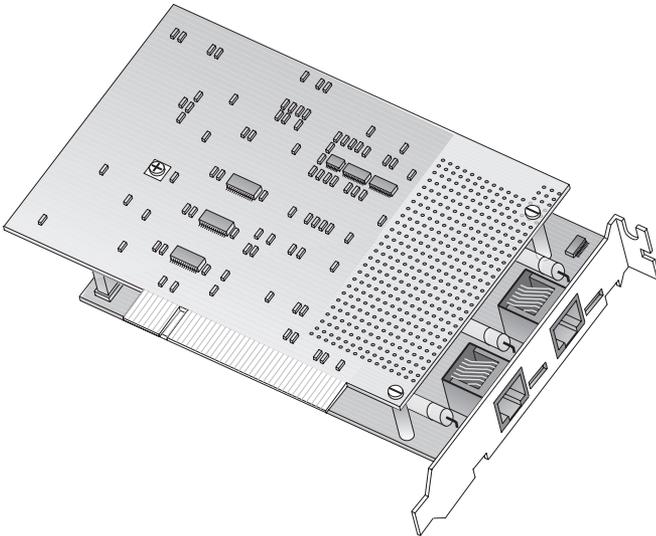
Figure 1-1. *i*SPAN PRI PCI ISDN Adapter (Dual PRI Version)

RAS Support Overview

This 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:

Printing   File sharing   Host access   Database   E-mail Scheduling

Remote Access Server (Windows NT Server)
Up to 46 simultaneous clients (60 for Europe)

ISDN

Remote Client

Internet Service Provider
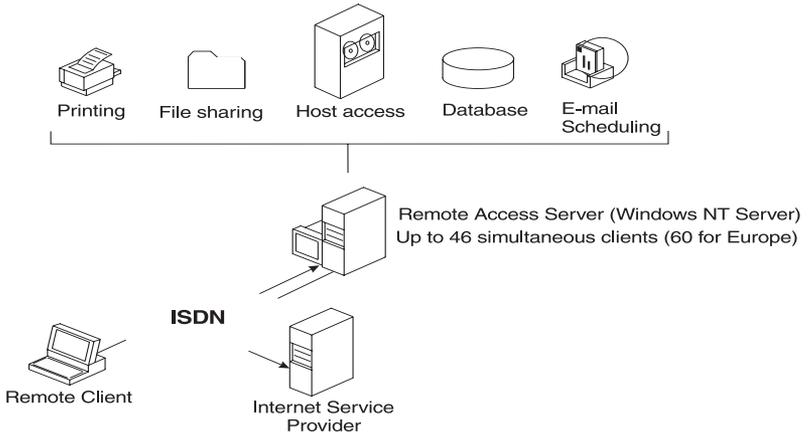
Figure 1-2. RAS Features

Product Features

- PCI 2.1 compliant master/target bus interface
- North America and Europe ISDN Compatibility (NET3, E-DSS1, NI-1, NI-2)
- Conforms to all industry standards and specifications (FCC part 15 class A and part 68, CE class A, IEC950)
- Single PRI version:
  - 32-bit RISC processor PowerPC 403GA @ 33 MHz
  - 4-MB dual port DRAM memory and 128 KB Flash EEPROM
  - RAS support for up to 30 B channels and 1 D channel (Europe) or 23 B channels and 1 D channel (United States and Japan)

- Dual PRI version:
  - 32-bit RISC processor PowerPC 403GCX @ 66 MHz
  - 8-MB dual port DRAM memory and 128-KB Flash EEPROM
  - RAS support for up to 60 B channels and 2 D channels (Europe) or 46 B channels and 2 D channels (United States and Japan)
- 32-bit, 33-MHz local bus
- HDLC and transparent mode on each B channel
- Short PCI form factor (174.63 x 106.68 mm)
- Full plug-and-play installation.

Minimum System Requirements

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

- An Intel® system running Windows NT Version 4.0 (either Workstation or Server)
- Bus architecture: PCI Local Bus Specification Revision 2.1
- Processor: Pentium at 133 MHz
- 32 MB RAM (you may need up to 128 MB depending on your RAS configuration and usage)
- A hard disk with 3 MB free
- A 3.5" diskette drive or a CD-ROM drive
- Single PRI version: One functional ISDN primary rate interface
- Dual PRI version: One or two functional ISDN primary rate interfaces

- CSU (Channel Service Unit)

  (For more information, see *North America T1/PRI Line* on page 17).

Software Drivers

You can install only one *i*SPAN-PRI PCI ISDN adapter per system. Each adapter requires the following drivers:

- WAN adapter driver for Windows NT: the basic driver required to support the adapter
- RAS Support: the driver required to support Microsoft Remote Access Service over ISDN. Enables the transport of TCP/IP, IPX/SPX, and NetBEUI protocols over ISDN lines.

These drivers are both installed during the installation procedure.

The general software architecture is as follows:
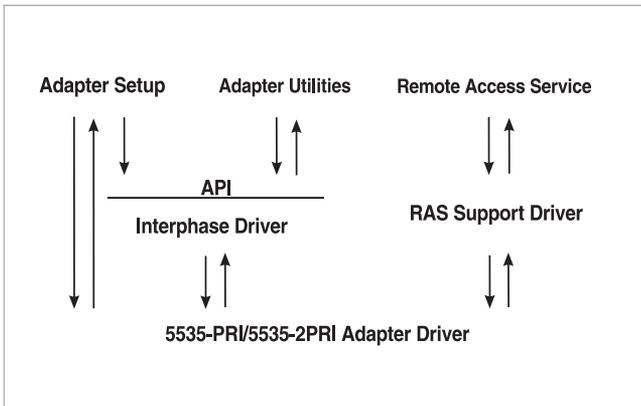
Figure 1-3. Software Architecture Overview

The complete *i*SPAN-PRI software is stored on a single diskette or a CD-ROM included in the adapter package.

Installing the Hardware

<div style="border:1px solid black">

2

</div>

Overview

You can install the *i*SPAN-PRI adapter in any suitable PCI
expansion slot. To install your 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. Both are delivered with the product and are
included in the packaging.

Verifying Minimum Requirements

Before installing this adapter, verify that your system meets
the minimum requirements described in *Minimum System
Requirements* on page 4.

Inspecting the Adapter

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

⚠ *CAUTION*

The adapter is packed in an antistatic bag to protect it during shipment. Keep the adapter in its protective antistatic bag until you are ready to install it in the host computer. To prevent damage to the adapter due to electrostatic discharge, wear a grounding strap on your wrist or ankle and handle the adapter only by its edges. Do not touch its components or any metal parts other than the faceplate. If your adapter is a fiber adapter, do not remove the connector cap(s) until you're ready to install the adapter.

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

⚡ *WARNING*

Your computer operates at voltages that can be lethal. Follow all cautions and warnings in this installation procedure, both to protect yourself and prevent damage to your computer. Use only tools with nonconductive handles, or tools coated with, covered with, or made with nonconductive materials. Nonconductive materials are materials that do not conduct electric current, such as

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.
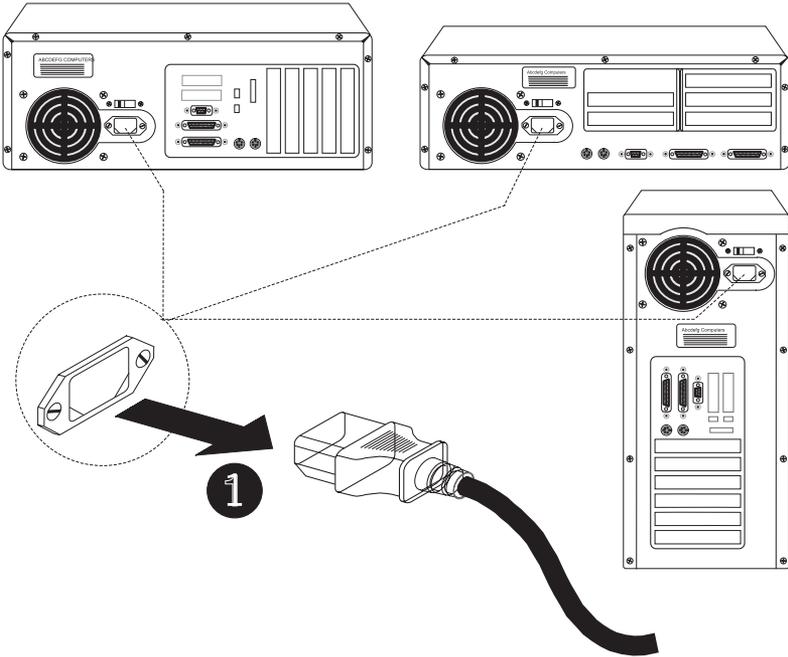
Figure 2-1. Unplugging the Computer

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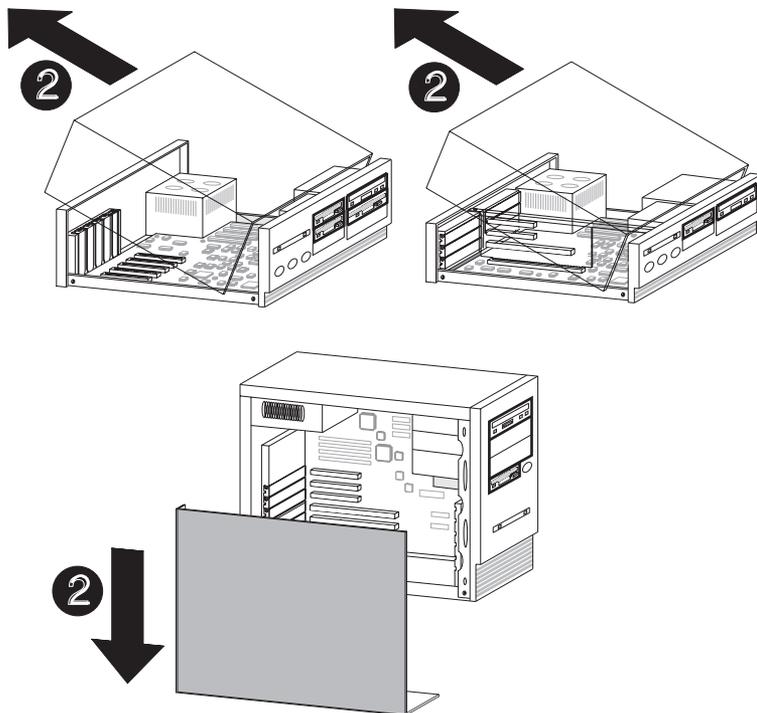
Figure 2-2. Removing the Computer Cover

> **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**.

⚠ *CAUTION*

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 14 for instructions before proceeding with the installation process.

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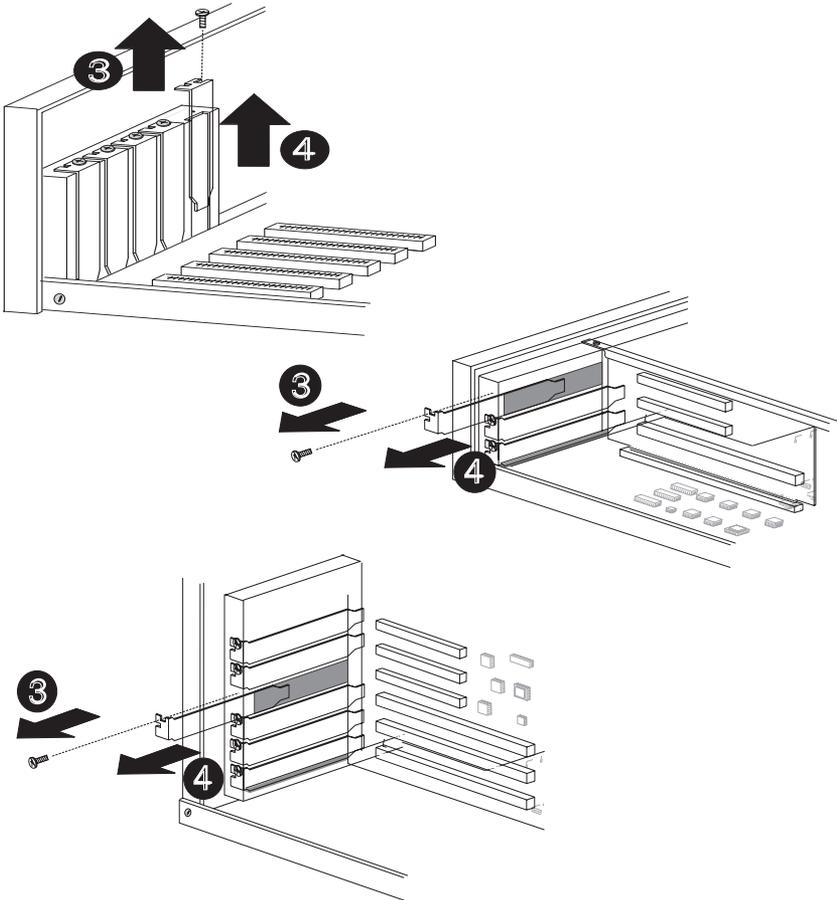
Figure 2-3. Removing the Expansion Plate

