

Note

Before using this information and the product it supports, be sure to read the general information under Appendix G, "Product Warranties and Notices" on page 89 and "Electronic Emission Notices" on page 94.

Third Edition (September 1995)

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Department E02
Design & Information Development
IBM Corporation
PO Box 12195
RESEARCH TRIANGLE PARK NC 27709-9990
USA

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Important Information for the USA

Safety Information

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electrical shock, and injury to persons, including the following:

- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.
- Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electrical shock from lightning.
- Do not use the telephone to report a gas leak in the vicinity of the leak.

Safety Notices



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



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



Vorsicht: Bevor mit der Installation des Produktes begonnen wird, die Sicherheitshinweise in *Achtung: Sicherheitsinformationen—Bitte zuerst lesen*, IBM SD21-0030. Diese



Veröffentlichung beschreibt die Sicherheitsvorkehrungen für das Verkabeln und Anschließen elektrischer Geräte.



Fare: Før du begynner å installere dette produktet, må du lese sikkerhetsinformasjonen i *Advarsel: Sikkerhetsinformasjon — Les dette først*, SD21-0030 som beskriver sikkerhetsrutinene for kabling og tilkobling av elektrisk utstyr.



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



Perigo: Antes de começar a instalar este produto, leia as informações de segurança contidas em *Cuidado: Informações Sobre Segurança—Leia Isto Primeiro*, SD21-0030. Esse folheto descreve procedimentos de segurança para a instalação de cabos e conexões em equipamentos elétricos.



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



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



Pericolo: prima di iniziare l'installazione di questo prodotto, leggere le informazioni relative alla sicurezza riportate nell'opuscolo *Attenzione: Informazioni di sicurezza — Prime informazioni da*

leggere in cui sono descritte le procedure per il cablaggio ed il collegamento di apparecchiature elettriche.



Varning — livsfara: Innan du börjar installera den här produkten bör du läsa säkerhetsinformationen i dokumentet *Varning: Säkerhetsföreskrifter— Läs detta först*, SD21-0030. Där beskrivs hur du på ett säkert sätt ansluter elektrisk utrustning.



VAARA: Ennen kuin aloitat tämän tuotteen asennuksen, lue julkaisussa *Varoitus: Turvaohjeet—Lue tämä ensin*, SD21-0030, olevat turvaohjeet. Tässä kirjasessa on ohjeet siitä, miten sähkölaitteet kaapeloidaan ja kytketään turvallisesti.



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



Peligro: Antes de empezar a instalar este producto, lea la información de seguridad en *Atención: Información de Seguridad — Lea Esto Primero*, SD21-0030. Este documento describe los procedimientos de seguridad para cablear y enchufar equipos eléctricos.



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



Peligro: Antes de empezar a instalar este producto, lea la información de seguridad en *Atención: Información de Seguridad — Lea Esto Primero*, SD21-0030. Este documento describe los procedimientos de seguridad para cablear y enchufar equipos eléctricos.



Danger: Voordat u begint met het installeren van dit produkt, dient u eerst de veiligheidsrichtlijnen te lezen die zijn vermeld in de publikatie *Caution: Safety Information - Read This First*, SD21-0030. In dit boekje vindt u veilige procedures voor het aansluiten van elektrische apparatuur.



Vigyázat: Mielőtt megkezdi a berendezés üzembe helyezését, olvassa el a *“Caution: Safety Information— Read This First, SD21-0030* könyvecskében leírt biztonsági információkat. Ez a könyv leírja, milyen biztonsági intézkedéseket kell megtenni az elektromos berendezés huzalozásakor illetve csatlakoztatásakor.



Uwaga:

Przed rozpoczęciem instalacji produktu należy zapoznać się z instrukcją: "Caution: Safety Information - Read This First", SD21-0030-02.

Zawiera ona warunki bezpieczeństwa przy podłączaniu do sieci elektrycznej i eksploatacji.



Pozor: Preden začnete z instalacijo tega produkta preberite poglavje: "Opozorilo: Informacije o varnem rokovanju-preberi pred uporabo," SD21-0030-02. To poglavje opisuje pravilne postopke za kabliranje,



Upozornění: než zahájíte instalaci tohoto produktu, přečtěte si nejprve bezpečnostní informace v pokynech „Bezpečnostní informace“ č. 21-0030-02. Tato brožurka popisuje bezpečnostní opatření pro kabeláž a zapojení elektrického zařízení.



危險：安裝本產品之前，請先閱讀
"Caution: Safety Information--Read
This First" SD21-0030-02 手冊中所提
供的安全注意事項。這本手冊將會說明
使用電器設備的纜線及電源的安全程序。



위험: 이 제품을 설치하기 전에 반드시
"주의: 안전 정보-시작하기 전에"
(SD21-0030-02)에 있는 안전 정보를
읽으십시오.



危険：導入作業を開始する前に、安全に関する
小冊子SD21-0030-02の「最初にお読みください」
(Read This First)の項をお読みください。
この小冊子は、電気機器の安全な配線と接続の
手順について説明しています。



About This Manual

This manual describes the installation and testing procedures for the IBM WaveRunner Digital Modem adapter. Two procedures are described, one to install the WaveRunner Adapter in a computer equipped with Industry Standard Architecture (ISA), and one to install the WaveRunner Adapter in a computer equipped with Micro Channel architecture.

There are also instructions on how to order integrated-services digital network (ISDN) service, configure the WaveRunner Adapter to operate with the ISDN, and install the software necessary for your WaveRunner Adapter to operate with the ISDN.



Introduction to the WaveRunner Digital Modem

The IBM WaveRunner Digital Modem (WaveRunner Adapter) is an adapter that provides a digital connection to a personal computer system for communications over an integrated services digital network (ISDN). It communicates with most ISDN devices at 64 Kbps and some proprietary configurations at 128 Kbps, while maintaining the ability to communicate through an ISDN to analog modems and facsimile (fax) machines connected to an existing telephone network. (See Figure 1.)

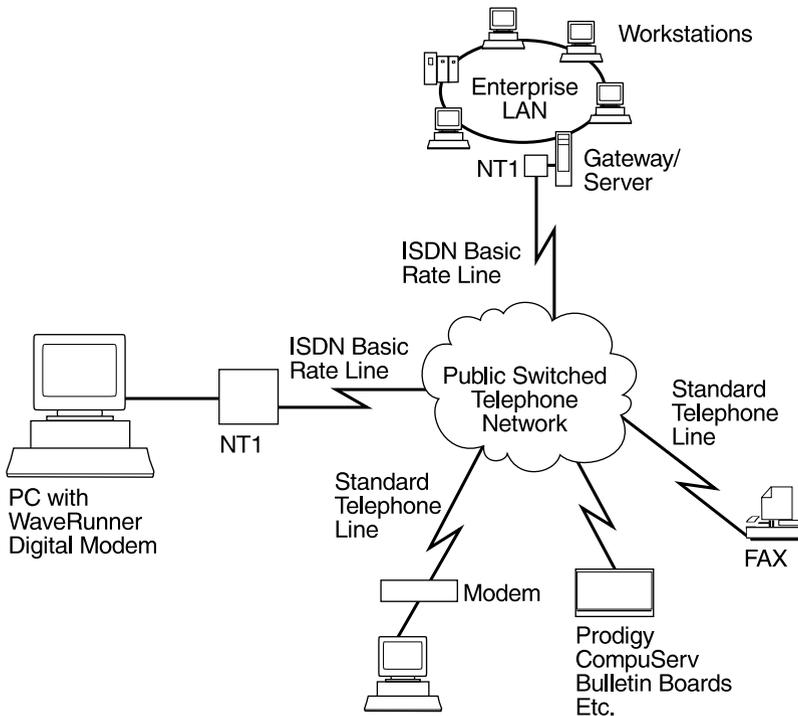


Figure 1. The WaveRunner Adapter in an ISDN Environment

The WaveRunner Adapter provides these capabilities on a single adapter. Its patented technology lets you take full advantage of

today's emerging, high-speed digital communications networks without abandoning existing technology.

ISDN is a network architecture that uses digital technology to support integrated voice, data, and image applications through standard interfaces over regular telephone lines served by digital switches. ISDN is a major advance in telecommunications technology that provides not one, but three, information-bearing channels on a single line for simultaneous transmission of voice, data, and image at high speeds. Unique to the design of the WaveRunner Adapter is its ability to communicate with devices attached to an existing analog telephone line via conventional modems as well as with those that are directly attached to an ISDN line. This feature enables customers to have a mix of different devices (ISDN and analog) in their establishment or enterprise and still maintain communications between all these devices.

The WaveRunner Adapter utilizes Mwave technology, which provides advanced facilities to achieve common, industry-standard signal processing, including communications. The Mwave technology platform, with its self-contained operating system, allows the functionality of the WaveRunner Adapter to be easily enhanced via software upgrades, thus protecting your investment in the product.

The WaveRunner Adapter can reduce costs in several ways. Its quick connection time and high speed can dramatically reduce telecommunications costs. Its ability to interoperate with both analog and digital networks can save you the expense of maintaining duplicate lines. It can often replace leased backup lines, delivering a high-speed link when you need it, without incurring the cost of unused bandwidth when you do not.

The list below summarizes the features of the WaveRunner Adapter.

- Communication with standard modems
- Hayes**-AT compatible command set
- Bell 103J, Bell 212A, V.22bis, V.32, V.32bis
- MNP**4/MNP5 error correction and data compression
- V.42 and V.42 bis error correction and data compression

- G3 fax capability with a fax application for Windows** (packaged with the adapter)
- A COMM Port Accelerator program for Windows (packaged with the adapter)
- 3-m (10-ft) RJ-45 cable (packaged with the adapter)
- V.120 encapsulation of asynchronous data
- Transmission Control Protocol/Internet Protocol (TCP/IP) serial line Internet protocol (SLIP) to synchronous TCP/IP translation (TCP/IP application sold separately)
- Interoperability with non-ISDN switched digital services of 56 Kbps
- Worldwide networks supported
- Network driver interface specification (NDIS) interface for selected applications



Installation and Testing Instructions

The following sections describe the procedures for installing and testing your WaveRunner Digital Modem. The instructions are geared towards the user who is installing the WaveRunner Adapter for the first time.

If you have a WaveRunner Adapter already installed and are performing a software upgrade, follow the instructions listed in Appendix C, "Upgrading the WaveRunner Adapter Software" on page 59.

Also, if you want to remove the WaveRunner Adapter software from your system for any reason, follow the instructions listed in "Removing the WaveRunner Adapter Software" on page 62.

Installation and Testing Checklist for WaveRunner Adapter for ISA

Warning

Do not connect a headset or handset to the WaveRunner Adapter. Doing so may cause damage to the headset or handset.

To install the WaveRunner Adapter in an ISA computer:

- **1** Verify that you have the items listed under "Contents of the Adapter Kit" on page 9.
- **2** Make sure that all of the conditions listed under "Installation Prerequisites" on page 11 have been met.
- **3** Follow the instructions under "Determining the Version of the WaveRunner Adapter" on page 14 to determine what type of adapter you have.

- **4** Follow the instructions under “Requesting ISDN Service” on page 16 to request ISDN service.
- **5** Follow the instructions under “Running MSD for the WaveRunner Adapter for ISA” on page 19 to obtain information about your computer’s configuration.
- **6** Follow the instructions under “Installing the WaveRunner Adapter Software” on page 21 to install the software to use with your adapter.
Note: The WaveRunner Adapter *cannot* be used in a computer that has another Mwave-compatible adapter. If an Mwave-compatible adapter is already present in your computer, you must remove it to use the WaveRunner Adapter.
- **7** If you have not configured your ISDN port, follow the instructions under “ISDN Port Configuration” on page 24.
- **8** Follow the instructions under “Placing the Adapter in an Expansion Slot” on page 29.
- **9** Follow the instructions under “Installing the NT1” on page 31.
- **10** Follow the instructions under “Connecting the WaveRunner Adapter to the NT1” on page 32.
- **11** To verify installation, follow the instructions under “Testing the WaveRunner Adapter for ISA” on page 30 to make sure that you have installed the adapter correctly.
- **12** You are finished with the WaveRunner Adapter installation.
To review the instructions concerning the use of the WaveRunner Adapter Application Drivers, refer to the online help information.

Installation and Testing Checklist for WaveRunner Adapter for Micro Channel

Warning

Do not connect a headset or handset to the WaveRunner Adapter. Doing so may cause damage to the headset or handset.

To install the WaveRunner Adapter in a Micro Channel computer:

- **1** Verify that you have the items listed under “Contents of the Adapter Kit” on page 9.
- **2** Make sure that all of the conditions listed under “Installation Prerequisites” on page 11 have been met.
- **3** Follow the instructions under “Requesting ISDN Service” on page 16 to request ISDN service.
- **4** Follow the instructions under “Updating the Reference Diskette” on page 27.
Note: The WaveRunner Adapter *cannot* be used in a computer that has another Mwave-compatible adapter. If an Mwave-compatible adapter is already present in your computer, you must remove it to use the WaveRunner Adapter.
- **5** Follow the instructions under “Placing the Adapter in an Expansion Slot” on page 29.
- **6** Follow the instructions under “Installing the NT1” on page 31.
- **7** Follow the instructions under “Connecting the WaveRunner Adapter to the NT1” on page 32.

- **8** Follow the instructions under “Configuring the WaveRunner Adapter for Micro Channel” on page 35 to make sure that the adapter is configured to work with your network.
- **9** Follow the instructions under “Testing the WaveRunner Adapter for Micro Channel” on page 41 if you want to verify that you have installed the adapter correctly.
- **10** Follow the instructions under “Installing the WaveRunner Adapter Software” on page 21 to install the software to use with your adapter.
- **11** If you have not configured your ISDN port, follow the instructions under “ISDN Port Configuration” on page 24.
- **12** You are finished with the WaveRunner Adapter installation.