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**.
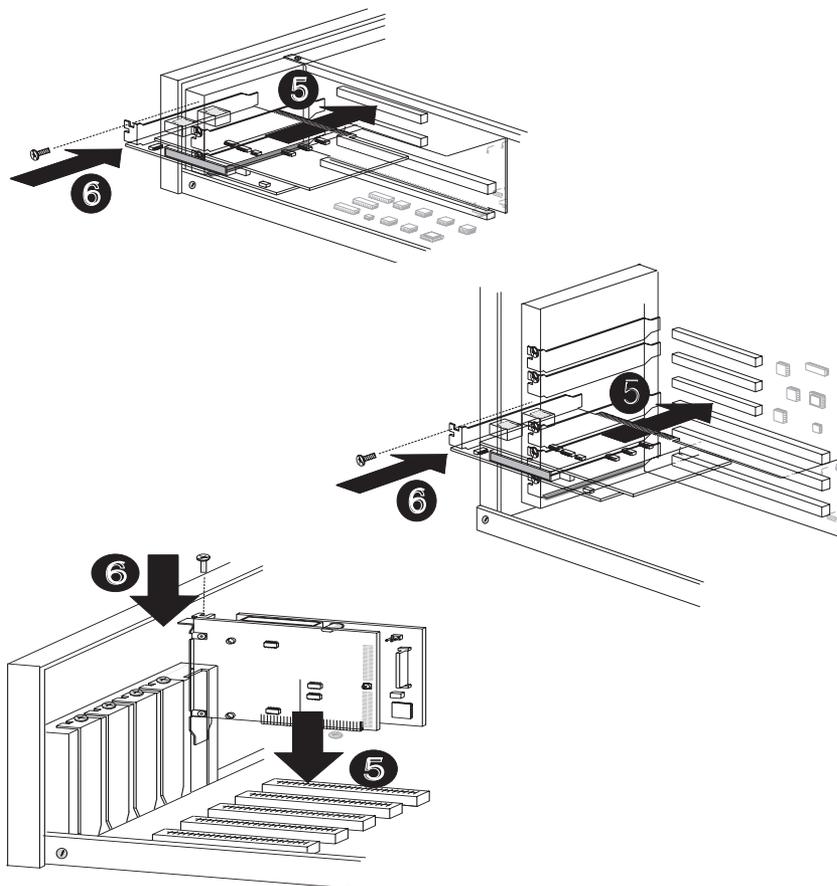
Figure 2-4. Inserting the Adapter

NOTE

If you need to connect the adapter to other MVIP telephony processing adapters in the cabinet, such as voice, data, fax, video or image processing adapters, and have not already done so, see *Connecting the Adapter to an MVIP Bus* on page 14.

7. Replace the computer cover.

You are now ready to connect the adapter to the appropriate PRI line, as described in *Connecting to the Line* on page 17.

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

Requirements for MVIP Bus Electrical Termination

For systems with five or fewer MVIP bus connections and less than 90 pF load on the clock lines, it is adequate to place the circuit board that is the master clock source at one end of the cable and electrically terminate the MVIP bus only on the circuit board located at the other end of the cable.

📝 *NOTE*

The *i*SPAN-PRI adapter is generally the master clock source, because it is connected to the network. In this case, place the *i*SPAN-PRI adapter at one end of the cable.

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.

If the *i*SPAN-PRI adapter is at one of the MVIP cable ends, you must set the dip switches to their ON position (down) to complete the required electrical termination. Consult the relevant manuals for other MVIP adapters to correctly configure their specific electrical termination.

If you do not connect the *i*SPAN-PRI to an MVIP bus, you can leave the dip-switches, located close to the 40-pin double-row right-angled header, on any position.

How to Configure MVIP Electrical Termination on the *i*SPAN-PRI

The factory default configuration for the *i*SPAN-PRI adapter does not require jumpers.

If the adapter does not have to be electrically terminated, do not insert any jumpers into the 2-pin connectors.

If this is the last board in a multiple MVIP bus configuration, the *i*SPAN-PRI 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, as described in the following figure.
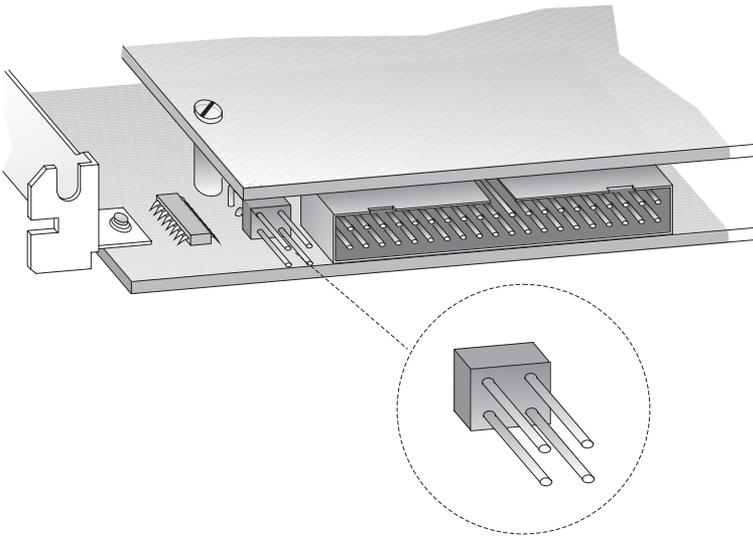
Figure 2-5. Electrically Terminating the MVIP Bus.

Connecting to the Line

<div style="float:right; border:2px solid black; padding:10px;">

3

</div>

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 adapter to the line:

- connection methods and requirements for connecting to a North American T1/PRI line
- connection methods and requirements for connecting to a European E1/PRI line
- summary of steps to connect the adapter to the network.

If you are in North America, continue with the next section.

If you are in Europe, skip to *European E1/PRI Line* on page 23.

North America T1/PRI Line

When you connect the adapter to a North American T1/PRI line, first determine the appropriate connection method, cabling requirements, and link requirements.

Two T1/PR1 line configurations exist: DSX1 (short haul) and DS1 (long haul). When the distance to your carrier is short enough (less than 655 feet or 200 meters), you can generally connect the adapter in a DSX1 configuration directly to the T1/PR1 line. All *i*SPAN-PRI adapters support the DSX1 configuration.

If the distance is longer (up to 6200 feet or 1800 meters), you need to connect the adapter in a DS1 configuration. In this configuration, a Channel Service Unit (CSU) must translate the short haul DSX1 interface in order to support the longer distance.

The *i*SPAN-PRI adapter optionally supports an internal CSU. In this case, you can connect the adapter directly to the T1/PRI line, also in a DS1 configuration. If your adapter does not include this option (and if the distance is too long), you will need to connect the adapter to an external CSU, which itself will be connected to the metallic T1/PR1 interface.

Connecting directly to the line without a CSU

You can connect the *i*SPAN-PRI directly to the line without any internal or external CSU if the distance to your carrier is short enough (less than 655 feet or 200 meters). The line will be in a DSX1 configuration (short haul). See Figure 3-1.
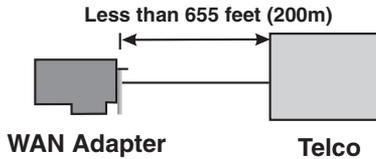
Figure 3-1. Adapter connected directly to the Telco

Direct connection is subject to constraints imposed by FCC rules and by your partner carrier. For more information about these constraints, and to find out if you can connect directly to the interface, contact your carrier.

⚡ *WARNING*

To avoid harming the WAN, you must first contact your carrier for approval before connecting the adapter to the line.

⚠ *CAUTION*

In accordance with FCC Rules, Part 68.218 (b), you must notify the telephone company prior to *disconnecting* the adapter from the line or turning off the power to the adapter's host system. Without this prior notification, the carrier might temporarily discontinue your T1/PRI service.

Connecting directly to the line with an internal CSU

If your *i*SPAN-PRI adapter includes the internal CSU option, you can connect it directly to the line and be up to 6200 feet (1.8 km) far from your carrier. The line will be in a DS1 configuration (long haul).
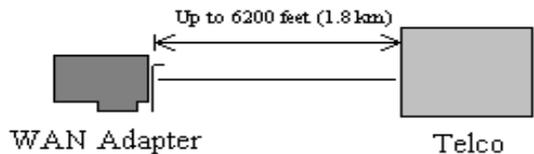
Figure 3-2. Adapter with an internal CSU

⚡ ***W**ARNING*

To avoid harming the WAN, you must first contact your carrier for approval before connecting the adapter to the line.

⚠ ***C**AUTION*

In accordance with FCC Rules, Part 68.218 (b), you must notify the telephone company prior to *disconnecting* the adapter from the line or turning off the power to the adapter's host system. Without this prior notification, the carrier might temporarily discontinue your T1/PRI service.

Connecting to the line through an external CSU

If the distance to your carrier is longer than 655 feet (200 meters), or if your carrier does not accept a direction DSX1 connection, and if your *i*SPAN-PRI adapter does not include an internal Channel Service Unit (CSU), you need to connect an external CSU between the adapter and the network.
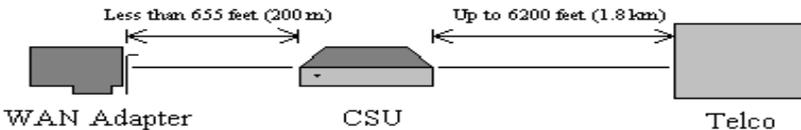
Figure 3-3. Adapter connected to an external CSU

WARNING

To avoid harming the WAN, you must first contact your carrier for approval before connecting the CSU to the line.

CAUTION

In accordance with FCC Rules, Part 68.218 (b), you must notify the telephone company prior to *disconnecting* the CSU from the line or turning the CSU's power off. Without this prior notification, the carrier might temporarily discontinue your T1/PRI service.

T1/PRI Cabling

WARNING

Before connecting the cable, read *Telephone Lines Unsafe Voltages* in the *Safety Precautions* section at the front of this manual.

The cable between the adapter and the carrier or the CSU must meet standard T1 attenuation and transmission requirements:

- 100 Ohm
- two twisted pairs, category 3 or higher
- maximum length: 655 feet (200 m) without a CSU, 6200 feet (1800 meters) with a CSU.

The actual cable length between the adapter and the carrier must be measured and recorded; you will need this information

The cable must include an RJ48C plug at the end dedicated to the WAN adapter. It must also provide the appropriate plug or cabling system at the end connected to the carrier or CSU. See *Connector Pinouts* on page 24 and relevant carrier or CSU documentation for more information.

T1 Link Requirements

The adapter and the CSU must be configured with several common specifications in order to interoperate. The adapter's T1 parameters are set to the following:

- **Line coding:** B8ZS
- **Frame format:** ESF (Extended Super Frame)
- **Line I/O impedance:** 100 Ohm ±5%

European E1/PRI Line

When you connect the adapter to a European E1/PRI line, first determine the appropriate connection method, cabling requirements, and link requirements.

This section describes the method and requirements for connecting the adapter to a European E1/PRI line.

Connection Method

Generally, your E1/PRI carrier provides a Network Termination 1 (NT1) device to interface between the WAN adapter and the metallic interface of the WAN. You need to connect the WAN adapter to the NT1.

E1/PRI Cabling Requirements

⚠ *WARNING*

Before connecting the cable, read *Telephone Lines Unsafe Voltages* in the *Safety Precautions* section at the front of this manual.

The cable between the adapter and the NT1 must meet the following standard E1 attenuation and transmission requirements:

- 120 Ohm
- two twisted pairs, category 3 or better
- maximum length: 200 m (655 feet)

The cable must include an RJ48C plug at the end dedicated to the WAN adapter. It must also provide the appropriate plug or cabling system at the end dedicated to the NT1. See *Connector Pinouts* on page 24 and your NT1 documentation for details.

E1 Link Requirements

To interoperate successfully, the adapter and the NT1 must be configured with several common E1 settings. The adapter's E1 parameters are in accordance with the IUT-T I 431 recommendation, as follows:

- **Line coding:** HDB3, according to IUT-T G.703
- **Frame format:** according to IUT-T G.704
- **CRC4 to Non-CRC4 operation:** according to IUT-T G.706 An.B
- **Line I/O impedance:** 120 Ohm ±5%.