To review the instructions concerning the use of the WaveRunner Adapter Application Drivers, refer to the online help information.



Contents of the Adapter Kit

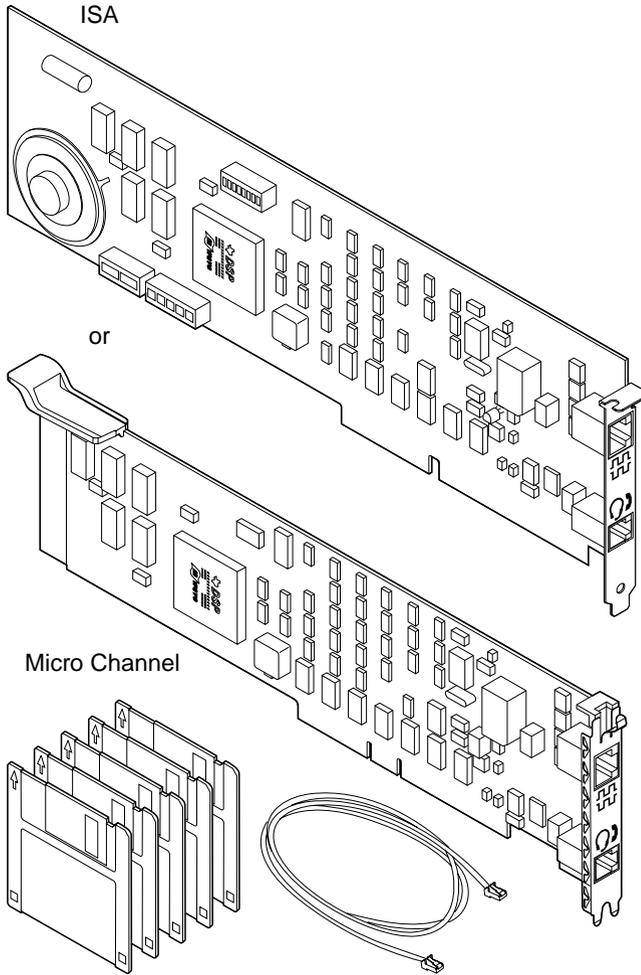


Figure 2. Contents of the Adapter Kit



Along with this manual, this adapter kit consists of:

- The WaveRunner Adapter for ISA or the WaveRunner Adapter for Micro Channel
- The WaveRunner Adapter installation diskettes
- The WaveRunner Adapter Diagnostics Diskette (if you have the WaveRunner Adapter for ISA) or one of the following option diskettes (if you have the WaveRunner Adapter for Micro Channel):
 - The WaveRunner Adapter Startup Option Diskette
 - The WaveRunner Adapter Option Diskette (Version 1.1 or higher)
- A data cable
- Fast Path to Installation cards for ISA and Micro Channel
- The *Ordering ISDN for the WaveRunner Digital Modem* reference sheet
- The *Safety Information* manual
- A fax program for use in a Windows environment
- A COMM port accelerator program (for use with Windows only)

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

The WaveRunner Adapter for ISA is for use with an IBM Personal Computer system or a compatible personal computer system equipped with a 386SX or better processor and Industry Standard Architecture (ISA) or Extended Industry Standard Architecture (EISA).

The WaveRunner Adapter for Micro Channel is for use with an IBM Personal System/2 (PS/2) computer or a compatible computer equipped with a 386SX or better processor and Micro Channel Architecture.

When you have verified that you have all of the contents of the adapter kit, place a check by this task on the checklist and continue with the next step.

Installation Prerequisites

To install *either* WaveRunner Adapter, you need:

- The WaveRunner Adapter for ISA or the WaveRunner Adapter for Micro Channel.
- One of the following sets of Installation Diskettes:
 - The WaveRunner Adapter OS/2 Installation Diskettes (Diskette 1 of 2 and Diskette 2 of 2)
 - The WaveRunner Adapter Windows Installation Diskettes (Diskette 1 of 2 and Diskette 2 of 2)
- The WaveRunner Adapter Startup Option Diskette or the WaveRunner Adapter Option Diskette for use with the WaveRunner Adapter for Micro Channel *or* the WaveRunner Adapter Diagnostics Diskette for use with the WaveRunner Adapter for ISA.
- An ISDN Network Termination Unit (NT1) to provide the interface between the WaveRunner Adapter and your ISDN line.

Some countries do not require you to have an NT1. However, if the country in which you will be using your WaveRunner Adapter requires that you have an NT1, you can purchase the IBM 7845 NT1 Extended (P/N: 82G6060) by calling 1-800-IBM-CALL (in the USA). You can also contact your ISDN service provider for information about obtaining an NT1.

If your NT1 does not have an integrated power supply, you will need to purchase a power supply. You will also need a cable to attach the NT1 to the ISDN line. These items are usually packaged with the NT1. If they are not packaged with your NT1, contact your place of purchase to obtain them.

- A Category 3 data cable with RJ-45 connectors (packaged with the adapter), to connect to your NT1.
- The information you receive from your local service provider when you subscribe to ISDN service.

See “Requesting ISDN Service” on page 16 for more details about the information you will supply to and the information you will receive from your local service provider.

- One of the following personal computer systems:
 - **If you are using a WaveRunner Adapter for ISA**, an IBM personal computer system or an IBM-compatible computer system equipped with:
 - ISA or EISA system bus
 - 16-MHz 386SX or higher system processor
 - Support for Direct Memory Access (DMA) bus master operation
 - System Memory (RAM)
 - 8 megabytes (MB) or more, excluding cache, for an OS/2 environment
 - 4 MB or more, excluding cache, for a Windows environment
 - 10 MB or more of available hard disk space to load the WaveRunner Adapter software
 - VGA or higher resolution display monitor
 - 3.5-inch, 1.44-MB floppy disk drive
 - PS/2- or Microsoft-compatible mouse
 - **If you are using a WaveRunner Adapter for Micro Channel**, a PS/2 computer or a compatible computer equipped with:
 - Micro Channel Architecture
 - A copy of one of the following versions of the Reference Diskette (packaged with the computer), based on your model of computer
 - Model 50/60, Version 1.06 or higher
 - Model 55/65, Version 1.04 or higher
 - Model 70/80, Version 1.10 or higher
 - Model 70-486, Version 1.04 or higher
- If you have an earlier version of one of these Reference Diskettes, contact an IBM Service Representative or IBM Authorized Service Representative for a copy of the updated Reference Diskette.

- 16-MHz 386SX or higher system processor
- Support for Direct Memory Access (DMA) bus master operation
- System Memory (RAM)
 - 8 MB or more, excluding cache, for an Operating System/2 (OS/2) environment
 - 4 MB or more, excluding cache, for a Windows environment
- 10 MB or more of available hard disk space to load the WaveRunner Adapter software
- VGA or higher resolution display monitor
- 3.5-inch, 1.44-MB floppy disk drive
- PS/2- or Microsoft-compatible mouse

Note: A full-length, 16- or 32-bit expansion slot must be available in your computer. The WaveRunner Adapter can be placed in either a 16- or a 32-bit expansion slot but operates only as a 16-bit adapter.

- One of the following operating system software packages:
 - IBM Operating System/2 (OS/2) Version 2.1 or higher
 - Microsoft** Windows Version 3.1 (Enhanced Mode)
- The instruction manual supplied with the computer

The installation diskettes provide the drivers required to support the WaveRunner Adapter.

When you have verified that all of the installation prerequisites have been met, place a check by this task on the checklist and continue with the next step.

Determining the Version of the WaveRunner Adapter

There are two versions of the WaveRunner Adapter for ISA. The first version is known as the ISA Rev A, which is used in North America only. The second version is known as the ISA Rev B, which is used worldwide.

Some options described in this manual apply only to the WaveRunner Adapter ISA Rev B version of the adapter. You need to know which version of the WaveRunner Adapter for ISA you have so you will know which options are available to you.

To determine if you have the WaveRunner Adapter ISA Rev B, look on the front of the adapter. As you look at the front of the adapter (with the bracket on the right-hand side), *ISA Rev B* will be printed on the upper left-hand corner. (See Figure 3 on page 15.)

The ISA Rev A does not have *ISA Rev A* printed on the adapter.

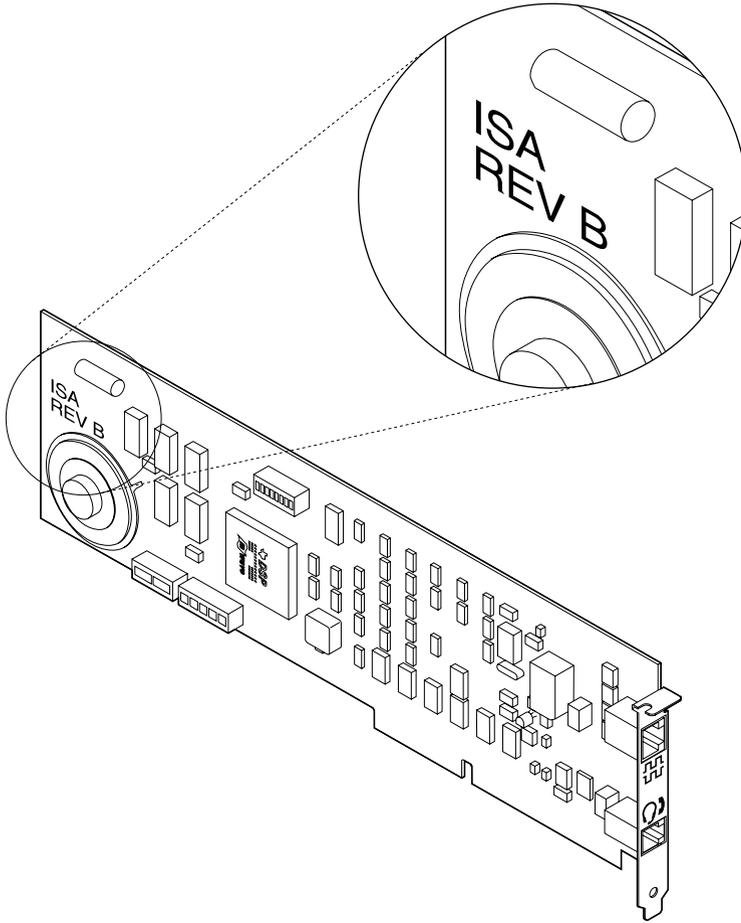


Figure 3. The WaveRunner Adapter ISA Rev B

When you have determined whether or not you have the WaveRunner Adapter ISA Rev B, place a check by this step on the checklist and continue with the next step on page 5.

Requesting ISDN Service

Before you can use the software for the WaveRunner Adapter, perform the following steps to request ISDN service:

- 1** Call your local service provider or provider of service and request ISDN service.

You will be asked for your area code and phone number to confirm that ISDN service is available in your area.

If you are using the WaveRunner Adapter outside the USA, your request is complete when you receive confirmation of ISDN availability. Go to step 3.

If you are using the WaveRunner Adapter in the USA, you will need to supply further information to the provider of service. Continue with step 2.

- 2** The provider of service will require further information in order to set up your ISDN switch. This extra information is known as *provisioning* information. The provisioning information that the provider of service will need is listed on the separate reference sheet entitled "Ordering ISDN for the WaveRunner Digital Modem" (packaged with this manual).

You can supply the provisioning information to the provider of service over the phone when you call to request ISDN service, or you can fax the "Ordering ISDN for the WaveRunner Digital Modem" sheet to them.

You have completed your request for ISDN service when the provisioning information has been supplied to the provider of service. Tell the service provider to configure your service according to information on the "Ordering ISDN for the WaveRunner Digital Modem" sheet.

The service provider will tell you which switch type you will be using.

If you are not sure that the country in which you are using your WaveRunner Adapter supports the adapter, you may call the IBM HelpWare number to check the status of WaveRunner

Adapter homologation. (See “Calling Customer Support” on page 57 for more information about calling for support.)

3 When your request for ISDN service is complete and service is installed, the provider of service will give you the information you need to configure your WaveRunner Adapter ISDN port.

4 If you are using the WaveRunner Adapter in the USA or Canada, record the information you receive from the provider of service in “USA and Canada ISDN Configuration Worksheet” on page 18.

If you are using the WaveRunner Adapter outside the USA, refer to Appendix D, “Configuration Worksheets for Countries Outside the USA” and record the information you receive from the provider of service in the worksheet that applies to your country.

You will need the information later when you configure your ISDN port.

5 Check this task off the checklist and continue with the next step.

USA and Canada ISDN Configuration Worksheet

Fill in the following fields based on the information from your service provider.

Switch Configuration Type: Circle one of the following types:

- National ISDN-1 (NI1) compliant
- Northern Telecom Pre-NI1 compliant
- Custom AT&T switch

Note: In Canada, circle Northern Telecom Pre-NI1 compliant.

Phone (Directory) Number: _____

Service Profile ID (SPID): _____

TEI (if Fixed TEI value) _____

Grade of Service: Circle one of the following types:

- CSV/D (Circuit Switched Voice and Data)
- CSV (Circuit Switched Voice)
- CSD (Circuit Switched Data)

If your ISDN line is configured for two phone numbers, fill out the information regarding the second directory number below.

Phone (Directory) Number: _____

Service Profile ID (SPID): _____

Grade of Service: Circle one of the following types:

- CSV/D (Circuit Switched Voice and Data)
- CSV (Circuit Switched Voice)
- CSD (Circuit Switched Data)

Note: If you intend the WaveRunner Adapter to share the ISDN line with an additional ISDN device, it is important that during the WaveRunner Adapter ISDN configuration, you fill in only the directory number you intend the WaveRunner Adapter to use. The second set of directory number parameters should be filled in when configuring the second device (for example, an ISDN phone). Make sure that you do not configure both devices to use the same phone number.

NT1 Recommendations

You must have an NT1 to connect your WaveRunner Adapter to the ISDN.

Some countries supply an NT1 for you. However, if the country in which you will be using your WaveRunner Adapter does not supply an NT1 for you, you can purchase the IBM 7845 NT1 Extended (P/N: 82G6060) by calling 1-800-IBM-CALL (in the USA) or through the authorized IBM dealer serving your locality.

You may also be able to purchase or lease an NT1 from your local service provider. Your local service provider may also have an installation service or an installation kit that you can purchase.

NT1 Recommendations

Style Desktop (recommended, not required)

Type NT1 Star (recommended, not required)

NT1 Power Supply Required

Note: Some NT1s have the power supply built in.

The 7845 NT1 Extended is a stand-alone desktop unit, complete with a power supply, cables, and a rechargeable battery to provide battery backup for the extended analog functions in the event of a power outage.

When you have completed your request for ISDN service and have chosen an NT1 to use with your WaveRunner Adapter, place a check by this task on the checklist and continue with the next step.

Running MSD for the WaveRunner Adapter for ISA

If you have Microsoft Windows or OS/2 installed on your personal computer, you have a utility program, Microsoft Diagnostics (MSD), that will analyze your computer system and help you determine the values you can use when installing the software for your WaveRunner Adapter for ISA.

To run MSD, perform the following steps:

1 Type **MSD** from a DOS prompt (*before* you start Windows) or from an OS/2 prompt to start the program.

2 Select **COM Ports**.

A window will appear that displays information about each of the COMM ports in your computer.

In the space provided below, put a check mark by each of the COMM ports that are denoted by N/A.

Note: COMM ports 3 and 4 are available only if you have the ISA Rev B version of the WaveRunner Adapter running in the Windows environment.

COM 1 _____

COM 2 _____

COM 3 _____

COM 4 _____

Those COMM ports you have checked are the ones available for use with your WaveRunner Adapter. Use the lowest COMM port number checked when setting the switches for the WaveRunner Adapter.

Select **OK** to return to the Main Menu.

3 Select **IRQ Status**.

A window will appear that displays all of the interrupt (IRQ) levels for your computer.

Look in the column titled Detected. Any available interrupt levels are denoted by a blank space or by the word No in this column.

In the space provided below, put a check mark by each of the interrupt levels that are available.

IRQ 3 _____

IRQ 4 _____

IRQ 5 _____

IRQ 11 _____

IRQ 15 _____

Those interrupt levels you have checked are the ones available for use with your WaveRunner Adapter.

Select **OK** to return to the Main Menu.

Use this information when setting the switches on your WaveRunner Adapter to avoid conflicts with other adapters.

4 Press **F3** to exit the MSD program.

5 Check this task off the checklist and continue with the next step.

Installing the WaveRunner Adapter Software

Important: If you are upgrading your WaveRunner Adapter software perform the steps listed under Appendix C, "Upgrading the WaveRunner Adapter Software" on page 59. The steps listed below apply only to first-time installation.

If you want to run Windows applications in a WIN-OS/2 session, use the WaveRunner Adapter OS/2 Installation diskettes and follow the instructions for installing the WaveRunner Adapter in an OS/2 environment.

Use the following procedure to install the software.

Warning: Save and close any open applications at this time to avoid any risk of data loss.

1 If you have not already done so, start OS/2 or Windows.

2 To install the adapter in an OS/2 environment:

a Insert the WaveRunner Digital Modem OS/2 Installation Diskette (diskette 1 of 2) in the diskette drive.

- b** Open an OS/2 window or OS/2 full screen.
- c** Type `a:setup` from an OS/2 command prompt (where *a* is the diskette drive that contains the OS/2 Installation Diskette). Press **Enter**.

Go to step 4.

3 To install the adapter in a Windows environment:

- a** Insert the WaveRunner Digital Modem Windows Installation Diskette (diskette 1 of 2) in the diskette drive.
- b** Select **File** from the Program Manager action bar menu.
- c** Select **Run** from the File pull-down menu.
- d** Type `a:setup` in the dialog box (where *a* is the diskette drive that contains the Windows Installation Diskette) and press **Enter**.

Continue with step 4.

4 Follow the instructions that appear on the panels as the software is being installed.

If you are installing a WaveRunner Adapter for Micro Channel, continue with step 8 on page 23.

If you are installing a WaveRunner Adapter for ISA, continue with step 5.

5 If you are installing a WaveRunner Adapter for ISA, you will be presented with a panel that will allow you to change the current parameter values. A diagram of the switches on the adapter will also be displayed. The diagram will change if you change any of the parameters to show how the switches should be set to correspond to the values you choose.

It is recommended that you use the default parameter values unless one of the default values conflicts with an adapter that is already in your computer. Use the values you recorded in

“Running MSD for the WaveRunner Adapter for ISA” on page 19 to determine whether or not conflicts will occur.

See Appendix E, “Setting the Switches for the WaveRunner Adapter for ISA” on page 71 for a detailed description of the parameters for the WaveRunner Adapter.

- 6** Set the switches on the WaveRunner Adapter exactly as they are shown on the computer’s display.
- 7** Record the switch settings in the blank switch blocks provided in Figure 4.

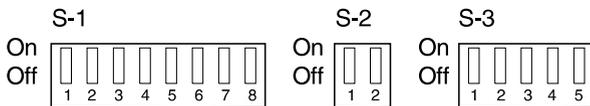


Figure 4. Blank Switch Blocks

See Appendix E, “Setting the Switches for the WaveRunner Adapter for ISA” on page 71 for more details about changing the switch settings.

Continue with step 8.

- 8** When you see the panel asking which type of install you want to perform, select a complete installation or a custom installation.

The custom installation will allow you to choose which options you want to install.

If you selected Complete Installation, go to step 10 on page 24.

If you selected Custom Installation, continue with step 9.

- 9** When the Custom Installation menu appears, select any of the following options that you would like installed:

- Modem
- Fax
- V.120

- ADLC
- NDIS

Continue with step 10.

10 After a few minutes, a Country Selection menu will appear on your display.

If you have all of the information you received from your local service provider when you requested ISDN service, you can continue and configure your ISDN port. (See “ISDN Port Configuration” if you need help.)

If not, select **Exit**.

When you receive the information from your service provider, go to “ISDN Port Configuration” and configure your ISDN Port.

Make sure you configure your ISDN Port when you receive the information you need from the service provider. You *must* configure your ISDN Port before your WaveRunner Adapter will operate correctly.

11 Place a check by this task on the checklist and continue with the next step.

ISDN Port Configuration

If you did not configure the ISDN port during the WaveRunner Adapter software installation, perform the following steps to do so now.

You *must* configure the ISDN port before the WaveRunner Adapter will operate correctly.

- 1** Select the ISDN Port icon.
- 2** When the WaveRunner Adapter Port Monitor window appears, select **Actions**.
- 3** Select **Change ISDN Port Configuration** from the Configuration pull-down.

The Country Selection menu will appear.

- 4** Select the country in which you will be using your WaveRunner Adapter from the list displayed on the screen and select **OK**.

If you are not sure that the country in which you are using your WaveRunner Adapter supports the it, you may call the IBM HelpWare number to check the status of WaveRunner Adapter homologation. (See “Calling Customer Support” on page 57 for more information about calling for support.)

If you are using your WaveRunner Adapter in the USA, a panel similar to the one shown in Figure 5 on page 26 will appear on your display.

If you are using your WaveRunner Adapter outside the USA, a panel similar to the one shown in Figure 6 on page 26 will appear¹.

- 5** Enter the ISDN port configuration parameter values on the display.

Use the Tab key or the arrow keys to select a field or click the mouse pointer on a specific field to enter data in that field.

Use the information from your provider of service that you copied onto the worksheet in “Requesting ISDN Service” on 18.

If you need more information about any of the parameters you see on the configuration panel, refer to the online help.

- 6** When you have finished entering all of the parameter values for the ISDN port, select **Save and Exit** to save your configuration and exit the ISDN port configuration program.

¹ The panel displayed in Figure 6 on page 26 applies only to countries that use the Euro-ISDN switch type. If the country in which you are using your WaveRunner Adapter uses a different switch type, the configuration panel you see will vary slightly.

- 7** Place a check by this task on the checklist and continue with the next step.

Parameters for North American Network Attachment

About

Switch Configuration Type

- AT&T 5ESS Custom
- Northern Telecom DMS100
- National ISDN 1

1 Phone Number
 2 Phone Numbers

Phone Number 1: 1234567891 Phone Number 2: 2345678901

SPID (Service Profile ID): 1234567891 SPID: 2345678901

TEI: Auto Fixed 01 TEI: Auto Fixed 02

Grade of Service

- CSWD Voice and Data
- CSD Data Only
- CSV Voice Only

Save and Exit Cancel ? Help

Figure 5. ISDN Port Configuration Parameters (USA Only)

Parameters for Euro-ISDN Network Attachment

ISDN Subscriber number:

Adapter passive bus incoming call: All Calls

D-channel ISDN Signaling TEI: Auto

Figure 6. Example Configuration Panel (Countries Outside the USA)

Updating the Reference Diskette

This procedure applies only to the WaveRunner Adapter for Micro Channel.

Before installing the adapter in your computer, you *must* update your backup copy of the Reference Diskette.

Note: In the instruction manual that came with your computer, the term *option* refers to the adapter, as in “Installing Options,” and “option diskette.” The *option diskette* is the diskette that came with the adapter.

- 1** Verify whether your WaveRunner Adapter was packaged with a Startup Option Diskette or an Option Diskette.

If your WaveRunner Adapter for Micro Channel was packaged with a Startup Option Diskette and you need to perform an update to the backup copy of the Reference Diskette on one of the systems listed below, the Reference Diskette must be one of the following versions:

- Model 50/60, Version 1.06 or higher
- Model 55/65, Version 1.04 or higher
- Model 70/80, Version 1.10 or higher
- Model 70-486, Version 1.04 or higher

If you have an earlier version of one of these Reference Diskettes, contact an IBM Service Representative or IBM Authorized Service Representative for a copy of the updated Reference Diskette.

To update your Reference Diskette using the Startup Option Diskette, perform the following steps.

- a** Insert the WaveRunner Adapter Startup Option Diskette in drive A and switch on the computer.
- b** Select the version of the Reference Diskette you are using from the list that appears on your computer’s display.

- c** You will be presented with the *target* diskette drive. Make sure to change the default drive to the drive where you will insert your backup copy of the Reference Diskette.

If your computer has the Reference Diskette stored on the hard disk, change the default drive to **C** and press **Enter**. Continue with 1e.

- d** Insert your backup copy of the Reference Diskette when the program requests the *target* medium.
- e** When the message appears that the update is complete, press **Enter**.
- f** Press **F3** to exit.

To update your Reference Diskette using the Option Diskette, perform the following steps.

- a** Insert the backup copy of your computer's Reference Diskette into drive A and switch on the computer.

If your computer has the Reference Diskette stored on the hard disk, see the instruction manual supplied with your computer if you need instructions to access the Reference Diskette.

- b** Select the item from the Main Menu that allows you to copy an option (adapter) diskette, and follow the instructions on the panel. Do *not* use the DOS COPY command. This operation copies files from the option diskette onto the backup copy of the Reference Diskette.

2 Remove the diskette from the disk drive.

3 Place a check by this task on the checklist and continue with the next step.

Placing the Adapter in an Expansion Slot

Note: Before installing the WaveRunner Adapter, be sure to read “Electronic Emission Notices” on page 94.

- 1** If you are running in a Windows environment, close Program Manager.
If you are running in an OS/2 environment, shutdown OS/2.
- 2** If you are installing the WaveRunner Adapter for ISA, make sure that you have set the switches on the adapter to match those you recorded in Figure 4 on page 23.
- 3** Ensure that the computer is switched off and unplugged. Refer to the computer’s instruction manual for instructions on installing the adapter. Install the adapter in any available full-length, 16- or 32-bit expansion slot.
- 4** Replace the cover on your computer and continue with step 5.
- 5** If you are using the WaveRunner Adapter for Micro Channel, record the slot number of the adapter installed in the space provided. You will need this information when configuring the adapter later.
Slot Number: _____
- 6** Plug your computer’s power cord into the electrical outlet.
- 7** Place a check by this task on the checklist and continue with the next step.

Testing the WaveRunner Adapter for ISA

Before running the WaveRunner Adapter diagnostics, make sure that the adapter is correctly connected to the ISDN line.

- 1** Insert the WaveRunner Adapter Diagnostics Diskette in drive A.

If your computer is switched off, switch it on with the diagnostics diskette in drive A.

If your computer is switched on, press **Ctrl**, **Alt**, and **Delete** simultaneously (with the diagnostics diskette in drive A) to reboot.

- 2** When the diagnostics appear on your computer's display, follow the instructions that are displayed.

- 3** If the tests run without errors, the WaveRunner Adapter is ready for use.

Remove the Diagnostics Diskette from the drive.

- 4** Exit the diagnostics and restart your operating system.

If an error occurs, follow the instructions shown on your computer's display.

If the problem is not resolved after following the instructions listed, call your support center. (See "Calling Customer Support" on page 57.)