Connector Pinouts

The following illustration of the adapter's faceplate shows the adapter's connectors and connector pins:

Pin	Signal
8	
7	
6	
5	Tx out (tip)
4	Tx out (ring)
3	
2	Rx in (tip)
1	Rx in (ring)

RJ48C Pinout

LEDs 1, 2, 3 & 4 (Port #0)

Port #0 (RJ48C)

LEDs 5, 6, 7 & 8 (Port #1)

Port #1 (RJ48C)
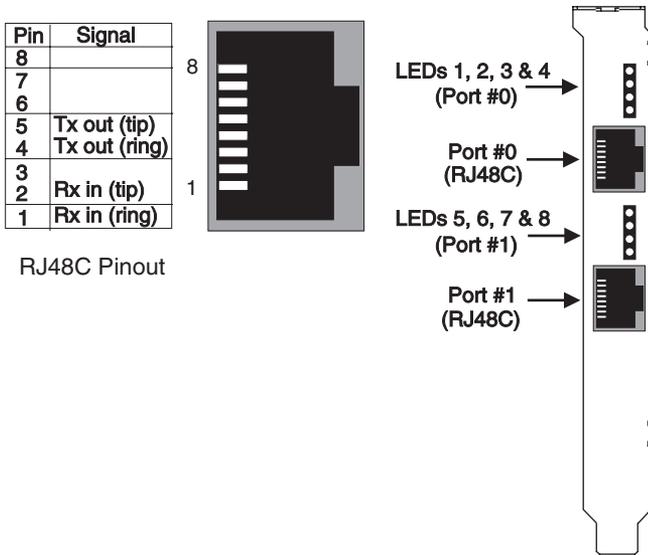
Figure 3-4. Adapter's Faceplate and Connector Pinouts

The adapter's connectors follow the RJ48C specification.

Four Light Emitting Diodes (LEDs) display the status of the link (as described in *Interpreting Adapter LEDs* on page 67).

Connecting the Adapter to the Network

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

1. Obtain the cable required for your type of connection, as described in *T1 Link Requirements* on page 22 or *E1/PRI Cabling Requirements* on page 23.

2. Attach the appropriate RJ48C-compliant connector to the adapter.

3. Reconnect the power cable and turn on the machine.

After connecting the adapter to the network, install the adapter drivers. See *Installing the Software* on page 27.

Installing the Software

Overview

This chapter describes the procedures for installing and setting up your *i*SPAN-PRI adapter's software on Microsoft Windows NT 4.0 workstations. This process installs both the basic WAN adapter driver and the RAS Support driver.

To install the software, follow these basic steps:

1. Verify that your system meets minimum requirements.

2. Install and set up the drivers.

This chapter also explains how to remove the drivers, if required.

If *Read Me First* documentation is included in your installation kit, review it before installing the driver. It may contain changes and updates made to this users guide after the print date.

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 4.

Installing and Setting Up the Drivers

To install and set up the adapter drivers, do the following:

1. Install the WAN and RAS Support drivers.

2. Set up RAS support properties.

3. Set up ISDN B channels.

4. Check the ISDN line with the LoopTest utility.

*N*OTE

The *i*SPAN-PRI adapter is called either *5535-1P-PRI or 5535-2P-PRI* in the software installation and configuration 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 WAN and RAS support drivers for the adapter:

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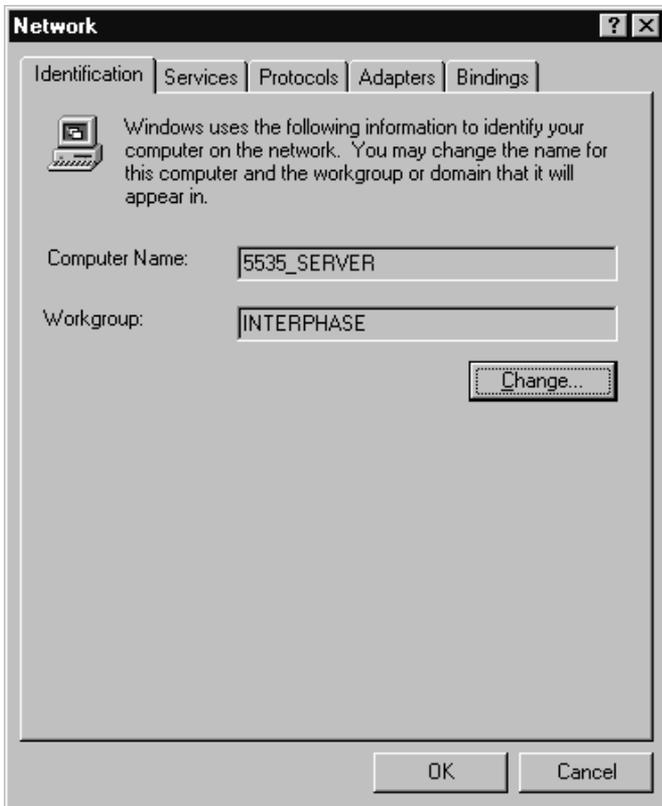
Figure 4-1. Network Identification tab of the Network dialog

2. Select the **Adapters** tab to display the Adapters dialog:

Figure 4-2. Network Adapters tab of the Network dialog

> **3.** Click **Add** to begin loading the drivers.
>
> The system creates an adapter list in the Select Network Adapter dialog:

Select Network Adapter

Click the Network Adapter that matches your hardware, and then click OK. If you have an installation disk for this component, click Have Disk.

Network Adapter:

- 3Com 3C508 ISA 16-bit Ethernet Adapter
- 3Com Etherlink II Adapter (also II/16 and II/16 TP)
- 3Com Etherlink III ISA/PCMCIA Adapter
- 3Com EtherLink III PCI Bus-Master Adapter (3C590)
- 3Com Etherlink16/EtherLink16 TP Adapter
- 3Com Fast EtherLink PCI 10/100BASE-T Adapter (3C595)

Have Disk...

OK   Cancel

Figure 4-3. Network Adapters List

4. Click **Have Disk.**

The Insert Disk dialog 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.

OK

Cancel

A:
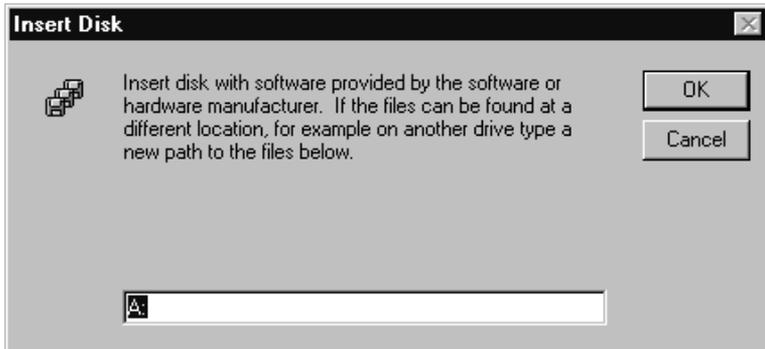
Figure 4-4. Insert Disk dialog

5. If you are installing the software from a diskette, insert the diskette, change the installation directory to A:\ and click OK.

If you are installing the software from a CD-ROM, insert the CD-ROM. If 'D:' is the letter assigned to the CD-ROM drive, change it to D:\5535PRI (or select the appropriate drive) and click OK.

The Select OEM Option dialog appears, with **5535 INTERPHASE RAS Support** selected:
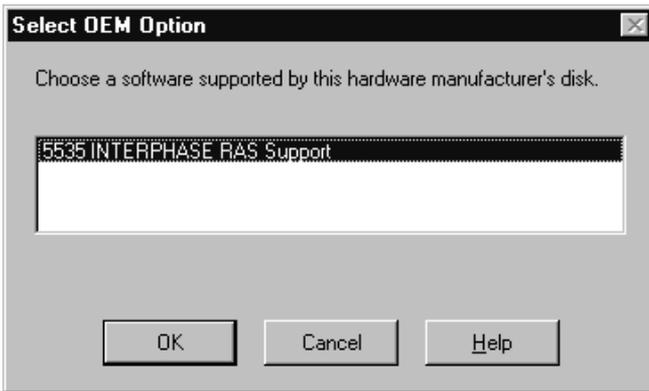
Figure 4-5. Select OEM Option dialog

6. Click **OK** to confirm the selection.

The INTERPHASE WAN Adapter driver window appears, prompting you to accept or change the installation directory and begin installation.

You can install the *i*SPAN-PRI adapter from a diskette or from CD-ROM as follows.

Figure 4-6. WAN Adapter Driver Installation

> **7.** If needed, change the default installation path in the
> **Copy To** field to the desired pathname.
>
> **8.** Click **Continue** to install the 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.
>
> Next, the WAN Adapters setup dialog appears:

Figure 4-7. WAN Adapters Setup

The adapter is automatically detected. The Cards list should be updated to include the *i*SPAN-PRI adapter (listed as a version of the *5535*) in your machine.

NOTE

If the cards list is empty, the adapter might not be properly installed. Click *OK*. Then see *Problems and Possible Solutions* on page 72 for information about correcting the problem.

9. Make sure the 5535 adapter is selected in the Cards list of the WAN Adapters Setup dialog. Then do the following to configure the adapter's ISDN ports:

   a. Select the port you want to configure (from **[0] ISDN PRI** to **[1] ISDN PRI)**, and click **Properties** to display the ISDN PRI Port Properties dialog:
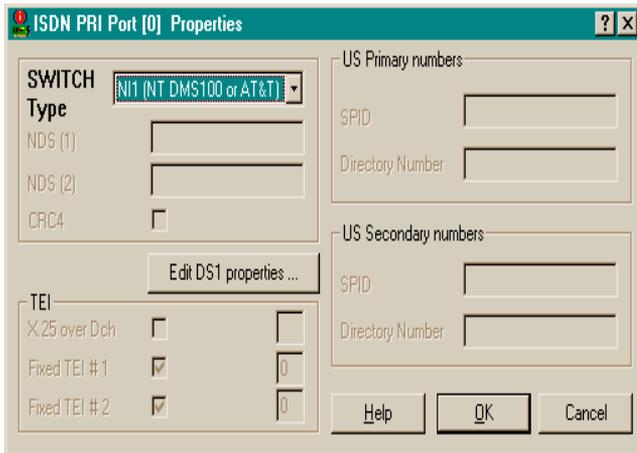
Figure 4-8. ISDN PRI Port Properties

   b. Select the switch type that corresponds to your ISDN subscription, and click **OK.** (For more information about switch types, see *Setting Up ISDN PRI Port Properties* on page 56.)

   c. When the WAN Adapters setup dialog reappears, repeat steps **a** and **b** for each ISDN PRI port.

   d. When all ISDN ports are configured, click **OK.**

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

10. When a message informs you that the driver is running, click **OK.**

Figure 4-9. Successful Setup Message

To continue the software installation, set up RAS support properties as described in the next section.

Setting up RAS Support Properties

After you respond **OK** to the message that the driver is running, the Interphase 5535 RAS Support dialog appears:
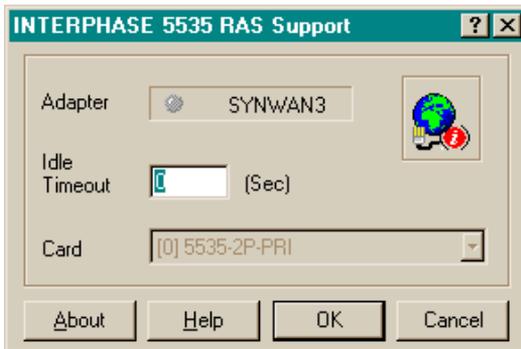
Figure 4-10. RAS Support Setup

This dialog enables you to set up RAS Support properties for the adapter.

To set up RAS support properties:

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

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

     Click **OK** to update the ISDN port list in RAS setup. Then skip to *Setting Up ISDN B Channels as RAS Ports* on page 38.

   – If **Remote Access Service is *not* yet installed** on your system, a message informs you that RAS support setup is complete, and states that *Remote Access Services (RAS) setup must now be **installed***:

     Click **OK,** and continue to step **2**.