- 5** When you have finished the tasks listed in this section, place a check mark by this task on the installation checklist and continue with the next step.

Installing the NT1

If the country in which you are using your WaveRunner Adapter does not require a separate NT1, skip this section.

When installing your NT1, it is recommended that you follow the instructions supplied with your NT1 for wiring a passive bus.

If you cannot use the wiring configuration suggested in the instructions supplied with your NT1, you can follow the steps listed below for wiring a short-branched passive bus.

1 Configure the NT1 as follows:

Timing Fixed (not adaptive)

Terminating Resistance

50 ohms

This is done by either setting a terminating resistance switch or by setting both terminating resistors of a pair to ON (or Enabled).

Refer to the documentation that was supplied with your NT1 for directions on setting these parameters if your NT1 allows you to set them.

2 If your NT1 does not have an integrated power supply, you must connect a power supply to the NT1.

The documentation supplied with your NT1 contains instructions on connecting a power supply.

3 Connect the NT1 to the ISDN line as directed in the documentation supplied with your NT1.

4 If you want to connect multiple devices to your NT1, see "Connecting Multiple Devices" on page 32 for additional information.

5 Place a check by this task on the checklist and continue with the next step.

Connecting Multiple Devices

The short-branched passive bus wiring configuration allows you to attach more than one device to your ISDN line and to branch the wiring from your NT1.

If you choose to branch the wiring, you must do so within 3 m (10 ft) of the NT1. Each branch can support a maximum of 4 devices, with the last device being no more than 69 m (226 ft) from the NT1. A maximum of 8 devices can be connected to your NT1. The cable connecting each device to a passive bus branch should be no more than 10 m (33 ft) in length. (See Figure 7.)

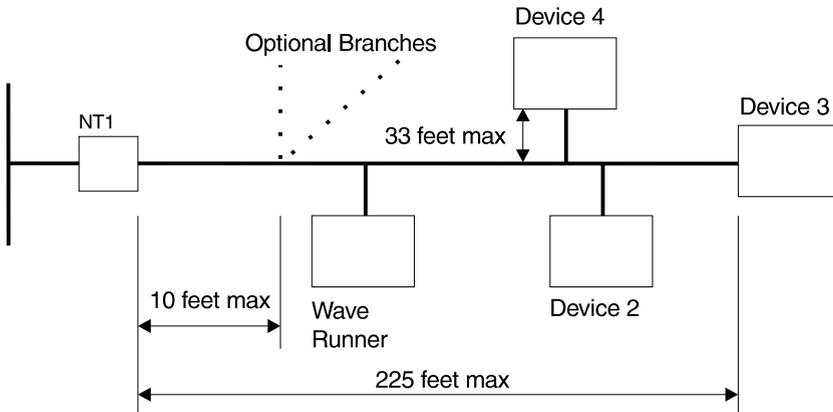


Figure 7. Short-Branched Passive Bus Wiring

If devices other than the WaveRunner Adapter on a passive bus branch use terminating resistors, they should be disabled.

Continue with "Connecting the WaveRunner Adapter to the NT1."

Connecting the WaveRunner Adapter to the NT1

- 1 To attach the WaveRunner Adapter to the NT1, you will need the cable with RJ-45 connectors that was packaged with the adapter. See Figure 8 on page 33.

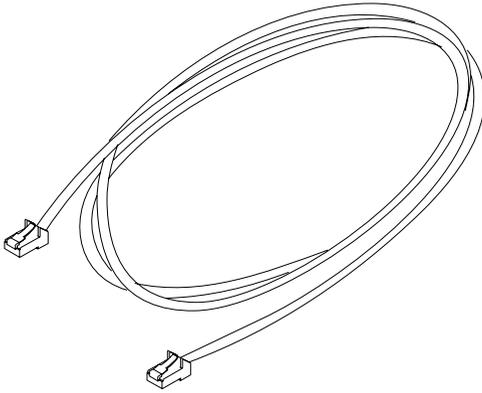


Figure 8. Category 3 Data Cable

Connect one end of the cable to the adapter. See Figure 9.

Warning: Do not connect a headset or handset to the WaveRunner Adapter. Doing so may cause damage to the headset or handset.

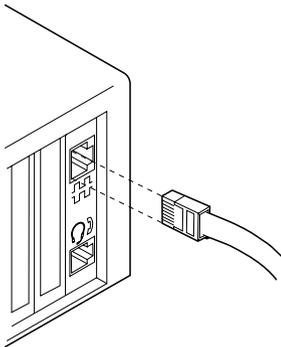


Figure 9. Connecting the Cable to the Adapter

- 2** Connect the other end of the cable to the NT1 in the slot marked TE or S/T. Or, if your NT1 is part of your ISDN, connect the other end of the cable to the ISDN service.

The instructions that were packaged with your NT1 contain detailed instructions for connecting the NT1 to the ISDN line.



3 Place a check by this task on the checklist and continue with the next step.



Configuring the WaveRunner Adapter for Micro Channel

This procedure applies to the WaveRunner Adapter for Micro Channel only.

If you have not updated your backup copy of the Reference Diskette using the WaveRunner Adapter Startup Option diskette, go to "Updating the Reference Diskette" on page 27 and do so now.

- 1** Insert the backup copy of your computer's Reference Diskette in drive A and switch on the computer.

If your computer has the Reference Diskette stored on the hard disk, see the instruction manual supplied with your computer if you need instructions to access the Reference Diskette.

You will receive an adapter configuration error (error number 165). This is a normal error when installing a new adapter. At the end of the error description, you will be presented with the choice of whether or not to automatically configure the system.

- 2** Press **Y (Yes)** to allow the system to configure itself automatically.

The following message is displayed:

Automatic configuration is being run.

Another message will be displayed when the automatic configuration is complete.

- 3** Press **Enter** to activate the configuration and to restart the computer. If your computer does not have the Reference Diskette stored on the hard disk, do not remove the backup copy of the Reference Diskette from drive A.

If your computer has the Reference Diskette stored on the hard disk, see the instruction manual supplied with your computer if you need instructions to access the Reference Diskette.

4 From the Main Menu, use the arrow keys to select **Set Configuration**. Press **Enter**.

The following message is displayed:

Set configuration files being loaded.
Please wait.

The Set Configuration Menu appears.

5 Use the arrow keys to select **View Configuration**.

From the View Configuration panel, ensure that the slot number and the adapter name (IBM WaveRunner Digital Modem) are correct for the adapter. The adapter name should appear beside the correct slot number. If the adapter name does not appear or the slot number is incorrect, make sure that all of the steps under "Updating the Reference Diskette" on page 27 and "Placing the Adapter in an Expansion Slot" on page 29 were performed correctly. Then, return to step 1 of this procedure. If the adapter name and slot number are still not correct when they are displayed, have your computer serviced.

You may consult Table 1 on page 37 for a brief description of each configuration parameter and a list of the valid options for each parameter.

6 On the View Configuration panel, review the parameters that have been configured.

If a conflict occurs with a previously installed adapter, an asterisk (*) will appear beside the conflicting parameter. Make sure that any conflicts are resolved before continuing.

To resolve conflicts, change the value of the conflicting parameter for the WaveRunner Adapter or for the existing adapter.

If you do not want to change any of the parameter values shown for the adapter, continue with step 7.

If the adapter default parameters need to be changed, press **F3** to exit View Configuration. Go to "Changing the

Configuration for the WaveRunner Adapter for Micro Channel™ on page 39 and begin with step 4.

- 7** Record the COMM port and IRQ parameter settings in the spaces provided here, for use when running applications.

COMM Port: _____

IRQ Level: _____

Date _____

- 8** Press **F3** to exit View Configuration and press **F3** again to exit Set Configuration.

- 9** Place a check by this task on the checklist and continue with the next step.

Table 1 (Page 1 of 3). Configuration Parameters — Descriptions and Options

Parameter	Description	Available Options
COMM Port	This parameter assigns the communication (COMM) port a value from COM 1 to COM 8, or disables the COMM port. Each COMM port value assigned is accompanied by an Interrupt Request (IRQ) value. This value establishes the priority with which the adapter can interrupt the computer. The lowest value is given the highest priority.	COM 1, IRQ 4 COM 2, IRQ 3 COM 3, IRQ 3 COM 4, IRQ 3 COM 4, IRQ 4 COM 5, IRQ 3 COM 5, IRQ 4 COM 6, IRQ 3 COM 6, IRQ 4 COM 7, IRQ 3 COM 7, IRQ 4 COM 8, IRQ 3 COM 8, IRQ 4 DISABLED

Table 1 (Page 2 of 3). Configuration Parameters — Descriptions and Options

Parameter	Description	Available Options
I/O Address Selection	This parameter selects the I/O address range that is used by the adapter.	0400–041F 04F8–04FF 0800–081F 08F8–08FF 0C00–0C1F 0CF8–0CFF 1000–101F 10F8–10FF 1400–141F 14F8–14FF 1800–181F 18F8–18FF 1C00–1C1F 1CF8–1CFF 2000–201F 20F8–20FF 2400–241F 24F8–24FF 2800–281F 28F8–28FF 2C00–2C1F 2CF8–2CFF 3000–301F 30F8–30FF 3400–341F 34F8–34FF 3800–381F 38F8–38FF 3C00–3C1F 3CF8–3CFF 4000–401F 40F8–40FF 4400–441F 44F8–44FF 4800–481F 48F8–48FF 4C00–4C1F 4CF8–4CFF
System Interrupt Selection	This parameter sets the System Interrupt Level. The value for this parameter establishes the priority by which the WaveRunner Adapter can interrupt the computer.	Interrupt Level 15 Interrupt Level 11
Arbitration Level	This parameter selects the arbitration level at which the WaveRunner Adapter will operate. Under normal conditions, you should accept the default value for this parameter.	Level 1 Level 3 Level 5 Level 6 Level 7 Level 8 Level 9 Level A Level B Level C Level D Level E

Table 1 (Page 3 of 3). Configuration Parameters — Descriptions and Options

Parameter	Description	Available Options
Fairness Enable/Disable	This parameter establishes whether or not the adapter will share the bus with other devices or retain control of the bus as needed. Under normal conditions, Fairness Disable is preferred.	Fairness Disable Fairness Enable

Changing the Configuration for the WaveRunner Adapter for Micro Channel

This procedure applies to the WaveRunner Adapter for Micro Channel only.

If you have configured an adapter and later you want to change its configuration, follow these steps.

- 1 Switch off your computer.
- 2 Insert the backup copy of your computer's Reference Diskette in drive A and switch on the computer.

If your computer has the Reference Diskette stored on the hard disk, see the instruction manual supplied with your computer if you need instructions to access the Reference Diskette.

- 3 From the Main Menu, use the arrow keys to select **Set Configuration**.

The following message will appear:

Set Configuration files being loaded.
Please wait.

- 4 From the Set Configuration menu, use the arrow keys to select **Change Configuration**.

5 From the **Change Configuration** menu, use the arrow keys to select the WaveRunner Adapter parameter you want to change. When you have selected the parameter, use **F5** or **F6** to change the value of the parameter. Press **Enter** to move to the next parameter.

6 When you have changed all the parameters you want to change, record the COMM port and the IRQ parameter values in the spaces provided here. You will need to use them when running communication applications.

COMM Port: _____

IRQ Level: _____

Date _____

Press **F10** to save the configuration.

The following message will appear:

Saving configuration. Please wait.

This message will be followed by:

Save configuration complete.

Press **Enter** to continue.

7 Press **F3** to exit Change Configuration.

8 Press **F3** to exit Set Configuration.

The following message will appear:

Configuration changes have been made.

Press Enter to restart the computer and activate the changes.

9 If you are installing an adapter for the first time, place a check by this task on the checklist and continue with the next step.

If you are changing the configuration for a previously installed adapter, the procedure is complete.

Testing the WaveRunner Adapter for Micro Channel

This procedure applies to the WaveRunner Adapter for Micro Channel only.

Before running the WaveRunner Adapter diagnostics, make sure that the adapter is correctly connected to the ISDN line.

- 1** If your computer is already switched on and the Main Menu of your backup copy of the Reference Diskette is displayed, skip this step and continue with step 2. Otherwise, insert your backup copy of the Reference diskette in drive A and switch on the computer.

If your computer has the Reference Diskette stored on the hard disk, see the instruction manual supplied with your computer if you need instructions to access the Reference Diskette.

- 2** From the Main Menu, press and hold **Ctrl**. Press **A** while you are still holding the Ctrl key.

The Advanced Diagnostic Menu will appear on the computer display.

- 3** From the Advanced Diagnostic Menu, select **System checkout**.

The following message will appear:

The tests are being loaded into memory.
Please stand by.

A list of all the devices installed in your computer will appear on the display.

- 4** If the WaveRunner Adapter appears in the list, enter **Y** to confirm that the list is correct.

If the WaveRunner Adapter does not appear in the list, make sure that all of the steps under "Updating the Reference Diskette" on page 27, "Placing the Adapter in an Expansion Slot" on page 29, and "Configuring the WaveRunner Adapter

for Micro Channel” on page 35 were performed correctly. If the WaveRunner Adapter still does not appear in the list, have your computer serviced.

5 From the Test Selection Menu, select **Run tests one time**.

The list of installed devices will appear again.

6 Use the arrow keys to select the WaveRunner Adapter and press **Enter** to start the tests.

A message will be displayed to inform you that the WaveRunner Adapter is being tested.

7 When you are presented with the option to run the NT1 Loopback and the Audio (Speaker) tests, enter **Y (Yes)** if your NT1 supports Loopback.