2. When a message informs you that Setup needs to copy Windows NT files, enter the complete path if you want Setup to find the files in a location other than the default:
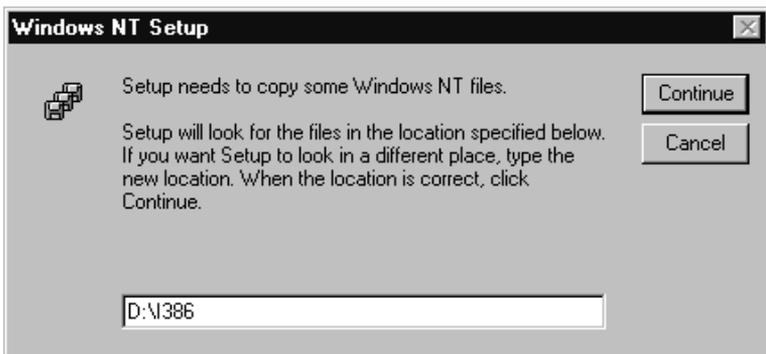
Figure 4-11. Windows NT Setup Message

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

When RAS installation is complete, a message informs you that Remote Access Service has been successfully installed, and reminds you to use Remote Access Admin or User Manager in the Administrative Tools Folder to assign RAS permissions to users.

4. Click **OK.**

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

Setting Up ISDN B Channels as RAS Ports

After RAS is installed, you can set up ISDN B channels as RAS ports, using the Add RAS Device dialog:
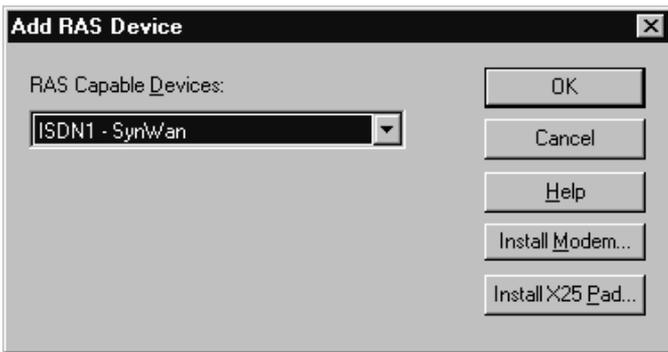
Figure 4-12. Add RAS Device

This dialog appears after you respond **OK** to the message that Remote Access Service must be invoked or that Remote Access Service has been successfully installed.

To set up the IDSN B channels:

1. Click **OK** to select the first ISDN B channel (ISDN1-SynWan).

The Remote Access Setup dialog appears, with the ISDN port included in the RAS port list:
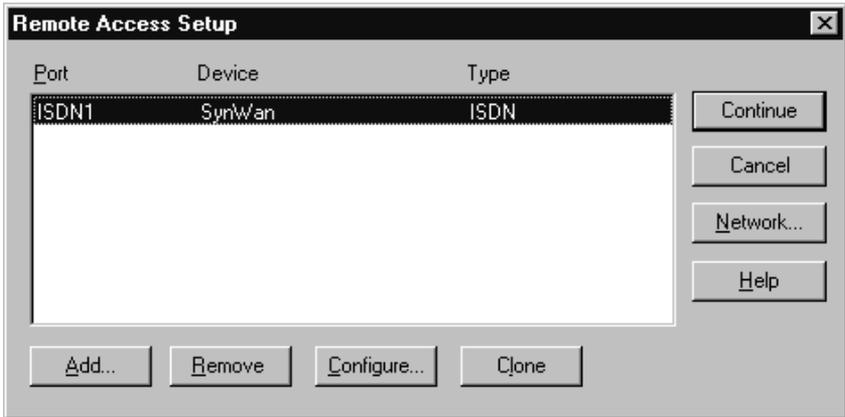
Figure 4-13. Remote Access Setup

2. Select the port and click **Configure** to set up its connection mode.

The Configure Port Usage dialog appears:
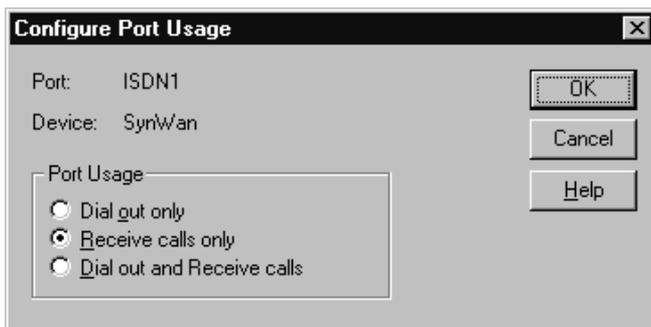
Figure 4-14. Configure Port Usage

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

The **Remote Access Setup** dialog reappears (see Figure 4-13 on page 39). It now shows one ISDN channel configured as a RAS port.

4. To quickly configure all ISDN channels with the same port usage as the first ISDN channel:

   a. Click **Clone** until a message informs you *there are no more ports of the specified type to clone*.

   b. Click **OK.**

5. When the **Remote Access Setup** dialog reappears, do the following to select the protocols (NetBEUI, TCP/IP, or IPX) and other settings to be bound to the adapter:

   a. Click **Network** to display the Network Configuration dialog:
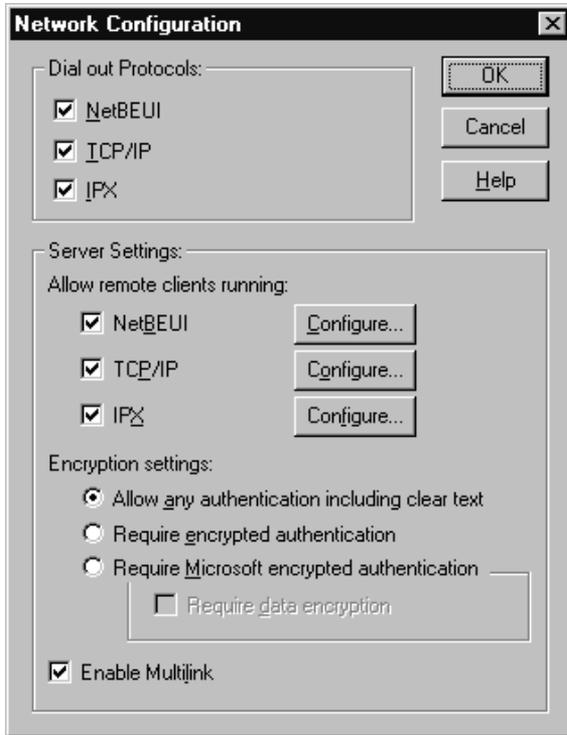
Figure 4-15. Network Configuration

On this dialog, you can select the **Enable Multilink** option to allow multiple ISDN B channels to make one logical network connection. This function aggregates several ISDN B channels to increase the bandwidth of PPP links.

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

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

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

6. The **INTERPHASE 5535 RAS ISDN support** adapter now appears in the Network Adapters list on the Adapters dialog:
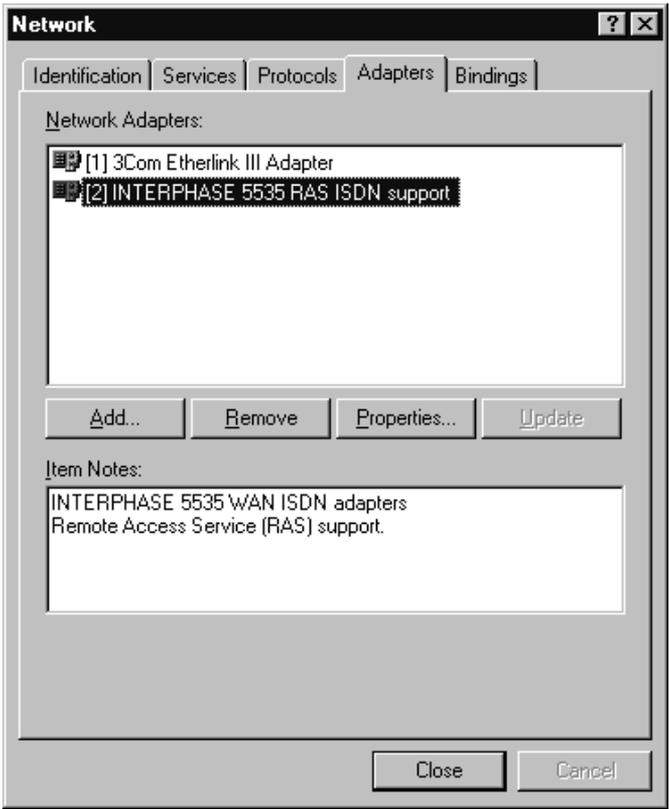
Figure 4-16. Network Adapters List

7. Click **Close** to complete the software installation.

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

⚠️ *CAUTION*

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. 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 will probably fail to start, or will not behave correctly when connecting ISDN lines.

To determine whether a Service Pack is installed, see *Index of Common Tasks* on page 115.

8. If the system is a Windows NT basic system, with no service pack installed, click **Yes** to restart the computer.

   Otherwise, click **No.** Then reinstall the Windows NT Service Pack before restarting the system.

Next, continue the software installation by checking the ISDN line, as described in the next section.

Checking the ISDN Line with LoopTest

After you have installed and configured the adapter software and restarted Windows NT, you can check your ISDN line using the LoopTest utility. This utility calls itself and establishes two ISDN B channels. One of the channels is set to listen, and the second channel calls the first one.

To check the IDSN line using LoopTest:

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

   a. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **Remote Access Admin.** The following dialog appears:
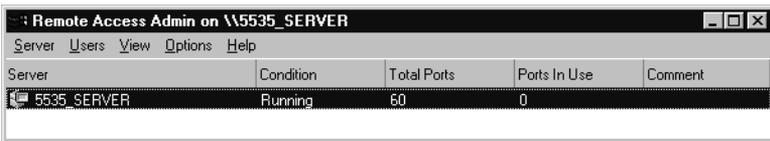
Figure 4-17. Remote Access Admin Dialog

   b. From the **Server** menu, select **Stop Remote Access Service.**

2. After the RAS server is stopped, from the **Start** menu, select **Programs**, then **INTERPHASE WAN Adapters**, and then **LoopTest.**

   The LoopTest dialog appears:
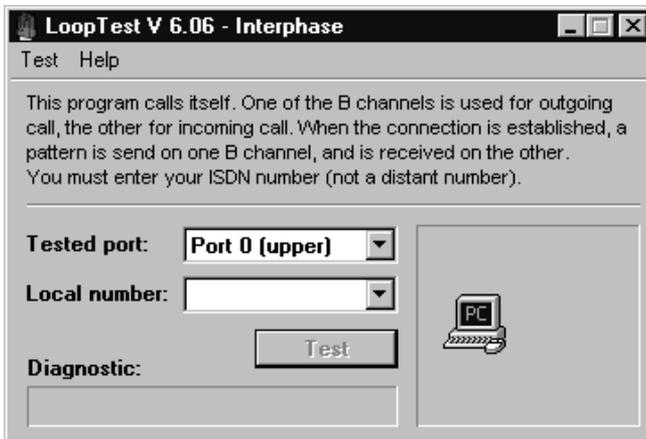
Figure 4-18. LoopTest Dialog

3. Select the port number to test (if your adapter has two PRI ports), and enter your local ISDN number.

4. Click **Test.**

The LoopTest Utility normally finishes with the message *Test passed* in the Diagnostic field.

If the *Test passed* message does not appear, make sure that the ISDN number you entered is correct. For more information about the LoopTest utility and its diagnostics, see *Using the LoopTest Utility* on page 89.

5. Do the following to enable the RAS Server again:

a. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **Access Admin.**

b. From the **Server** menu, select **Start Remote Access Service** to enable the RAS Server.

     c. If Windows NT does not display the server name automatically, enter the server name preceded by two backslashes (\\). To determine the server name, see *Index of Common Tasks* on page 115.

     d. Click **OK.**

To use the adapter in the RAS environment (RAS Server or RAS Dial-Up Networking), see the following:

- For an overview, see *Index of Common Tasks* on page 115.

- For detailed information, see Microsoft RAS online help.

Removing the Drivers

If you no longer use the adapter, do the following to remove the WAN and RAS Support drivers:

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:
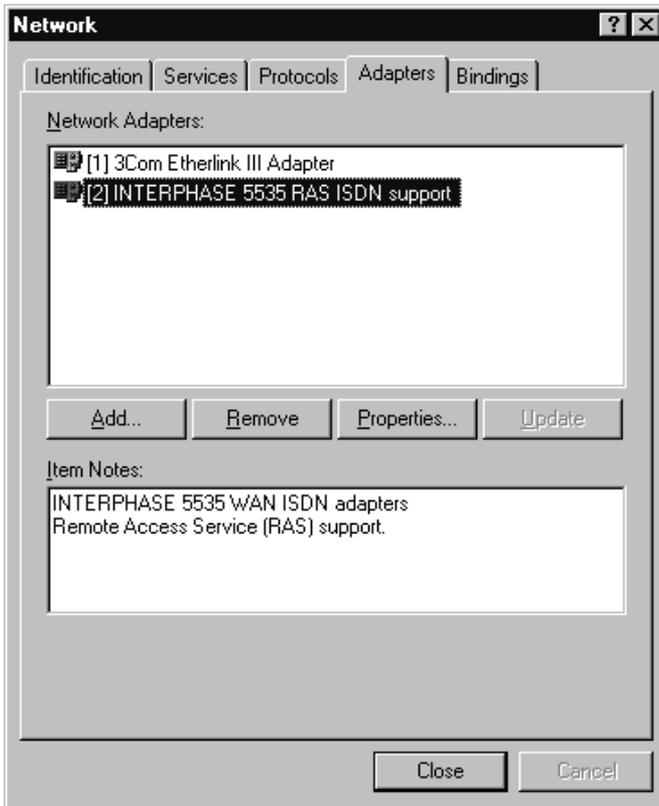
Figure 4-19. Network Adapters List

3. Select **INTERPHASE 5535 RAS ISDN support** (for the *i*SPAN-PRI), and click **Remove.**

A warning message informs you that this action will permanently remove the component, and asks if you want to continue.

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

The Interphase WAN Adapters driver dialog identifies the install path that will be deleted, and asks if you are sure you want to deinstall the software:

INTERPHASE WAN Adapters driver ✕

UNINSTALLATION
Are you sure you want to deinstall this software?

This directory, its files and sub-directories will be deleted:

Install path :   C:\WANSETUP

[Continue]   Cancel   About

Figure 4-20. Uninstallation Main Dialog

5. Click **Continue** to deinstall the WAN Adapters driver.

6. Confirm your choice by clicking **Yes** when a pop-up asks you to confirm the card(s) removal and driver deletion.

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

– Deletes product files and the WAN Adapter program group from the Start menu

– Dynamically unloads the drivers from memory

– Cleans up the registry

When the deinstallation process is finished, the Adapters dialog reappears.

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

The Windows NT Network updates network bindings.

8. **If the *i*SPAN-PRI 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.

Click **OK** to complete the driver deletion.

NOTE

When the system boots up again, the Remote Access Service will fail to initialize. (As a result, RAS errors will appear in the Windows NT Event Viewer). To avoid this problem, uninstall Remote Access Service after you uninstall the adapter, as described in Microsoft documentation and online help. Then restart your computer.

---

9. When a message informs you that you must restart your computer for new settings to take effect, and prompts you to restart your computer, click **Yes.**

Setting Up WAN Firmware and Hardware | 5

Overview

The WAN Adapter Setup utility enables you to manage hardware and firmware for all Interphase WAN adapters. Use this utility to add and remove Interphase WAN adapters and their firmware, and to manage ISDN properties for adapter ports.

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

- Access online help
- Manage adapter firmware and hardware
- Set up ISDN 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.
- Place the cursor on a window control to display a pop-up with the name of the control.

Managing Firmware and Hardware

NOTE

The *i*SPAN-PRI is listed as the *5535* adapter in WAN Adapter Setup dialogs.

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 **INTERPHASE WAN Adapters,** and then **WAN Setup.**

When you start the utility, the WAN Adapters Setup dialog appears:
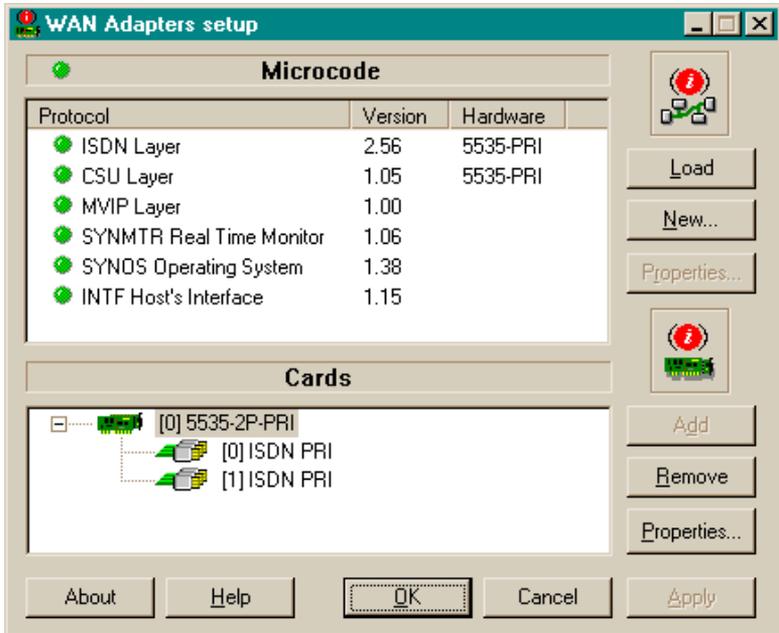
Figure 5-1. WAN Adapters Setup

The WAN Adapters setup dialog has two sections:

- The **Microcode** section is for firmware management.
- The **Cards** section is for hardware management.

Firmware Management

The Microcode section of the Wan Adapter Setup dialog displays firmware information for the currently-selected WAN adapter. It displays the protocols you can use with the adapter, and their status. You can view the microcode status, reload the microcode, or change the microcode.

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

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

Use the following buttons to set up microcode information:

Click...	To do this...
Load	Download the current microcode to the selected adapter. ⚠ **CAUTION** **CAUTION: This option disconnects all current RAS-connected users and disables the RAS Server. After a microcode 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 an alternate microcode as the current one.

📝 **NOTE**

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

Hardware Management

The Cards section of the WAN Adapter Setup dialog displays all the Interphase adapters installed in the machine, their status, and their available communication ports. The

Microcode section displays firmware information for the adapter selected in the Cards section. You can use the buttons in this section to add, remove, or configure WAN adapters.

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.

Use the following buttons to set up adapter hardware:

Click...	To do this...
Add	Add a new adapter. This option is enabled if one more Interphase adapters can be installed.
Remove	Remove an existing adapter. This option removes an adapter and its drivers.
Properties	Display the hardware properties of a selected adapter or the port properties of a selected port. For ISDN ports, these properties are essentially subscription parameters, such as switch type.

Setting Up ISDN PRI Port Properties

NOTE

Before you configure your PRI ISDN line, first obtain the ISDN switch type from your ISDN provider.

Use the ISDN PRI Port Properties dialog to view and set the ISDN port switch type (and, for Europe, the CRC type).

To display the ISDN PRI Port Properties dialog:

1. Select the ISDN port you want to configure in the Cards section of the WAN Adapters setup dialog (shown in Figure 5-1 on page 53.)

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

The ISDN PRI Port Properties dialog appears:
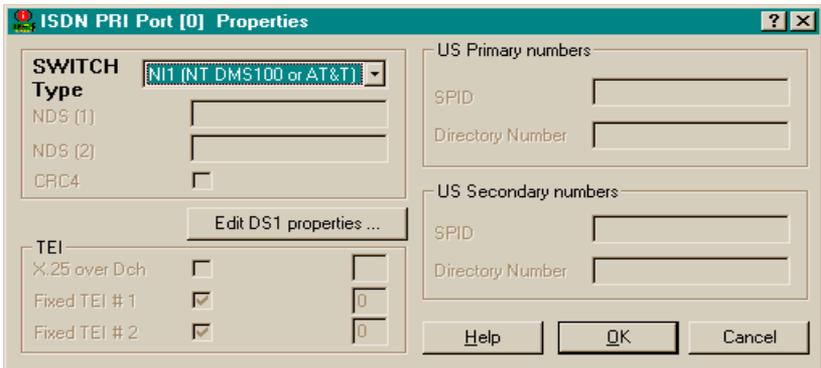
Figure 5-2. ISDN PRI Port Properties

Configuring the Switch Type

In the ISDN PRI Port Properties dialog, select one of the following switch type settings, depending on your location and your ISDN provider's switch type.

- In **North America,** select one of the following switch types:

  – Select **NT DMS100 NI1** if your telephone company uses a Northern Telecom DMS-100 switch that complies with the National ISDN 1(or National

ISDN 2) standard (sometimes referred to as *National*).
Select **AT&T CUSTOM** if your telephone company uses an AT&T 5ESS Custom switch.

All of these switch types offer T1/PRI access (also called *23B+D*).

- In **Europe,** select **ETSI EUROISDN.** This switch type offers E1/PRI access (also called *30B+D*).

Selecting the CRC Type (Europe Only)

If your location is Europe, you also need to select the CRC type in the ISDN PRI Port Properties dialog (shown in Figure 5-2 on page 57). The CRC type depends on the switch type (whether E1 or PRI) and the country:

- For European countries other than France, select **CRC4**.
- For France, deselect **CRC4**.

Editing DS1 Properties (North America Only)

If you have selected an American Switch Type, you can edit the DS1 properties on the DS1 Properties dialog.

To display the DS1 Properties dialog:

1. Select the ISDN port to configure in the Cards section of the WAN Adapters setup dialog (shown in Figure 5-1 on page 53).

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

3. On the ISDN PRI Port Properties dialog (shown in Figure 5-2 on page 57), click **Edit DS1 Properties.**

NOTE

The Edit DS1 Properties button is enabled only when an American Switch Type is selected.

The DS1 Properties dialog appears:
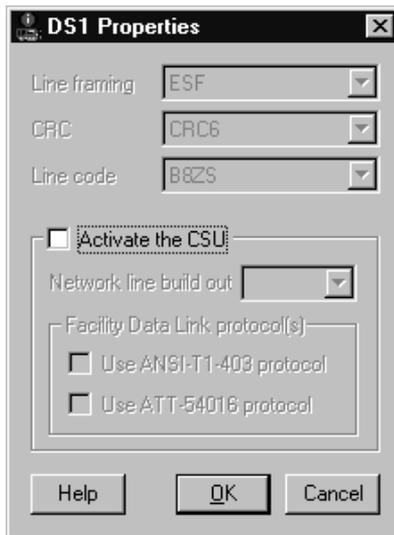
Figure 5-3. DS1 Properties

Line framing, CRC, and Line code parameters describe physical level parameters, which cannot be modified on a PRI Line.

The following table describes DS1 options that can be edited:

Option	Description
Activate the CSU	This option depends on whether the connection between the adapter and the T1 line requires a CSU: • Select **Activate the CSU** to activate a CSU between the network and the adapter. The CSU is included on the *i*SPAN-PRI adapter. However, to activate the CSU you must purchase the CSU option. (An external CSU is not required). • Deselect **Activate the CSU** to deactivate a CSU between the network and the adapter. The CSU facility is protected by a password. You must enter this password when selecting 'Activate the CSU' for the first time. For password instructions, refer to the *Read Me First* information provided in your adapter package.
Network Line Build Out	The Network line build out compensates for the signal attenuation due to the length of the cable between the adapter and the switch. Four values are available (expressed in dB): • 0 • 7.5 • 15 • 22.5. Select the value indicated by your Telco. If this information is not available, use **0 dB**.

Option	Description
Facility Data Link Protocol(s)	Facility Data Link protocols are used to exchange messages between the adapter and the remote end of the network. Such messages are issued by the Telco to put the adapter in loopback mode for testing when problems occur. They are also used to transmit statistics about physical transmission errors on the line. Two protocols are available for the facility data link: the ANSI-T1-403 and the ATT-54016 protocol. Both are compatible with each other. Use the protocol(s) indicated by your Telco. If this information is unavailable, the best choice is to use both protocols.

Setting Up RAS Support Properties

6

Overview

The RAS Support Setup utility enables you to set up an inactivity timer for ISDN connections and determine RAS Support parameters for the adapter.

The chapter explains how to do the following Ras Support Setup tasks:

- Access online help
- Determine RAS Support parameters

Accessing Online Help

For detailed information about the functions described in this chapter, see the RAS Support 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.
- Move the cursor over a window control to display a pop-up with the name of the control.

Determining RAS Support Parameters

You can use the RAS Support dialog to determine the network name of the adapter and set a timeout limit for adapter ports.

NOTE

The *i*SPAN-PRI is listed as the *5535* in RAS Support Setup dialogs.

To access the RAS Support Setup dialog:

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

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

3. On the Adapters dialog, select **INTERPHASE 5535 RAS ISDN support** (for the *i*SPAN-PRI) from the adapters list, and click **Properties.**

   The Interphase 5535 RAS Support dialog appears:
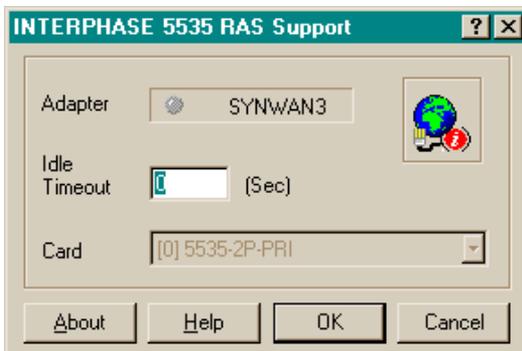
Figure 6-1. RAS Support Dialog

The following table describes the parameters in the 5535 RAS Support dialog fields:

Parameter	Function
Adapter	Identifies 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, *3*) is the logical network adapter number assigned by Windows NT.
Idle Timeout	The Idle timer is an inactivity timer. It is 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.
Card	Displays the name of the physical 5535 adapter.