If your NT1 does not support NT1 Loopback or if the country in which you are using the WaveRunner Adapter does not support Loopback, enter **N (No)** for this option.

8 If the tests run without errors, the WaveRunner Adapter is ready for use. Press **F3** to exit the diagnostics. Press **F3** again to exit Advanced Diagnostics.

Note: If your computer has the Reference Diskette stored on the hard disk, you will press **Enter** instead of pressing F3.

If an error occurs, record any messages that appear and go to “Problem Solving for the WaveRunner Adapter for Micro Channel” on page 53 for more information.

9 Remove the backup copy of the Reference Diskette and restart your operating system.

10 Place a check by this task on the checklist and continue with the next step.

For future reference, store these instructions with the instruction manual supplied with your computer.



Note: If you are using the WaveRunner Adapter in an IBM P70 or P75 model computer, you may not be able to hear call progress tones through the system speaker. This is due to the internal design of the computer and does *not* affect the operation of the WaveRunner Adapter.





Appendix A. Understanding ISDN

The phone service that has been available for the past 50 years or more is an analog service commonly known in the telecommunications industry as *plain old telephone service* (POTS). In the past several years, the majority of the telephone network has been converted to a digital format, except for the local connection to most homes and businesses. This portion of the network has remained in analog format.

What is ISDN?: An integrated services digital network (ISDN) provides a means of connecting to the telephone network using all-digital ISDN devices. The WaveRunner Adapter is one of those devices.

With an ISDN device, no portion of the telephone network is analog unless it is a link to a non-ISDN device on another portion of the network. Because this setup eliminates the need to encode digital information into analog format, faster data transmission rates are possible between ISDN devices. However, some ISDN devices (such as the WaveRunner Adapter) are capable of encoding data so that communication with devices connected to analog portions of the telephone network is still possible.

ISDN Channels: When you order ISDN Basic Rate service for your home or business, you receive three phone lines in one. These three lines are referred to as *channels*. One of the channels, called the *D channel*, is used to send data and to send and receive the information needed for connecting and disconnecting calls. The other two channels, called *B channels*, are used exclusively for sending voice and data.

The D channel is capable of transmitting or receiving data at 16 Kbps, whereas the B channels are capable of transmitting or receiving data at 64 Kbps each. However, multiple devices can be connected to your ISDN line simultaneously. This configuration, known as *passive bus configuration*, allows the D channel to establish a call for each B channel simultaneously.



Due to differences between ISDN and analog technology, you may find some minor differences when dialing with your WaveRunner Adapter than when dialing with an analog modem. You can view the online help for more detailed information about dialing.



Appendix B. Troubleshooting

This section describes some of the common errors that can occur with the WaveRunner Adapter. These errors are usually the result of a configuration or setup discrepancy, and can usually be corrected by changing a configuration parameter or changing the connection of the WaveRunner Adapter or an NT1.

You may also use the online help for more information regarding error messages received during WaveRunner Adapter operation. In some cases, the online help is more current than what is printed in the following list.

Error 165 on startup.

Description: Occurs if an adapter has been added or removed from your personal computer system without reconfiguring the system.

User Response: Restart your system using the Reference Diskette and run the automatic configuration.

Mouse no longer works.

Description: Occurs when a bus mouse controller adapter that decodes only the low-order 10 bits of the I/O address bus is installed. The bus mouse controller adapter recognizes and responds to addresses in the range of X'230'-X'23F', which conflicts with the WaveRunner Adapter adapter's address.

User Response: Either select a new address for your mouse controller adapter or remove it, so that it does not interfere with the WaveRunner Adapter operations.

Windows stops during initialization.

Description: Occurs when the DMA channel number is incorrect.

User Response: Verify that the DMA= setting in your SYSTEM.INI file matches the DMA channel for which the WaveRunner Adapter is configured.

Check this setting by viewing the SYSTEM.INI file. Look under the [mwave] section to see how the DMA= entry is set.

The SYSTEM.INI file can be found in the Windows start-up directory, usually \WINDOWS\SYSTEM.INI. Either change the WaveRunner Adapter configuration to match the setting in SYSTEM.INI or change the setting in the SYSTEM.INI file to match the WaveRunner Adapter configuration. Restart Windows.

Windows error message that the SPID is rejected by the network.

Description: Occurs only for National ISDN-1 (NI-1) compliant network switches or pre NI-1 Northern Telecom switches. It indicates that there is an error in the WaveRunner Adapter ISDN configuration.

User Response: Go to the WaveRunner Adapter ISDN configuration (from the ISDN Port Monitor application). Verify that the value entered for the SPID matches the value received from the phone company. Also, if you selected a fixed TEI value during the WaveRunner Adapter ISDN configuration, make sure that the TEI value you entered corresponds to the configured SPID.

ISDN Port Monitor window Line Active indicator does not come on.

Description: Indicates that the WaveRunner Adapter is unable to synchronize with the ISDN line. This is caused by one of the following conditions:

- Cable not connected to WaveRunner Adapter.
- Cabling from wall through NT-1 to WaveRunner Adapter not correct. (Most NT-1s provide LEDs that help determine whether the NT-1 is connected correctly. Refer to your NT-1

documentation or “Connecting Multiple Devices” on page 32 for suggestions on connecting your NT-1.)

- Incorrect settings on NT-1. Refer to your NT-1 documentation to verify that the settings on the NT-1 are correct.

This situation can also occur if the D channel software has not been loaded.

User Response: To load the D channel software, select **Action** from the Port Monitor window action bar. Select **Load D channel** from the Action pull-down menu.

D channel Active indicator in the ISDN Port Monitor window does not come on.

Description: Before trying to diagnose this problem, be sure to attempt at least one call. In some configurations, the WaveRunner Adapter will not activate the D channel until at least one call has been attempted. If this indicator is still off and the Line Active indicator is on after making a call, the WaveRunner Adapter ISDN configuration is not valid.

If you do not want to attempt a call, you can load the D channel software from the Port Monitor window. To do so, select **Action** from the Port Monitor window action bar. Select **Load D channel** from the Action pull-down menu.

User Response: Check the status window in the ISDN Port Monitor window for any call status errors. Check the online help to view detailed information about any messages you see.

Other possible courses of action:

- Verify that the TEI type you configured in the WaveRunner Adapter ISDN configuration matches the TEI type you received from the phone company when you requested ISDN service.
If the TEI type you have configured is a fixed value, verify that the value you entered is correct.
- If you are connected to a passive bus to which other ISDN devices are also connected, make sure that each device has a unique TEI. If two devices request the same TEI, both TEIs will be removed. If there is a conflict, change one of the device's

TEI values. (This problem is applicable to only fixed value TEI lines.)

- Verify that you chose the correct switch type in the WaveRunner Adapter ISDN configuration. Review the information you received from the phone company when you requested ISDN service to make sure that you have configured the correct switch type.

No response from application driver (Modem, V.120, V.120/Modem, Async-to-Sync) when running communications application.

Description: Indicates a conflict in COMM port addresses or interrupt assignments.

User Response: Make sure that all appropriate application drivers have been loaded onto your WaveRunner Adapter. If all drivers have been loaded and you still get no response from your communications application, verify that the COMM port addresses and interrupt assignments specified in your communications application match the COMM port addresses and interrupt assignments configured for the WaveRunner Adapter.

B Channel Active indicator in the ISDN Port Monitor window does not come on when attempting to place or receive a call.

Description: Indicates that the D channel is active but that the network cannot complete a call to the remote device. You will often receive a fast busy tone if this condition exists. This is usually caused by an ISDN configuration error.

User Response: Open the ISDN Port Monitor window and watch the window while making a call. If neither of the B Channel Active indicators comes on, check the status window for any messages. Check the online help to view detailed information about any messages you see.

Verify that the following conditions are met:

- The phone number you have configured matches the phone number you received when you requested ISDN service.

- Your ISDN line is *not* configured for EKTS.

Refer to the *Ordering ISDN for the WaveRunner Digital Modem* sheet (packaged with this manual) for ISDN configuration information.

- The grade of service you have configured is correct.

Also, if the grade of service you have for your ISDN phone line is CSD, there could be errors when making calls with the modem application driver, which should normally use CSV. This is also true if you are trying to make non-modem application driver calls, which should normally use CSD, on an ISDN line that is configured for CSV.

- Configuration overrides are correctly set for outgoing calls (not applicable to the modem function).

B Channel Active indicator is on but calls cannot connect with remote device.

Description: Indicates an incompatible configuration in the active WaveRunner Adapter application driver.

User Response: Check the following conditions:

- TCP/IP RFC mode set correctly.

The TCP/IP driver allows you to set the RFC1294 mode On or Off. If this mode is On for a non-RFC1294 link, the WaveRunner Adapter will not be able to connect. Make the call with the RFC1294 mode Off.

- Incorrect USERNAME for RFC1294 mode link (TCP/IP driver only).
- Incorrect application driver is loaded on WaveRunner Adapter.
- Overrides are incorrectly set for incoming calls (not applicable to the modem function).

Modem will not connect at higher speeds.

Description: Indicates that the wrong modem speed has been chosen.

User Response: Open the modem application driver and select the configuration pull-down. If the modem speed you want to use is not checked, select the desired modem speed and restart the modem application.

AT Command Error received.

Description: The WaveRunner Digital Modem returns ERROR in response to an AT command issued from an application.

User Response: Check Appendix F, "Additional Modem Information" on page 87 to ensure that each of the commands in your AT string is valid on the WaveRunner Adapter. If the string is longer than 40 characters (after the AT portion of the string), it must be shortened to 40 characters or fewer.

Initialization strings can often be shortened by using the &F command followed by only those commands that are different from the default. (See the description about the &F command in Appendix F, "Additional Modem Information" on page 87 for more information.)

If the initialization string is still too long, refer to the &W and &Y commands (listed in Appendix F, "Additional Modem Information" on page 87) for instructions about how to store and load user profiles.

Error Messages

There are specific error messages that you can receive during installation of the WaveRunner Adapter software, when you are trying to start the application drivers, or when you are trying to make a call.

Any of these messages that appear will also display instructions about how to correct the error. If you receive an error message, follow the instructions displayed.

If the instructions displayed with an error message do not contain enough information for you to correct the error, you can use the Help option to find a more detailed description of the error.

If you still cannot correct the error, follow the instructions listed under “Calling Customer Support” on page 57.

Problem Solving for the WaveRunner Adapter for Micro Channel

This section applies to the WaveRunner Adapter for Micro Channel only. It is applicable to errors that are received when you are running the adapter diagnostics for the WaveRunner Adapter for Micro Channel.

If an error occurs, refer to the following instructions:

The format of the 8-digit error code on your computer’s display is *0nnnxyz*, where:

- The first digit is always 0
- *nnn* is the decimal equivalent of the device ID
- *xx* represents the test number
- *y* represents the slot number of the adapter in error
- *z* is a specific error indicator

Listed below are some error codes for the WaveRunner Adapter and the possible causes for each error. If you receive an error that is not listed below, call your support center to have the adapter replaced. (See “Calling Customer Support” on page 57.)

Error Code	Possible Cause
-------------------	-----------------------

0nnn46y2	No response to System Interrupt 11. Change the system interrupt level from IRQ11 to IRQ15. See “Changing the Configuration for the WaveRunner Adapter for Micro Channel” on page 39.
0nnn48y2	No response to System Interrupt 15. Change the system interrupt level from IRQ15 to IRQ11. See “Changing the Configuration for the WaveRunner Adapter for Micro Channel” on page 39.

0nnn70y1 The WaveRunner Adapter audio is defective or the connection from the WaveRunner Adapter to the system speaker is defective.

The WaveRunner Adapter is still functional, but without audio feedback (busy signals or ringing, for example). No action is required.

If you need the audio feedback function, have your WaveRunner Adapter for Micro Channel replaced.

0nnn70y2 System speaker is not functioning. Have the system speaker serviced.

0nnn94yz If your NT1 does not support loopback, this error is not correct and the WaveRunner Adapter for Micro Channel is still operational. Refer to the documentation supplied with your NT1 to determine whether your NT1 supports loopback.

If your NT1 supports loopback, the following conditions may exist.

- Defective ISDN cable
- The WaveRunner Adapter not correctly connected to NT1
- NT1 not powered on
- Defective NT1
- NT1 does not support S&Q maintenance channel loopbacks
- Defective WaveRunner Adapter

If any of the conditions exists, correct the problem and run the test again, starting at “Testing the WaveRunner Adapter for Micro Channel” on page 41.

If none of the preceding conditions exists, check the following conditions:

1. The actions under “Updating the Reference Diskette” on page 27 were performed correctly.

2. The actions under “Placing the Adapter in an Expansion Slot” on page 29 were performed correctly and the adapter is firmly seated in the slot.
3. The actions under “Configuring the WaveRunner Adapter for Micro Channel” on page 35 were performed correctly.
4. The actions under “Connecting the WaveRunner Adapter to the NT1” on page 32 were performed correctly and the cables are firmly attached.

If none of the preceding conditions exist, call your support center to have the adapter replaced. (See “Calling Customer Support” on page 57.)

Other Common Problems

If your WaveRunner Adapter still is not operating correctly, one of the following conditions could exist:

- There is a compatibility problem between the WaveRunner Adapter and one or more other adapters in your personal computer system.

To isolate a compatibility problem, remove any of the other adapters from your personal computer system and run the diagnostics while these adapters are removed.

Mwave technology currently supports a maximum of one Mwave-compatible adapter per system. If you have another Mwave-compatible adapter in your system, it will not work with your WaveRunner Adapter.

- The adapter configuration conflicts with the resources used by another adapter installed in your personal computer system.
- The COMM port number under which your application is running is not the same as the COMM port number under which the WaveRunner Adapter was installed.

Check your WaveRunner Adapter configuration to verify that the WaveRunner Adapter is configured for the same COMM port that your application is using.

- The cabling used to connect your NT1 and WaveRunner Adapter is defective.

- The NT1 is defective.
- The computer is defective.
- The WaveRunner Adapter is defective.

You should also check the READ.ME file in the directory where you installed your WaveRunner Adapter software. Any problems that were discovered after this manual was printed will be detailed there.

Support Call Checklist

To help diagnose the problem, please have as much of the following information available as possible. This information will help to identify your problem as quickly as possible.

- WaveRunner Adapter configuration (COMM port and IRQ values as recorded in "Configuring the WaveRunner Adapter for Micro Channel" on page 35 or "Changing the Configuration for the WaveRunner Adapter for Micro Channel" on page 39 if you are using the WaveRunner Adapter for Micro Channel. If you are using the WaveRunner Adapter for ISA, the information recorded in Figure 4 on page 23. Of the information in the [mwave] section of the SYSTEM.INI file)
- ISDN subscription information (received from phone company)
- Make and model of NT-1
- Make and model of computer
- Type of processor
- Amount of system memory (RAM)
- Other adapters in your system (and their configuration information, if possible)
- Other devices attached to your system
- Operating system versions
- WaveRunner Adapter software version
- Diagnostic error information, if available
- ISDN Port Monitor status window information

- List of application software running when the problem was encountered
- Events leading up to the point of failure

Calling Customer Support

If you have tried the suggested actions listed previously and your WaveRunner Adapter still is not operating correctly, call one of the following numbers:

- Within the United States
 - For support, call the Options by IBM HelpCenter at 1-800-426-7299.
 - For more information about the product or for information concerning future product offerings, call (919) 254-ISDN and select the appropriate option.
- Within Canada
 - For support, call HelpPC at 1-800-565-3344.
 - For more information or to place an order, call 1-800-465-7999.
- Outside the United States and Canada, contact your IBM HelpWare number, your place of purchase, or your local branch office.



Appendix C. Upgrading the WaveRunner Adapter Software

Perform the following steps to upgrade your WaveRunner Adapter software.

1 If you have not already done so, start OS/2 or Windows.

Warning: Save and close any open applications at this time to avoid any risk of data loss.

2 To install the adapter in an OS/2 environment:

a Insert the WaveRunner Digital Modem OS/2 Installation Diskette (diskette 1 of 2) in the diskette drive.

b Open an OS/2 window or OS/2 full screen.

c Type **a:setup** from an OS/2 command prompt (where *a* is the diskette drive that contains the OS/2 Installation Diskette). Press **Enter**.

Go to step 4.

3 To install the adapter in a Windows environment:

a Insert the WaveRunner Digital Modem Windows Installation Diskette (diskette 1 of 2) in the diskette drive.

b Select **File** from the Program Manager action bar menu.

c Select **Run** from the File pull-down menu.

d Type **a:setup** in the dialog box (where *a* is the diskette drive that contains the Windows Installation Diskette) and press **Enter**.

4 The WaveRunner Adapter logo will appear on your display.

After a few seconds, the WaveRunner Adapter Setup V2.1 panel will appear on your display, followed by the Setup Options window.

From the Setup Options window, you can choose to update existing WaveRunner Adapter software or to remove existing WaveRunner Adapter software.

- 5** If you want to remove existing WaveRunner Adapter software from your computer, follow the instructions listed in “Removing the WaveRunner Adapter Software” on page 62.

If you want to update your existing WaveRunner Adapter software, select **Update Existing Software** and continue with step 6.

- 6** Follow the instructions that appear on the panels as the software is being installed.

If you are installing a WaveRunner Adapter for Micro Channel, continue with step 10 on page 61.

If you are installing a WaveRunner Adapter for ISA, continue with step 7.

- 7** If you are installing a WaveRunner Adapter for ISA, you will be presented with a panel that will allow you to change the current parameter values. A diagram of the switches on the adapter will also be displayed. The diagram will change if you change any of the parameters to show how the switches should be set to correspond to the values you choose.

It is recommended that you use the default parameter values unless one of the default values conflicts with an adapter that is already in your computer. Use the values you recorded in “Running MSD for the WaveRunner Adapter for ISA” on page 19 to determine whether or not conflicts will occur.

See Appendix E, “Setting the Switches for the WaveRunner Adapter for ISA” on page 71 for a detailed description of the parameters for the WaveRunner Adapter.

8 Set the switches on the WaveRunner Adapter exactly as they are shown on the computer's display.

9 Record the switch settings in the blank switch blocks provided in Figure 10.

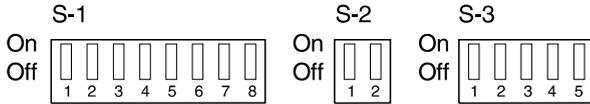


Figure 10. Blank Switch Blocks

See Appendix E, "Setting the Switches for the WaveRunner Adapter for ISA" on page 71 for more details about changing the switch settings.

Continue with step 10.

10 When you see the panel asking which type of install you want to perform, select a complete installation or a custom installation.

The custom installation will allow you to choose which options you want to install.

If you selected Complete Installation, go to with step 12.

If you selected Custom Installation, continue with step 11.

11 When the Custom Installation menu appears, select any of the following options that you would like installed:

- Modem
- Fax
- V.120
- ADLC
- NDIS

Continue with step 12.

12 After a few minutes, a Country Selection menu will appear on your display.

If you have all of the information you received from your local service provider when you requested ISDN service, you can continue and configure your ISDN port. (See "ISDN Port Configuration" on page 24 if you need help.)

If not, select **Exit**.

When you receive the information from your service provider, go to "ISDN Port Configuration" on page 24 and configure your ISDN Port.

Make sure you configure your ISDN Port when you receive the information you need from the service provider. You *must* configure your ISDN Port before your WaveRunner Adapter will operate correctly.

- 13** Place a check by this task on the checklist and continue with the next step.

Removing the WaveRunner Adapter Software

Perform the following steps to remove the WaveRunner Adapter software from your computer.

- 1** If you have not already done so, start OS/2 or Windows.
- 2 To remove the software in an OS/2 environment:**
 - a** Insert the WaveRunner Digital Modem OS/2 Installation Diskette (diskette 1 of 2) in the diskette drive.
 - b** Open an OS/2 window or OS/2 full screen.
 - c** Type **a:setup** from an OS/2 command prompt (where **a** is the diskette drive that contains the OS/2 Installation Diskette). Press **Enter**.

Go to step 4.

- 3 To remove the software in a Windows environment:**

- a** Insert the WaveRunner Digital Modem Windows Installation Diskette (diskette 1 of 2) in the diskette drive.
- b** Select **File** from the Program Manager action bar menu.
- c** Select **Run** from the File pull-down menu.
- d** Type **a:setup** in the dialog box (where *a* is the diskette drive that contains the Windows Installation Diskette) and press **Enter**.

4 The WaveRunner Adapter logo will appear on your display.

After a few seconds, the WaveRunner Adapter Setup 2.0 panel will appear on your display, followed by the Setup Options window.

From the Setup Options window, you can choose to update existing WaveRunner Adapter software or to remove existing WaveRunner Adapter software.

5 If you want to update existing WaveRunner Adapter software, follow the instructions listed in Appendix C, "Upgrading the WaveRunner Adapter Software" on page 59.

If you want to remove your existing WaveRunner Adapter software, select **Remove Existing Software** and follow the instructions that appear on the panels.



Appendix D. Configuration Worksheets for Countries Outside the USA

This section contains worksheets for the different switch configurations and countries. Use these worksheets to record the information you received from your service provider. When you configure your WaveRunner Adapter software for ISDN support, refer to the worksheet you filled out to complete the configuration panels.

To fill out the worksheet:

- 1 Locate the worksheet you need:

Country	Switch Configuration	Worksheet Location
Austria	Euro-ISDN	Page 66
Belgium	Euro-ISDN	Page 66
Denmark	Euro-ISDN	Page 66
Finland	Euro-ISDN	Page 66
Germany	Euro-ISDN, 1TR6	Page 66 or page 68
Ireland	Euro-ISDN	Page 66
Italy	Euro-ISDN	Page 66
Japan	INS-NET64	Page 69
Korea	INS-NET64	Page 69
Netherlands	Euro-ISDN	Page 66
New Zealand	Euro-ISDN	Page 66
Norway	Euro-ISDN	Page 66
Portugal	Euro-ISDN	Page 66
Singapore	Euro-ISDN	Page 66
Spain	Euro-ISDN	Page 66
Sweden	Euro-ISDN	Page 66
Switzerland	Euro-ISDN	Page 66
United Kingdom	Euro-ISDN	Page 66

- 2** Go to the worksheet for your switch configuration and fill in the required information.

Euro-ISDN Configuration Worksheet

Fill in the following fields based on the information from your service provider and the information supplied here:

ISDN Subscriber Number: _____

Adapter Passive Bus Incoming Call Selection: _____

Adapter Passive Bus Address: _____

ISDN Subscriber Number:

This is the 1- through 20-digit number allocated to you by your service provider. It must be a continuous string of digits in the range 0 through 9; for example, 98761234.

Adapter Passive Bus Incoming Call Selection:

If your terminal is connected to a passive bus (see "Connecting Multiple Devices" on page 32) that is shared by other terminals or telephones, the WaveRunner Adapter can be given an address and only incoming calls that match the address are passed to applications. Calls that do not match the address are ignored. You have the following choices:

- All Calls** All incoming calls will be selected by the WaveRunner Adapter and passed to the application. This is the default.
- CPSA** Called Party Subaddress allows only incoming calls that match the CPSA information element. The entire CPSA must match to allow the call to be selected.
- MSN/DDI** Multiple Subscriber Number/Direct Dial-In allows only incoming calls that match the Called Party Number (CPN) information element. A match is detected if the value of the adapter passive bus address and the corresponding number of digits at the end of the CPN information element are the same. For example, if an address of 8210 is entered, an incoming call with a CPN of 98768210 is allowed.

Your service provider can provide more information about these features.

Adapter Passive Bus Address:

This is the address allocated to this adapter when you choose incoming call selection by CPSA or MSN/DDI.

Leave this field blank if you chose "All Calls."

If you chose "CPSA" or "MSN/DDI," the address of the WaveRunner Adapter must be entered in this field.

The address format for CPSA can be:

NSAP (X.213) A string of 1 through 20 International Alphabet 5 characters starting with the letter P. For example, P3310.

User-specified A user-specified string from 1 to 20 characters in length.

The address format for MSN/DDI is a continuous string of 1 to 20 numeric characters in the range 0 through 9.

1TR6 Configuration Worksheet

Fill in the following fields based on the information from your service provider and the information supplied here:

ISDN Subscriber Number: _____

Passive Bus Terminal Call Selection: _____

Passive Bus Terminal Selection Digit: _____

ISDN Subscriber Number:

This is the 1- through 20-digit number allocated to you by your service provider. It must be a continuous string of digits in the range 0 through 9; for example, 98761234.

Passive Bus Terminal Call Selection:

If your terminal is connected to a passive bus (see "Connecting Multiple Devices" on page 32) you can give the WaveRunner Adapter a unique address digit known as the *Endgeräteauswahiziffer* (EAZ) digit. This is the final digit of the destination address. Only incoming calls that match that address are passed to the application; all other calls are ignored. You have the following choices:

All Calls All incoming calls will be selected by the WaveRunner Adapter and passed to the application. This is the default.

EAZ_PBTS EAZ for Passive Bus Terminal Selection allows incoming-call selection using the EAZ digit in the destination address information element. A match is detected when the selection digit of the passive bus terminal and the EAZ digit are the same. For example, if you enter address 4, an incoming call with destination address 98768214 is passed to the applications.

Note: The calling party must ensure that the EAZ digit is added to the end of the destination address.

Passive Bus Terminal Selection Digit:

This is a single digit that you must allocate to the WaveRunner Adapter. The field should be left blank if "All Calls" was chosen for the Passive Bus Terminal Call Selection.

If terminal call selection is used, ensure that the Passive Bus Terminal Call Selection is set to EAZ_PBTS.

The format for EAZ_PBTS is a numeric character in the range 1 through 9. A remote user must make a call that includes this digit so that the WaveRunner Adapter can accept the call.

INS-Net64 Configuration Worksheet

Fill in the following fields based on the information from your service provider and the information supplied here:

ISDN Subscriber Number: _____

Adapter Passive Bus Incoming Call Selection: _____

Adapter Passive Bus Address: _____

D-Channel ISDN Signaling TEI Mode: _____

D-Channel ISDN Signaling TEI Value _____

ISDN Subscriber Number:

This is the 1- through 32-digit number allocated to you by your service provider. It must be a continuous string of digits in the range 0 through 9; for example, 98761234.

Adapter Passive Bus Incoming Call Selection:

If your terminal is connected to a passive bus (see "Connecting Multiple Devices" on page 32) that is shared by other terminals or telephones, the WaveRunner Adapter can be given an address and only incoming calls that match the address are passed to applications. Calls that do not match the address are ignored. You have the following choices:

- All Calls** All incoming calls will be selected by the WaveRunner Adapter and passed to the application. This is the default.
- CPSA** Called Party Subaddress allows only incoming calls that match the CPSA information element. The entire CPSA must match to allow the call to be selected.
- MSN/DDI** Multiple Subscriber Number/Direct Dial-In allows only incoming calls that match the Called Party Number (CPN) information element. A match is detected if the value of the adapter passive bus address and the CPN information are the same. For example, if 1234567 is entered, only an incoming call with a CPN of 1234567 is allowed.