Troubleshooting

<div style="text-align: right;">

7

</div>

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 the 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 Interphase Technical Support at one of the locations listed in the *Assistance* section at the front of this Users Guide.

Interpreting Adapter LEDs

The *i*SPAN-PRI provides four LEDs above each port:
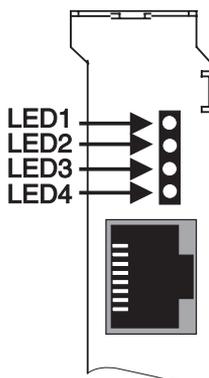
Figure 7-1. Adapter LEDs Arrangement

LED functions differ depending on whether the adapter is configured to operate in North America (with T1/PRI access), in European countries other than France (with E1/PRI access and CRC4), or in France (with E1/PRI access and no CRC type).

North America

In North America, the adapter LEDs for each port function are as follows:

LED	Color	Meaning if the light is ON...
1	Green	Clock is synchronized.
2	Green	Physical layer is active.
3	Yellow	Your ISDN provider is currently sending an RAI alarm to the adapter.
4	Red	Loss Of Signal (LOS), indicating no electrical power is detected on the line.

In their operational state, the LEDs must be as follows:

LED	Color	State must be...
1	Green	On
2	Green	On
3	Yellow	Off
4	Red	Off

The following table describes the adapter status when the sequence of LEDs appears as follows:

LED1	LED2	LED3	LED4	Meaning
On	On	Off	Off	Adapter is operational.
On	On	On	Off	A synchronization problem occurred on the ISDN carrier side.
Off	Off	Off	On	No power is detected on the line. Make sure cable is plugged in correctly.
Off	Off	Off	Off	Your ISDN provider is currently sending an AIS alarm to the adapter.

Europe (Other than France)

In European countries other than France, the adapter LEDs for each port function are as follows:

LED	Color	Meaning if the light is ON...
1	Green	Clock is synchronized.
2	Green	Physical layer is active.
3	Yellow	Your ISDN provider is currently sending an RAI alarm to the adapter.
4	Red	Error: CRC4 not found.

In their operational state, the LEDs must be as follows:

LED	Color	State must be...
1	Green	On
2	Green	On
3	Yellow	Off
4	Red	Off

The following table describes the adapter status when the sequence of LEDs appears as follows:

LED1	LED2	LED3	LED4	Meaning
On	On	Off	Off	Adapter is operational.
On	Off	On	On	Your E1/PRI line does not support CRC4 functionality. Deselect the **CRC4** option. (See *Setting Up ISDN PRI Port Properties* on page 56.)
On	Off	On	Off	Remote Alarm Indication (RAI). Your ISDN provider has synchronization problems and is reporting this problem to you.
On	Off	Off	On	Your E1/PRI line does not support CRC4 functionality. Deselect the **CRC4** option. (See *Setting Up ISDN PRI Port Properties* on page 56.)
Off	Off	Off	Off	No electrical signal is on the E1/PRI line. Make sure your cable is plugged in correctly.

France

In France, the adapter LEDs for each port function are as follows:

LED	Color	Meaning when the light is ON...
1	Green	Clock is synchronized.
2	Green	Physical layer is active.
3	Yellow	Your ISDN provider is currently sending an RAI alarm to the adapter.
4	Red	No meaning.

In their operational state, the LEDs must be as follows:

LED	Color	State must be...
1	Green	On
2	Green	On
3	Yellow	Off
4	Red	Off

The following table describes the adapter status when the sequence of LEDs appears as follows:

LED1	LED2	LED3	LED4	Meaning
On	On	Off	Off	Adapter is operational.
On	Off	On	Off	Your E1/PRI line requires CRC4. Select the **CRC4** option. (See *Setting Up ISDN PRI Port Properties* on page 56.)
On	Off	Off	Off	Your E1/PRI line requires CRC4. Select the **CRC4** option. (See *Setting Up ISDN PRI Port Properties* on page 56.)
Off	Off	Off	Off	Either no electrical signal is on the E1/PRI line, or your ISDN provider is currently sending an AIS alarm to the adapter. Make sure your cable is plugged in correctly.

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 driver files to the installation directory. (That is, the cards list is empty on the WAN Adapter Setup dialog, as described on page 33 of *Installing the Software*.)
	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 7.
	3. If the WAN Adapter Setup still cannot detect the adapter, see *Computer does not boot up or Host adapter not found* on page 73.
	When the adapter is installed, continue as follows:
	1. From the **Start** menu, select **Programs**, then **INTERPHASE WAN Adapters,** and then **WAN Setup.**
	2. Click **Add** on the main dialog, and do the following, (as instructed in *Installing the Software*):
	a. Configure the adapter's ISDN ports, as described in step **9** on page 35.
	b. Start the WAN and RAS support software installation as described in steps **1** through **6,** starting on page 28.
	c. Complete the steps described in *Setting up RAS Support Properties* on page 36, *Setting Up ISDN B Channels as RAS Ports* on page 38, and *Checking the ISDN Line with LoopTest* on page 43.

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 Interphase 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 94.
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 115.) **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. (Does SynWatch see the ISDN call in progress? Is this call accepted by the remote system?) **5.** Use SynWatch to see if a PPP negotiation problem exists.

Problem	Possible Solution(s)
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 115: **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 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. (Does SynWatch see the ISDN call in progress? Is this call accepted by the remote system?) **7.** 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 115.)
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).

Problem	Possible Solution(s)
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 115.) **2.** In the **WAN Adapter Setup** program, check that the ISDN Layer is present in the adapter microcode.
CSU activation failed at load time	If a message appears at load time informing you that the CSU activation failed, you probably entered an invalid password for CSU activation. Enter the password again to activate the CSU and reload. See *Editing DS1 Properties (North America Only)* on page 58 for additional information.

Specifications

<div style="border:1px solid black; display:inline-block; padding:10px; font-size:2em; font-weight:bold">A</div>

Adapter Specifications

Item	Specification
Host Bus Interface	PCI Local Bus Revision 2.1
PCI Form Factor	Length: 174.6 mm Width: 106.7 mm Depth: 17.2 mm
Host Data Transfer	Adapter with 2 PRI ports: 8MB dual port DRAM Adapter with 1 PRI port: 4MB dual port DRAM
Optional Functions	32-bit, 33-MHz local bus
Operating Power	1.3A maximum @ 5.0 VDC

Operating Environment

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

Storage Environment

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

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

Using the SynWatch Utility

<div style="border:1px solid black; display:inline-block; padding:10px; font-size:2em; font-weight:bold;">B</div>

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, as well as 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 various SynWatch tasks, such as:

- Access online help
- Start the utility
- Use mouse buttons to select SynWatch functions
- Watch ISDN channels
- Watch ISDN Layer 1 alarms
- 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.
- Move the cursor over a window control to display a pop-up with the name of the control.

Starting SynWatch

NOTE

The *i*SPAN-PRI is listed as the *5535* adapter in SynWatch dialogs.

To start Synwatch, from the **Start** menu, select **Programs**, then **INTERPHASE WAN Adapters**, and then **SynWatch**. The main SynWatch dialog appears:
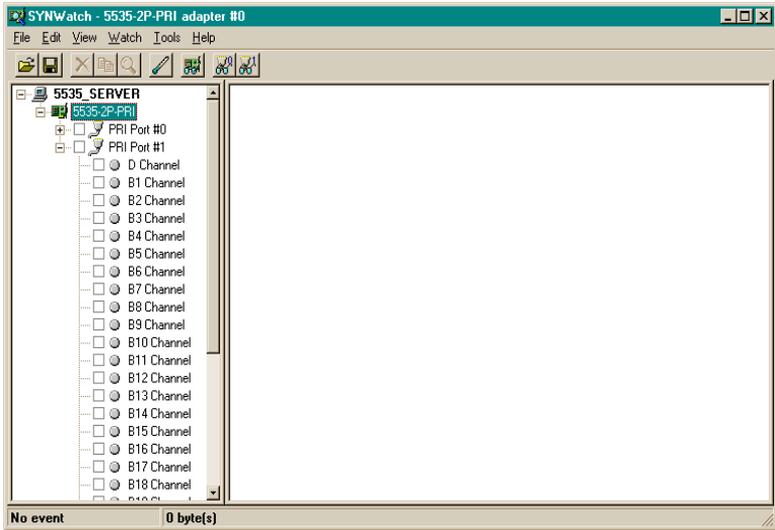
Figure B-1. Main SynWatch dialog

The main SynWatch dialog has 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**: Ports available on an adapter

- **Fourth level**: Channels available on a port

  Each port has one ISDN D channel and 23 ISDN B channels (on an American ISDN switch), or 30 ISDN B channels (on an ETSI ISDN switch).

Mouse Button Functions

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

	Left-click the checkbox 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 checkbox beside the *port*. To select or deselect all of an *adapter's ports*, left-click the checkbox 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.

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.

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 **Hexadecimal Dump** to see Hexadecimal dump of signalling frames (in Hexadecimal Dump 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 be sure to capture call data, you must activate traces for all the ISDN 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.

   To activate watching on *all* ISDN channels, select the PRI port related to the adapter (Port #0 or Port #1) in the configuration panel of the Synwatch dialog.

   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):

   – X25

   – PPP

   – Frame Relay

   – SDLC

   – QLLC

   – Hexadecimal Dump

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

Watching ISDN Layer 1 Alarms

ISDN Layer 1 alarms are managed by the adapter, and are activated when physical events occur.

To display these alarms using SynWatch:

1. In the Configuration panel of the SynWatch dialog, right-click the PRI port for which to display alarms.

2. Select to enable **Layer 1 alarms.**

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.

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 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. You can change the watch mode, enabling SynWatch to reinterpret the frame protocol.

Here is an example of when it is useful to change the watch mode: 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** 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 Hexa Dump 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 required.

Editing ISDN Channel Settings

The monitor panel displays information about each exchanged frame listed in text lines in the monitor panel. You can define different display fonts and/or color(s) for each ISDN channel.

To change the font or color 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 appears, select the **Colors** tab to display the Colors dialog:
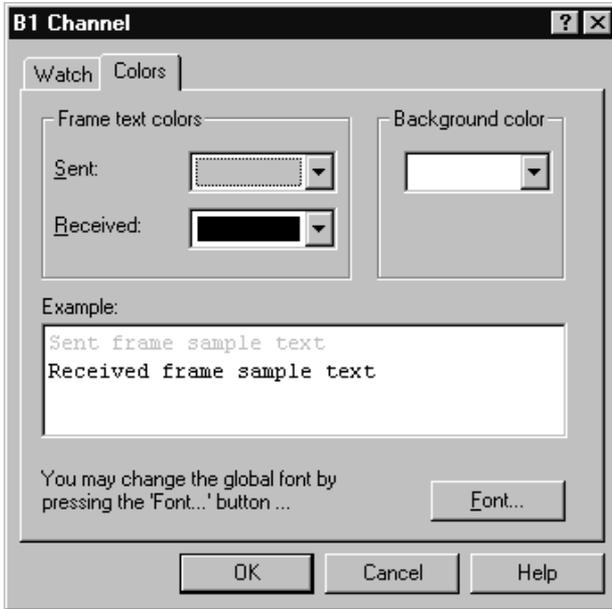
Figure B-4. ISDN Channel Settings

> **3.** Choose the font and/or color(s) you want to use for this
> channel, and click **OK.**

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. On the other hand,
SynWatch can read or reinterpret a binary file.

Using the LoopTest Utility   C
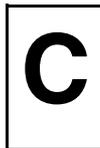
Overview

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

LoopTest also 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 gets to 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.

This appendix explains how to perform various LoopTest tasks, including:

- Access online help
- Test your ISDN line
- Display and save events
- Customize LoopTest
- 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.
- Move the cursor over a window control to display a pop-up with the name of the control.