Your service provider can provide more information about these features.

Adapter Passive Bus Address:

This is the address allocated to this adapter when you choose incoming call selection by CPSA or MSN/DDI.

Leave this field blank if you choose "All Calls."

If you choose "CPSA" or "MSN/DDI," the address of the WaveRunner Adapter must be entered in this field.

The address format for CPSA can be:

NSAP (X.213) A string of 1 through 20 International Alphabet 5 characters starting with the letter P. For example, P3310.

User-specified A user-specified string from 1 to 20 characters in length.

The address format for MSN/DDI is a continuous string of 1 to 20 numeric characters in the range 0 through 9.

D-Channel ISDN Signaling TEI Mode:

Choose "auto" if the TEI is assigned automatically. This is the default.

Choose "manual" if a specific TEI value has been assigned by your service provider. The value is in the range 0 through 63.

D-Channel ISDN Signaling TEI Value:

A value for this field is required only if you have chosen "manual" as the D-Channel ISDN Signaling TEI Mode. The value must be in the range 0 through 63 and is unique for each manual TEI. The TEI is user-defined to allow access to the D-Channel for ISDN signaling.

Note: If you are connected with other ISDN devices on a passive bus, make sure that each device has a unique TEI. Two devices cannot be assigned the same TEI value.

Appendix E. Setting the Switches for the WaveRunner Adapter for ISA

The following section applies only to the WaveRunner Adapter for ISA

Each adapter has three switch blocks: Switch Block 1 (S-1) has eight switches, Switch Block 2 (S-2) has two switches, and Switch Block 3 (S-3) has five switches.

You must set these switches before you place the WaveRunner Adapter in your computer. The following sections describe the different switch settings in detail.

The switches vary slightly depending on whether you have the WaveRunner Adapter ISA Rev A or the WaveRunner Adapter ISA Rev B.

If you have the WaveRunner Adapter ISA Rev A Adapter, follow the instructions listed under "Setting the Switches for the WaveRunner Adapter ISA Rev A Adapter."

If you have the WaveRunner Adapter ISA Rev B Adapter, follow the instructions listed under "Setting the Switches for the WaveRunner Adapter ISA Rev B Adapter" on page 80.

Setting the Switches for the WaveRunner Adapter ISA Rev A Adapter

Follow the instructions listed below to change any of the switch settings for the WaveRunner Adapter ISA Rev A Adapter, which is used in North America only.



Setting the Switches on Switch Block 1 (ISA Rev A)

Figure 11 shows the location of Switch Block 1 on the WaveRunner Adapter ISA Rev A and the WaveRunner Adapter ISA Rev B Adapters.

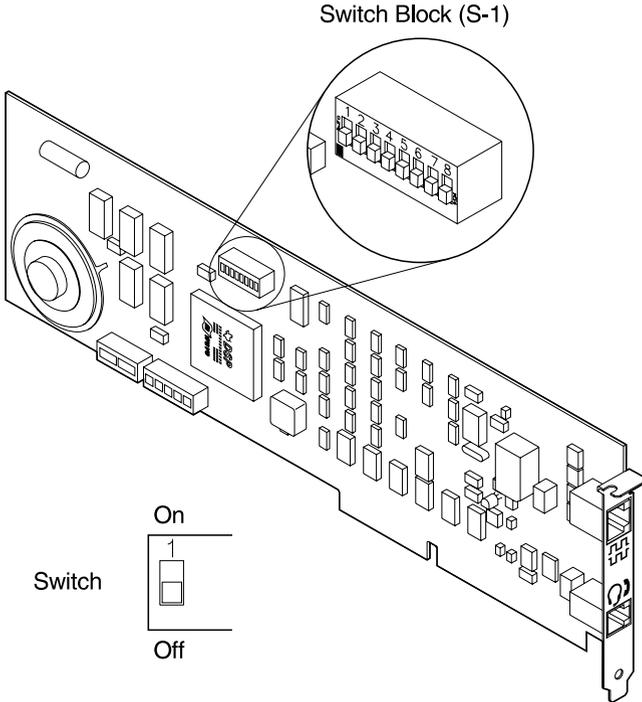
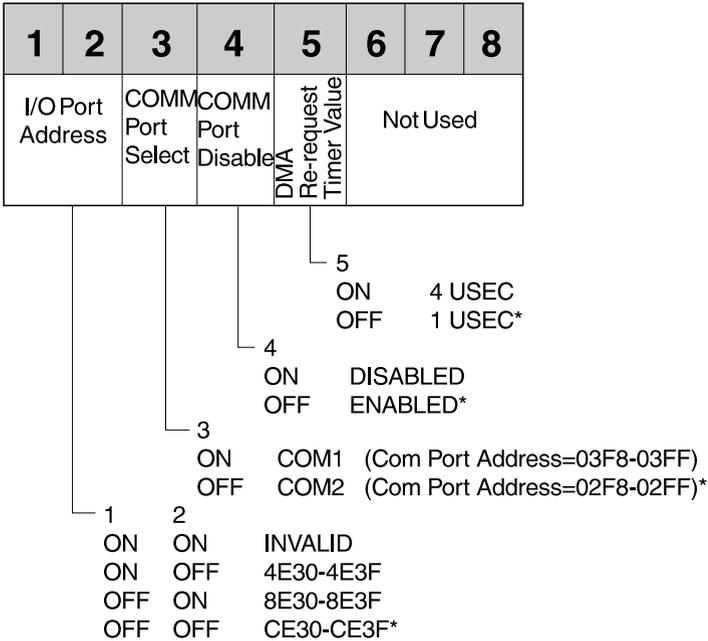


Figure 11. Switch Block 1 Location

See Figure 12 for switch descriptions for Switch Block 1.



Switch Block 1 (S-1)



* Default settings

Figure 12. Switch Description Summary (Switch Block 1—WaveRunner Adapter ISA Rev A)

The switches on Switch Block 1 (S-1) determine:

- I/O Port Address (Switches 1 and 2)

Each adapter installed in your computer must have a unique input/output (I/O) port address to allow communication between the adapter and the system unit.

You must set this address so that it does not conflict with the I/O address of any other adapter already installed in your computer. If conflicts occur, incorrect operation may occur.

- Communication (COMM) Port (Switch 3)

The COMM port (or Serial Port) is one of the ways in which your personal computer system communicates. COMM port designations are assigned to serial ports or to internal devices.

For example, if you have a personal computer system with only one serial port, by default that serial port would be assigned a COM 1 port designation.

If you have an internal device, such as the WaveRunner Adapter, that you want to use in that same personal computer system, it would need a COMM port designation, even though it is an internal device and not connected to a serial port. You could not configure the WaveRunner Adapter for COM 1 because the device connected to the serial port is assigned COM 1.

The default selection for the WaveRunner Adapter is COM 2. If you already have another communications device attached to COM 2, set Switch 3 On to select COM 1.

If both COMM ports are already in use, you must configure one of the existing devices that uses COM 1 or COM 2 to use another COMM port, such as COM 3 or COM 4. If the devices already existing in your computer cannot operate on COM 3 or COM 4, you must disable one of those devices in order to use the WaveRunner Adapter. **The WaveRunner Adapter can be used only on COM 1 or COM 2.**

Note: The setting of this switch should agree with the switch setting for Switches 4 and 5 on Switch Block 3. Normally, COM 1 uses IRQ 4 and COM 2 uses IRQ 3. If an existing device uses the IRQ value that corresponds to your COMM port selection, you can use IRQ 5.

- COMM Port Disable (Switch 4)

This switch allows you to disable the COMM port. Change the setting on Switch 4 to On if you want to disable the COMM port.

Note: The COMM port *must* be enabled to run any of the communications applications that can be used with the WaveRunner Adapter.

- DMA Re-request Timer Selection (Switch 5)

This switch determines the amount of time between when the WaveRunner Adapter completes a DMA cycle and when it requests the system DMA controller for another cycle.

This setting should be left on 1 microsecond (μsec) unless errors are encountered during DMA transfers.

Change the setting on Switch 5 to On if you want to change the value from 1 μsec to 4 μsec .

Setting the Switches on Switch Block 2 (ISA Rev A)

Figure 13 shows the location of Switch Block 2 on both the WaveRunner Adapter ISA Rev A and the WaveRunner Adapter ISA Rev B Adapters.

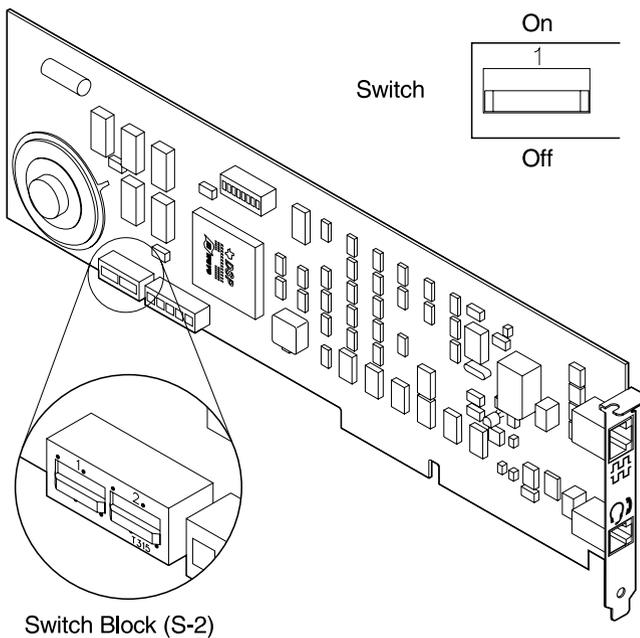


Figure 13. Switch Block 2 Location

See Figure 14 on page 76 for the switch settings for Switch Block 2.

Switch Block 2 (S-2)

1	2		
DMA Channel Select			
1	2		
ON	ON	DMA 0	
ON	OFF	DMA 6	
OFF	ON	DMA 0	
OFF	OFF	DMA 7*	

* Default settings

Figure 14. Switch Description Summary (Switch Block 2—WaveRunner Adapter ISA Rev A)

The switches on Switch Block 2 (S-2) determine:

- DMA Channel Select (Switches 1 and 2)

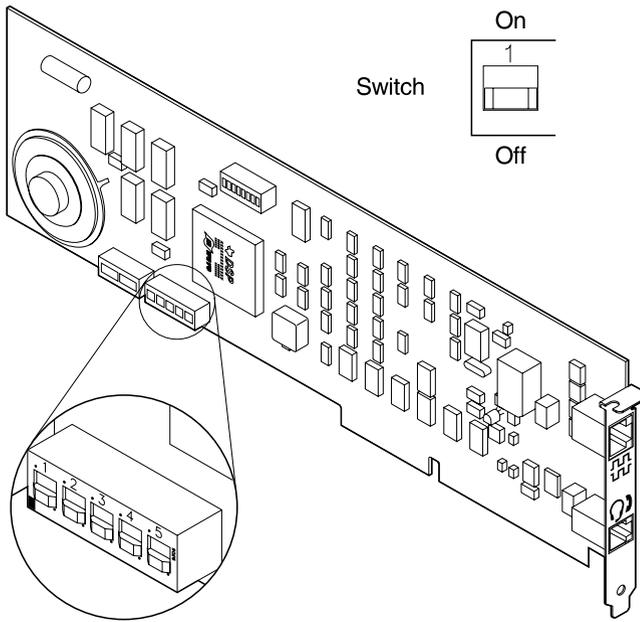
Direct memory access (DMA) allows the transfer of data between memory and input/output units without processor intervention. This method is necessary to support the high data speeds of the WaveRunner Adapter.

If there is no other DMA adapter in your computer, you should not need to change the default value for this parameter.

However, if there is another DMA adapter in your computer, that already uses the default DMA value of 7, you will need to set switches 1 and 2 to select DMA 6 or DMA 0.

Setting the Switches on Switch Block 3 (ISA Rev A)

Figure 15 on page 77 shows the location of Switch Block 3 on both the WaveRunner Adapter ISA Rev A and the WaveRunner Adapter ISA Rev B Adapters.



Switch Block (S-3)

Figure 15. Switch Block 3 Location

See Figure 16 on page 78 for the switch settings for Switch Block 3.



Switch Block 3 (S-3)

1	2	3	4	5
SIO Channel Ready Gated Timing Select	DMA Byte/Word Select	System Interrupt Level	Comm Port Interrupt Level	
1	2	3	4	5
ON	ON	ON	ON	ON
OFF	OFF	OFF	OFF	OFF
Mod 30-286 Mode	8/16 Bit	SYS IRQ 11	IRQ 5	IRQ 3
Normal Mode*	16-Bit only*	SYS IRQ 15*	IRQ 4	IRQ 3*

* Default settings

Figure 16. Switch Description Summary (Switch Block 3—WaveRunner Adapter ISA Rev A)

The switches on Switch Block 3 (S-3) determine:

- Channel Ready Gated Timing Select (Switch 1)

This parameter defines when the Start I/O channel ready signal will be generated. This parameter allows the WaveRunner Adapter to be compatible with different implementations of the ISA architecture. You can select either Mod 30-286 mode or normal mode.

Switch 1 should be changed only if you are experiencing random errors or if the system fails with the switch in the Off position.

- DMA Byte/Word Select (Switch 2)

All DMA operations are assumed to be 16-bit. To be compatible with a memory adapter that is mapped to 8-bit, you must specify 8- or 16-bit operations.

If your memory adapter is mapped to 16-bit operations, you do not need to change this parameter value. If your memory adapter is mapped to 8-bit operations, set Switch 2 to On.