Testing your ISDN Line

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 **Programs**, then **Administrative Tools (Common),** and then **Remote Access Admin.**

The following dialog displays information about the 5535 (*i*SPAN-PRI) server:
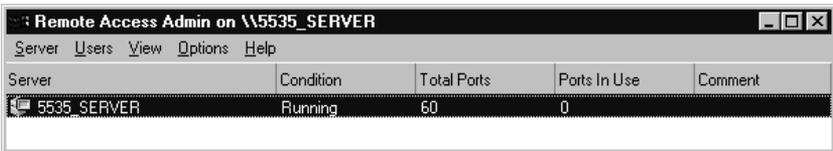
Figure C-1. Remote Access Admin

b. From the **Server** menu, select **Stop Remote Access Service.**

2. From the **Start** menu, select **Programs**, then
   INTERPHASE WAN Adapters, and then **LoopTest.**
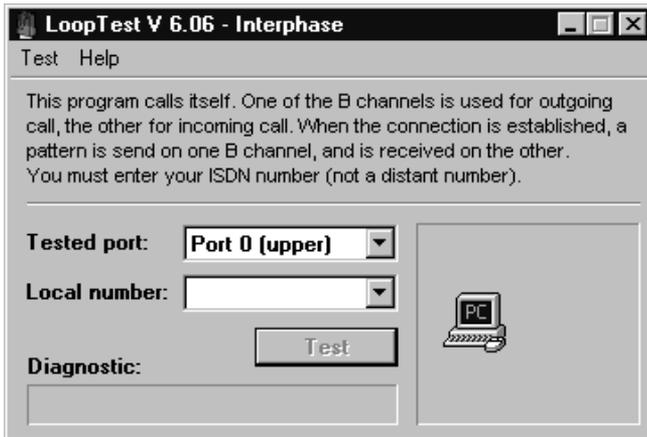
   The main LoopTest dialog appears:

Figure C-2. LoopTest main dialog

3. Select the port to test from the drop-down list (if your
   adapter has two PRI ports), and enter your own 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
   about the cause and circumstances of the error. For
   more detailed information about these messages, see
   Understanding LoopTest Messages on page 94.

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 2 to 4 for each channel or port. (You can change the number of frames sent if you want a longer test—see *Setting the Number of Frames to Send* on page 93).

5. To re-enable the RAS Server:

   a. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **Remote Access Admin.**

   b. From the **Server** menu, select **Start Remote Access Service.**

   c. If Windows NT does not display the name automatically, enter the server name preceded by two backslashes (\\). To determine the server name, see *Index of Common Tasks* on page 115.

   d. Click **OK.**

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 steps **1** and **2** of *Testing your ISDN Line* on page 90.

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

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

Setting the Number of Frames to Send

You can set the number of frames you want LoopTest to send during communication.

To set the number of frames to send:

1. Access the LoopTest main dialog, as described in step **2** of *Testing your ISDN Line* on page 90.

2. Select the **Parameters** option from the **Test** menu to display the Test Parameters dialog.
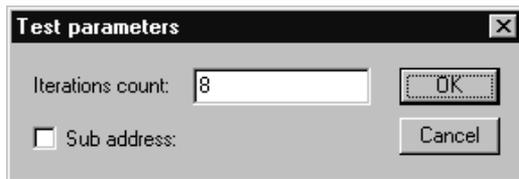
Figure C-3. LoopTest parameters

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

(The sub-address is not used for the *i*SPAN-PRI testing.)

Understanding LoopTest Messages

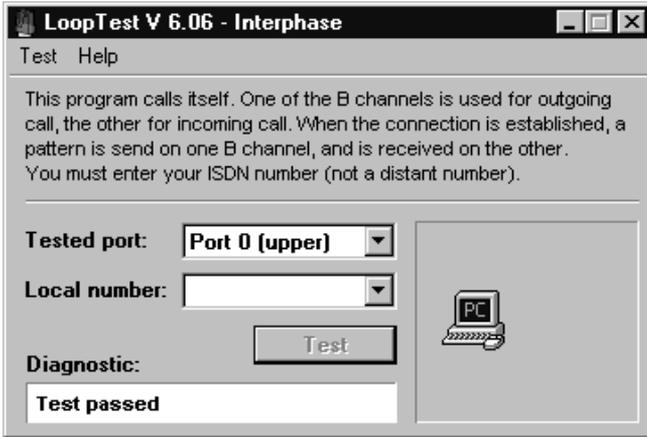The Diagnostic field in the main LoopTest dialog displays LoopTest test results:

Figure C-4. LoopTest Main Dialog

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 **INTERPHASE WAN Adapters,** and then **WAN Setup.**
	
	  b. Make sure the firmware contains the ISDN layer.

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 **INTERPHASE WAN Adapters,** and then **WAN Setup.** **b.** See if the microcode is loaded (LEDs 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.

Message	Cause
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 90.
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**.

Using RAS Utilities

<div style="float:right; border: 2px solid black; padding: 10px; font-size: 2em; font-weight: bold;">D</div>

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 following 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 following 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. It makes Windows NT Server an even more compelling platform for communications.

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)

- An easy, intuitive, remotable graphical user interface and command line interface with scripting

- 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 following web site: `www.microsoft.com`

Using the LineTest Utility

<div style="border:1px solid;">E</div>

Overview

⚠ *CAUTION*

The LineTest utility should be used only in cases of trouble at installation, and only with Telco agreement.

When an adapter port is working properly, it is in Operational mode. The LineTest utility enables you to set port modes so that you can do low-level testing.

This appendix explains how to do the following LineTest tasks:

- Access online help
- Set port testing and clock modes

Accessing Online Help

For detailed information about the functions described in this appendix, see the LineTest 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.
- Move the cursor over a window control to display a pop-up with the name of the control.

Determining the Current Port Mode

NOTE

The *i*SPAN-PRI is listed as the *5535* in LineTest utility dialogs.

To determine the port's current mode:

1. From the Start menu, select Programs, then INTERPHASE WAN Adapters, and then LineTest. The main LineTest dialog appears.

Figure E-1. LineTest Dialog

On this dialog, animated port icons and a text message provide a continuously updated status of the port mode.

Setting Port and Clock Modes

To set port and/or clock modes on the adapter:

1. Access the LineTest dialog, as described in step **1** of *Determining the Current Port Mode* on page 102.

---

2. Click **Select mode** to display the Port Test Configuration dialog.
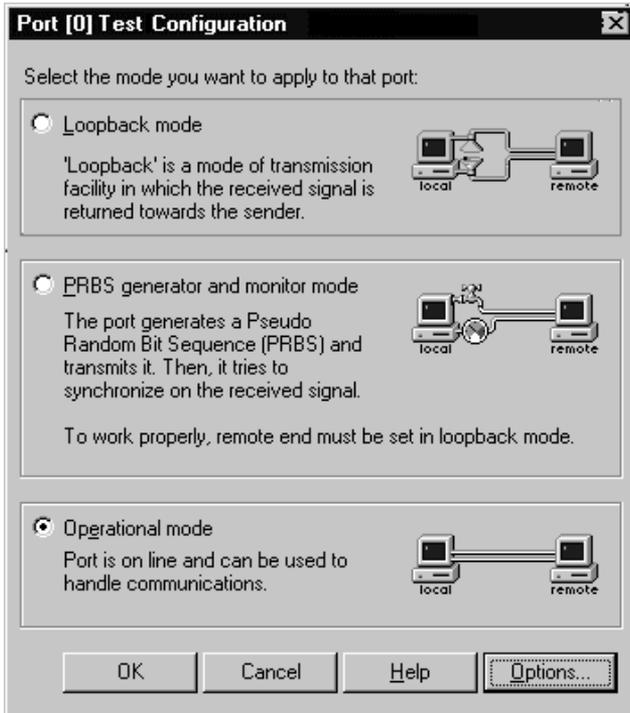
Figure E-2. Port Test Configuration Dialog

3. Select the appropriate port or clock mode for your testing or operating needs.

The following sections provide detailed information about setting these modes.

Loopback Mode

Loopback mode is a transmission state in which the signal received by the port is returned to the sender. Use this mode when the remote end (the Telco, for example) is testing your line; all information sent is returned to the remote end.

To select this mode, select **Loopback mode** on the Port Test Configuration dialog (shown in Figure E-2 on page 103).

Two loopback settings are available:

- Line loopback

  The signal returned to the loopback command source consists of the full signal. Bit sequence integrity is maintained. No change in framing occurs, and no bipolar violations are removed. This is the default loopback setting.

- Payload loopback

  The signal returned to the loopback command source consists of the payload of the received signal and newly-generated ESF framing.

To select one of these loopback modes:

1. Click **Options** on the LineTest Configuration Dialog.

    The LineTest Options dialog appears:
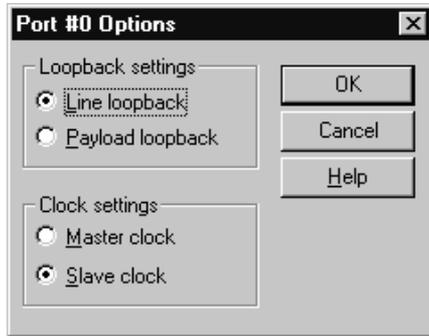
Figure E-3. Port Options dialog

2. Select the LoopTest setting you want to use.

PRBS Generator and Monitor Mode

The PRBS Generator and Monitor mode causes a port to generate and transmit Pseudo Random Bit Sequences online while it tries to synchronize on the received signal.

> ⚠ *CAUTION*
>
> **Use this mode only with Telco agreement. Also, when you use this mode, make sure that remote equipment is set to loopback mode.**

To select this mode, select **PRBS Generator and Monitor mode** on the Port Test Configuration dialog (shown in Figure E-2 on page 103).

When this mode is selected, the text message portion of the LineTest main dialog displays the following synchronization results:

Message	Meaning
No error	The receiving bit sequences completed, and the port found no errors when comparing sent and received bit sequences.
X bits in error/sec	The port is comparing received bit sequences with sent bit sequences. Each erroneous bit found is added, and the sum is displayed each second.
Not synchronized	The port is unable to recognize what it sent.

Operational Mode

After a test has completed, you must return the port used for testing to Operational mode so that it can handle incoming and outgoing communications.

To return the port to Operational mode, select **Operational mode** on the Port Test Configuration dialog (shown in Figure E-2 on page 103).

Before closing the LineTest utility, you are requested to restore each port in testing mode to the operational mode.

Clock Modes

In some test configurations (such as *back-to-back* configurations), a port must use the remote adapter clock to successfully synchronize on the received signal.

In such configurations, the clock of the local port must be in slave mode, and the clock of the remote adapter must be in master mode (which is the default clock type).

To set the clock mode:

1. Click **Options** on the Port Test Configuration Dialog (shown in Figure E-2 on page 103).

The Port Options dialog appears:
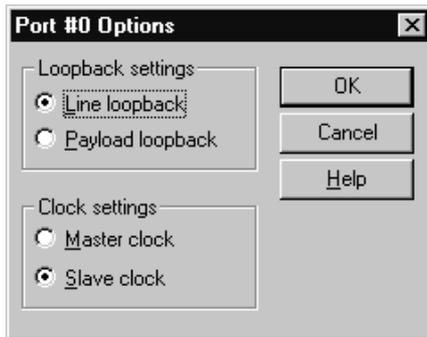
Figure E-4. LineTest Options dialog

2. Select the clock setting you want to use.

Using the LineStatus Utility

Overview

The LineStatus utility enables you to see what's wrong when a problem occurs with your network adapter (for example, if you cannot connect to a remote site or if no one can connect to your host).

This appendix explains how to do the following:

- access online help
- interpret alarm, error, loopback, and statistics information.

Accessing Online Help

For detailed information about the functions described in this appendix, see the LineStat 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.
- Move the cursor over a window control to display a pop-up with the name of the control.

Interpreting LineStatus Indicators

NOTE

The *i*SPAN-PRI is listed as the *5535* in the LineStatus dialog.

The LineStatus dialog displays LEDs and statistics about each adapter port. It notifies you of alarms, errors, loopback mode, and statistics related to the port. When a port is operating under normal conditions, all LEDs are grey.

To view LineStatus information:

1. From the **Start** menu, select Programs**,** next INTERPHASE WAN Adapters, and then **LineTest.** The main LineTest dialog appears.
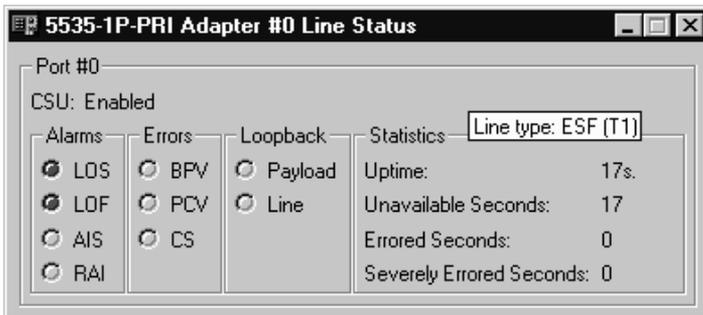
Figure F-1. Main LineStatus dialog

The following sections provide detailed information about LineStatus LEDs and statistics.

Alarm LEDs

The following alarm LEDs indicate connection problems that result from line failures:

LED	Meaning
LOS	Loss of Signal. Typically appears when no electrical signal is detected. (check if line is plugged on the adapter and on the network interface).
LOF	Loss of Frame (also known as *Red Alarm*) appears when many frames are lost because of framing errors. The terminal is unable to synchronize on the DS1 signal.
AIS	Alarm Indication Signal (also known as *Blue Alarm*). Transmitted instead of the normal signal to maintain transmission continuity. Also indicates to the receiving equipment that a transmission interruption occurred either at the equipment originating the AIS signal, or upstream of the originating equipment.
RAI	Remote Alarm Indication (also known as *Yellow Alarm*). Transmitted in the outgoing direction when a terminal determines that it has lost the incoming signal.

Error LEDs

The following error LEDs indicate port error events that generate communication problems:

LED	Meaning
BPV	BiPolar Violation. For an AMI-coded signal, the occurrence of a pulse of the same polarity as the previous pulse causes a BPV error event.
PCV	Path Coding Violation. • In D4 and E1-nonCRC formats, a frame synchronization bit error. • In ESF and E1-CRC formats, a CRC error.
CS	Controlled Slip. Results from the replication or deletion of the payload bits of the DS1 frame. A Controlled Slip may be performed when there is a timing difference between a synchronous receiving terminal and the received signal.

Loopback LEDs

The following Loopback LEDs indicate whether the port is in a loopback mode (which can be why it isn't running normally):

LED	Meaning
Payload	The signal returned toward the source of the loopback command consists of the payload of the received signal (with bit sequence integrity retained), and newly-generated ESF framing.
Line	The signal returned to the loopback command source consists of the full signal. Bit sequence integrity is maintained, framing is not changed, and Bipolar Violations are not removed. (See *Error LEDs* on page 112 for information about Bipolar violations.)

Statistics Parameters

The following statistics fields display performance parameters accumulated during the last 24 hours the interface is running:

Parameter	Meaning
Uptime	Length of time that the interface has been running.
UnAvailable Seconds	(Also known as *UAS*). Number of seconds that the interface is unavailable. The DS1 interface is considered unavailable from the onset of 10 contiguous SESs, or the onset of the condition leading to a failure.
Errored Seconds	(Also known as *ES*). Number of seconds during which any the following have existed: • One or more PCV • One or more LOF • One or more CS • Detected AIS defect
Severely Errored Seconds	(Also known as *SES*). For ESF signals, number of seconds during which any of the following have existed: • 320 or more PCVs • One or more LOFs • Detected AIS defect CSs are not included in this parameter.

Quick Reference of Common Tasks

<div style="border:1px solid; display:inline-block; padding:4px 12px;">**G**</div>

Overview

This section explains how to complete common tasks associated with the *i*SPAN-PRI 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.	116
Determine the server name needed to start the Remote Access Server.	116
Know which adapter's port is used when calling with an ISDN RAS port.	117
See if the drivers are running.	117
Open the Remote Access Setup.	118
Bind a protocol to an ISDN RAS Port.	118
Configure a RAS port to accept incoming calls.	119
Configure a RAS port to dial out.	119
Manage RAS incoming ports.	119
Determine how many remote users are connected.	119
Determine how many ports are available.	119
Make a RAS outgoing call.	119
Configure a multilink connection.	120

For information about how to…	See page...
Enable IPX or IP routing.	121
Allow a remote user to set a specific IP address.	122
Supply an IP address from a static address pool to a remote user.	123
Disconnect an ISDN port automatically when no data traffic occurs after a specified length of time.	124

Procedures

NOTE

The *iSPAN-PRI* is listed as the *5535* in software dialogs.

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.

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 *i*SPAN-PRI is the only ISDN RAS-capable device):
	
	• Port #0: ISDN 1 - 23 (USA)
	    ISDN 1 - 30 (Europe)
	
	• Port #1: ISDN 24 - 46 (USA)
	    ISDN 30 - 60 (Europe)

See if the drivers are running	1. From the **Start** menu, select **Programs,** then **Administrative Tools (Common),** and then **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*: – Interphase 5535 RAS ISDN – Interphase SYNOS V6 API – Interphase WAN Adapters In addition, the software LEDs must be green in the WAN Adapter Setup dialog and the Interphase 5535 RAS Support Properties dialog.

If you want to...	Do this...
Open Remote Access Setup	**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:
	3. From the Network Services list, select **Remote Access Service,** and then click **Properties.**
	Figure G-1. Remote Access Setup
Bind a protocol to an ISDN RAS Port	**1.** Open the **Remote Access Setup** dialog. (See *Open Remote Access Setup* on page 118). 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.
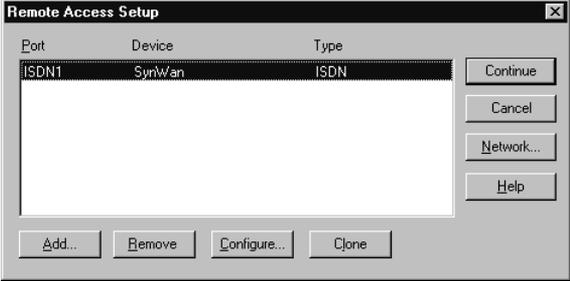
If you want to...	Do this...
Configure a RAS port to accept incoming calls	**1.** Open the **Remote Access Setup** dialog. (See *Open Remote Access Setup* on page 118). Then click **Configure.**
	2. Enable either the **Receive calls only** or the **Dial out and Receive calls** option.
	3. Confirm your choice by clicking **OK.**
Configure a RAS port to dial out	**1.** Open the **Remote Access Setup** dialog. (See *Open Remote Access Setup* on page 118). 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.

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.
	c. From the Network Services list, select **Remote Access Service,** and then click **Properties.**
	d. In the Remote Access Setup dialog, click **Network** to display the Network Configuration dialog.
	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.

If you want to...	Do this...
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 only activated if different IPX internal network numbers are assigned between the two network adapters. For more detailed information, see the Microsoft networking online help.
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.

If you want to...	Do this...
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, click **Network.**
	5. In the **Network** dialog, click the TCP/IP **Configure** button.
	6. In the RAS server TCP/IP Configuration dialog, enable the **Allow remote clients to request a predetermined IP address** option.

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, click **Network.**
	5. In the **Network** dialog, click the TCP/IP **Configure** button.
	6. In the RAS server TCP/IP Configuration dialog, 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 G-2. IP addressing

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 **Adapter** tab. **3.** From the adapter list, select **INTERPHASE 5535 RAS ISDN support,** and then click **Properties.** **4.** On the RAS Support dialog, 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.

ISDN Technology Overview

<div style="border:1px solid black; display:inline-block; padding:4px 12px; font-weight:bold; font-size:large">H</div>

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.

Regulatory Statements

<div style="border:1px solid">

I

</div>

FCC

*i*SPAN-PRI FCC Part 15 Regulatory Compliance

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.

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 04DU9-1SN.
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 Interphase Corporation at 214-654-5000 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.

Canada

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 to the Model 5535_2PRI_MVIP device.

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.

Tested to Comply with Canadian Standards

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

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

Europe

Regulatory Information for Europe

This equipment displays the CE 165 X 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 72/23/EEC, as amended by Directive 93/68/EEC).

EN60950–IEC950 Security Standard

This equipment complies with the EN60950–IEC950 security standard, with the following restrictions:

- The modem card must be used only in a data terminal equipment (DTE)—for example, a computer—with a screw-down cover or lid. Because unsafe voltages (TNV) exist on the modem card, disconnect the modem card from the telephone line while the cover (lid) of the DTE (computer) is removed.

- The card must be installed in the DTE in a way that ensures at least 2 mm of air space between the PCB card and any other components in the DTE.

BABT Guidelines for ISDN Cards

The ISDN cable(s) must remain disconnected from the telecommunications system until the card has been installed in a host which provides necessary protection of the operator.

- If you need to open the host equipment later for any reason, ISDN cable(s) must be disconnected prior to accessing the ISDN adapter.

-

C (UL) US Accessory

These cards are for use only with UL Listed personal computers that have instructions detailing installation of accessories by the user.

Glossary

2B+D ◆ **See BRI.**

23B+D ◆ See PRI.

30B+D ◆ See PRI.

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).

AIS (Alarm Indication Signal) ◆ PRI alarm, also known as *Keep Alive* or *Blue* signal. An unframed all-ones signal sent to maintain transmission continuity.

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.

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 the USA.

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.

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

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 64 Kbps 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 (multi-rate services).

BPV (BiPolar Violation) ◆ A BPV error event for an AMI-coded signal is the occurrence of a pulse of the same polarity as the previous pulse.

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.

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) on page ITU (International Telecommunication Union).

Centrex ◆ Local Public Exchange with PBX facilities.

channel aggregation ◆ Channel aggregation combines multiple physical channels into one logical channel of greater bandwidth.

CO (Central Office) ◆ The site where the local Telco switches reside for all the telephone system's call routing and 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 beyond the telephone service demarcation point. In the USA this typically includes the NT1 and all ISDN devices. Customer equipment may also include inside wiring, as well as telephone modems, ISDN equipment, and so on.

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.

CS (Controlled Slip) ◆ A CS is the replication or deletion of the payload bits of the DS1 frame. A Controlled Slip may be performed when there is a difference between the timing of a synchronous receiving terminal and the received signal.

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. Contrast with CSV.

CSU/DSU (Channel Service Unit/ Data Service Unit) ◆ A device which 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. Contrast with CSD.

D channel ◆ One of the three standard channels on a BRI line. At 16 Kbps, a D channel carries all signaling information and can carry low-speed packet data such as X.25 packet switching.

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.

Directory Number ◆ Your seven digit telephone number (without the area code), as found in the telephone directory. Each BRI connection can have up to two directory numbers, one for each B channel.

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.

DSU ◆ See CSU/DSU.

ETS (European Telecommunications Standard)

ETSI ◆ ETSI is 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.

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

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 framing protocol specified by the ISO that can provide error-free Data Link layer services.

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

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.

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 to 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-D (Link Access Procedure-D) ◆ A Data Link layer procedure using D channel communications, typical of ISDN.

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

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

LED ◆ Light Emitting Diode

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

LLC/SNAP (Logical Link Control/SubNetwork Attachment Point)

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

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 serves that customer. (ISDN service *could* be available at a longer distance than that with a repeater.)

LOS (**Loss Of Signal**) ◆ PRI alarm.

LT (**Line termination**) ◆ The equivalent of the NT1 function at the Central Office.

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 also 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.

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 also IP (Internet Protocol).

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.

NET (Normes Européennes de Télécommunication) ◆ 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.

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.

NSAP (Network Services Access Point) ◆ In the OSI environment, 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 an 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 in 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).

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

PSTN (**Public Switched Telephone Network)**

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 that were created by the AT&T divestiture: Nynex, Bell Atlantic, Bell South, Southwestern Bell, US West, Pacific Telesis and Ameritech.

REN (Ringer Equivalence Number) ◆ A standard requirement of the FCC for devices such as a telephone or answering machine. The required REN 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 archived as historical recommendations.

RJ-45 connector ◆ Standard 8-wire connector for IEEE 802.3 networks and some telephone applications.

router ◆ A 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.

SAPI (Service Access Point Identifier) ◆ Part of the address in an ISDN signalling frame. Identifies the service that the signalling frame is intended for.

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.

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 (Signaling System 7) ◆ This is a common channel signaling system used to establish ISDN call functions.

Switch Type ◆ The type of equipment that the telephone company uses to provide you with ISDN service.

synchronous transmission ◆ A data transmission scheme where the interval between transmitted characters is fixed so that start and stop bits are not required. As opposed to asynchronous transmissions, synchronous transmissions are guaranteed a specific percentage of bandwidth on the network medium.

TCP/IP (Transmission Control Protocol/Internet Protocol) ◆ A set of communications protocols that define how different types of computers talk to each other. It is the standard architecture for internetworking multiple organizations, and the common link that ties the huge Internet together.

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.

U Interface ◆ The interface point between the user premises network termination (NT1) and the local digital exchange.

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.25 ◆ Packet-switching protocol that lets computers communicate via wide-area packet-switched data networks.

Index

When using this index, keep in mind that a page number indicates only where referenced material begins. It may extend to the page or pages following the page referenced.