Note: In some computers, the WaveRunner Adapter will not be able to read and write to system memory if 8/16 Bit mode is selected.

- System Interrupt Level (Switch 3)

Each adapter in a computer must use unique Interrupt Request Level (IRQ) selections to allow communication between the adapter and the system unit. If two adapters in the same computer have the same IRQ, incorrect operation of the adapters involved may occur.

Set Switch 3 to the On position if you need to change the IRQ setting from its default value of IRQ 15 to IRQ 11.

- COMM Port Interrupt Level (Switches 4 and 5)

This switch determines the interrupt level used for the COMM port. This switch setting is dependent on the setting you chose for Switch 3 on Switch Block 1 (COMM Port).

Normally, a parameter value of COM 1 uses IRQ 4 and a parameter value of COM 2 uses IRQ 3.

The IRQ value you choose for the WaveRunner Adapter must **not** conflict with the IRQ value of any other device already in your computer. If an existing device uses the IRQ value that corresponds to your COMM port selection, you may set switches 4 and 5 so the value for the WaveRunner Adapter is IRQ 5.

The switches on Switch Block 1 (S-1) determine:

- I/O Port Address (Switches 1 and 2)

Each adapter installed in your computer must have a unique I/O port address to allow communication between the adapter and the system unit.

You must set this address so that it does not conflict with the I/O address of any other adapter already installed in your computer. If conflicts occur, incorrect operation may occur.

- Communication (COMM) Port (Switches 3 and 4)

The COMM port (or Serial Port) is one of the ways in which your personal computer system communicates. COMM port designations are assigned to serial ports or to internal devices. For example, if you have a personal computer system with only one serial port, by default that serial port would be assigned a COM 1 port designation.

If you have an internal device, such as the WaveRunner Adapter, that you want to use in that same personal computer system, it would need a COMM port designation, even though it is an internal device and not connected to a serial port. You could not configure the WaveRunner Adapter for COM 1 because the device connected to the serial port is assigned COM 1.

The default selection for the WaveRunner Adapter is COM 3. If you already have another communications device attached to COM 3, set Switches 3 and 4 to select COM 1, COM 2, or COM 4.

If all four COMM ports are already in use, you must configure one of the existing devices that uses COM 1, COM 2, COM 3, or COM 4 to use another COMM port, such as COM 5 or COM 6. If the devices already existing in your computer cannot operate on COM 5 or COM 6, you must disable one of those devices in order to use the WaveRunner Adapter.

- COMM Port Disable (Switch 5)

This switch allows you to disable the COMM port. Change the setting on Switch 5 to On if you want to disable the COMM port.

Note: The COMM port *must* be *enabled* to run any of the communications applications that can be used with the WaveRunner Adapter.

- DMA Re-request Timer Selection (Switch 6)

This switch determines the amount of time between when the WaveRunner Adapter completes a DMA cycle and when it requests the system DMA controller for another cycle.

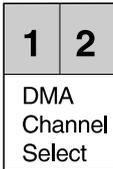
This setting should be left on 1 microsecond (μsec) unless errors are encountered during DMA transfers.

Change the setting on Switch 6 to On if you want to change the value from 1 μsec to 4 μsec .

Setting the Switches on Switch Block 2 (ISA Rev B)

See Figure 18 for the switch settings for Switch Block 2. (If you want to see the location of Switch Block 2 on the adapter, see Figure 13 on page 75).

Switch Block 2 (S-2)



1	2	
ON	ON	DMA 0
ON	OFF	DMA 6
OFF	ON	DMA 0
OFF	OFF	DMA 7*

* Default settings

Figure 18. Switch Description Summary (Switch Block 2—WaveRunner Adapter ISA Rev B)

The switches on Switch Block 2 (S-2) determine:

- DMA Channel Select (Switches 1 and 2)

Direct memory access (DMA) allows the transfer of data between memory and input/output units without processor intervention. This method is necessary to support the high data speeds of the WaveRunner Adapter.

If there is no other DMA adapter in your computer, you should not need to change the default value for this parameter. However, if there is another DMA adapter in your computer that already uses the default DMA value of 7, you will need to set switches 1 and 2 to select DMA 6 or DMA 0.

Switch 1 should be changed only if you are experiencing random errors or if the system fails with the switch in the Off position.

- DMA Byte/Word Select (Switch 2)

All DMA operations are assumed to be 16-bit. To be compatible with a memory adapter that is mapped to 8-bit, you must specify 8- or 16-bit operations.

If your memory adapter is mapped to 16-bit operations, you do not need to change this parameter value. If your memory adapter is mapped to 8-bit operations, set Switch 2 to On.

Note: In some computers, the WaveRunner Adapter will not be able to read and write to system memory if 8/16 Bit mode is selected.

- System Interrupt Level (Switch 3)

Each adapter in a computer must use unique Interrupt Request Level (IRQ) selections to allow communication between the adapter and the system unit. If two adapters in the same computer have the same IRQ, incorrect operation of the adapters involved may occur.

Set Switch 3 to the On position if you need to change the IRQ setting from its default value of IRQ 15 to IRQ 11.

- COMM Port Interrupt Level (Switches 4 and 5)

This switch determines the interrupt level used for the COMM port. This switch setting is dependent on the setting you chose for Switch 3 on Switch Block 1 (COMM Port).

Normally, a parameter value of COM 1 uses IRQ 4 and a parameter value of COM 2 uses IRQ 3.

The IRQ value you choose for the WaveRunner Adapter must *not* conflict with the IRQ value of any other device already in your computer. If an existing device uses the IRQ value that corresponds to your COMM port selection, you may set switches 4 and 5 so that the value for the WaveRunner Adapter is IRQ 5.



Appendix F. Additional Modem Information

The following information concerns the modem function of the WaveRunner Adapter

The AT Command Set, first developed by Hayes Microcomputer Company, is an industry standard for controlling asynchronous modems. Configuration and dialing options for the modem are controlled using these commands, which are sent to the modem using the same serial I/O interface used to transfer data.

Special escape sequences in the data sent through this interface determine whether the interface is processing AT commands or data for transmission to another modem. Because of the popularity of the AT Command Set interface, the WaveRunner Adapter supports it for the ISDN environment, permitting many modem applications to work at ISDN speeds without change.

The AT commands supported by the WaveRunner Adapter are listed in the online help. To access the AT commands, bring up the Help Index and select **AT Command Description**

The online help also includes S-Register Summary information and information about modem messages and codes.



Appendix G. Product Warranties and Notices



International Business Machines Corporation Armonk, NY 10504

Statement of Limited Warranty

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

Machine: WaveRunner Digital Modem

Warranty Period*: One Year

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

Production Status

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

The IBM Warranty

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

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

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

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

If a Machine does not function as warranted during the warranty period, IBM or your reseller will repair or replace it (with a Machine that is at least functionally equivalent) without charge. If IBM or your reseller is unable to do so, you may return it to your place of purchase and your money will be refunded.

If you transfer a Machine to another user, warranty service is available to that user for the remainder of the warranty period. You should give your proof of purchase and this Statement to that user.

Warranty Service

To obtain warranty service for the Machine, you should contact your reseller or call IBM. In the United States, call IBM at **1-800-426-7299** In Canada, call IBM at **1-800-565-3344**. You may be required to present proof of purchase.

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

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

It is your responsibility to:

1. obtain authorization from the owner (for example, your lessor) to have IBM or your reseller service a Machine that you do not own;
2. where applicable, before service is provided —
 - a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provide,
 - b. secure all programs, data, and funds contained in a Machine,
 - c. inform IBM or your reseller of changes in a Machine's location, and
 - d. for a Machine with exchange service, remove all features, parts, options, alterations, and attachments not under warranty service. Also, the Machine must be free of any legal obligations or restrictions that prevent its exchange; and
3. be responsible for loss of, or damage to, a Machine in transit when you are responsible for the transportation charges.

Extent of Warranty

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

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

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

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

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2. loss of, or damage to, your records or data; or
3. economic consequential damages (including lost profits or savings) or incidental damages, even if IBM is informed of their possibility.

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Electronic Emission Notices

The following statements apply to this IBM product. The statement for other IBM products intended for use with this product will appear in their accompanying manuals.

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

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

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

interference received, including interference that may cause undesired operation.

Industry Canada Compliance Statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled: *Digital Apparatus*, ICES-003 of Industry Canada.

Avis de conformité aux normes d'Industrie Canada

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe B prescrites dans la norme sur le matériel brouiller: *Appareils numériques*, NMB-003 édictée par Industrie Canada.

Notice to New Zealand Users

Physical Damage:

Immediately disconnect the equipment should it become physically damaged and arrange for its disposal or repair.

Mains powered electrical equipment:

The PC which houses this card is classified as a computer rather than a communications terminal. As with all mains powered electrical equipment, there is a legal requirement for it to meet the requirements of the New Zealand Wiring Regulations. It is the responsibility of the PC supplier rather than the Telepermit System to ensure that these requirements are met.

Notice to United Kingdom Users

Approval for Connection

WaveRunner Adapter adapter cards which bear the logo and approval number of the British Approvals Board for Telecommunications (BABT) are approved for direct connection to UK public telecommunications networks.

WaveRunner Adapter adapter cards which do not bear a BABT logo and approval number are approved under UK General Approval number NS/1210/G/1234/J/100003 for indirect connection only. Such connection can only be made by way of other equipment which is itself type approved for direct connection to UK public telecommunications networks.

The following section applies to WaveRunner Adapter adapter cards intended for direct connection:

- The WaveRunner Digital Modem adapter is intended for installation in internal expansion slots of personal computer systems which meet the requirements for Safety Extra Low Voltage (SELV).
- Electrical characteristics of the WaveRunner Adapter adapter card are given below.

Voltage	Maximum Current
+ 5V dc +/- 5%	1.6A
+12V dc +/- 10%	35mA
- 12V dc +/- 10%	25mA

It is a condition of approval that the current drawn by the total of all adapter cards installed within the host environment, together with any auxiliary apparatus, does not exceed the power specification as stated in the technical reference material of the host equipment. Failure to comply with this instruction will invalidate the approval of this adapter card if as a result it ceases to comply with safety requirements.

- The WaveRunner Adapter adapter card does not use or generate excessive voltages: an excessive voltage is one which exceeds 42.4V peak ac or 60V dc. The electrical interface at the adapter card edge connector uses Safety Extra Low Voltages. To maintain the independent approval of this adapter card, it is essential that other optional cards do not use or generate mains voltage or any other hazardous voltage. If there is any doubt, the advice of a competent engineer must be obtained before any other adapters are installed into the host environment.
- Connection of this adapter card to the network must be made via the cable supplied with it; connection via any other cable will invalidate the approval.

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HelpCenter	Personal System/2
HelpWare	Person to Person/2
LAN Distance	PS/2
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Other company, product, and service names, which may be denoted by a double asterisk (**), may be trademarks or service marks of others.

Glossary

This Glossary defines terms and abbreviations as applicable to the WaveRunner Adapter. It glossary includes terms and definitions from the *IBM Dictionary of Computing* (New York; McGraw-Hill, Inc., 1994).

- The symbol (A) identifies definitions from the *American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies can be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018.
- The symbol (I) identifies definitions from published parts of the *Information Technology Vocabulary*, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1).
- The symbol (T) identifies definitions from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1.
- The symbol (N) identifies definitions from *A Catalog of National ISDN Solutions for Selected NIUF Applications, Draft 5*, published by the North

American ISDN Users' Forum in October 1992.

analog. Pertaining to data consisting of continuously variable physical quantities. (A) Contrast with *digital*.

application driver. Software written to enable functions on and allow applications to access a hardware device.

B-Channel. 64 kbps "bearer" channel used for voice, circuit or packet switched data. (N)

Basic Rate Access (BRA). An ISDN line that includes two 64-kbps B channels and one 16-kbps D-channel; also known as Basic Rate Interface (BRI). (N) Synonymous with *2B+D*.

baud. The rate at which signal conditions are transmitted per second. Contrast with *bits per second (bps)*.

Bell 103. U.S. Standard modem protocol for 300-bps communications.

Bell 212A. U.S. Standard modem protocol for 1200-bps communications.

bits per second (bps). The rate at which bits are transmitted per second. Contrast with *baud*.

channel. A path along which signals can be sent.

Circuit-mode. Type of switching that causes a one-to-one correspondence between a call and a circuit. That is, a circuit or path is assigned for a call between each switching node, and the circuit or path is not shared with other calls. (N)

Customer Premise Equipment (CPE). A generic term for communications terminal gear that resides on the customer's premise and is owned by the customer. (N)

D-Channel. The ISDN channel that carries signaling information to control the call setup, teardown, or invocation of supplementary services. The D-Channel may also be used to provide Packet Mode Data Service. (N)

digital. (1) Pertaining to data in the form of digits. (A) Contrast with *analog*. (2) Pertaining to data consisting of numerical values or discrete units.

DN. A directory number or subscriber number or telephone number entries. (N)

Group 3 fax (G3 fax). A protocol for the transmission of facsimile through the analog telephone network.

High-level Data Link Control (HDLC). A synchronous bit-oriented protocol used for communicating high-speed data between two

synchronous devices over a wide area network.

Integrated Services Digital Network (ISDN). An international standard defined by the CCITT for an all-digital network providing end-to-end digital connectivity to support a wide range of voice and non-voice (data and video) services. (N)

Microcom Networking Protocol (MNP). A series of ten communications protocols developed by Microcom, Inc. Modems commonly use the first five of these protocols. MNP2-4 are error correcting protocols. MNP5 is a data compression protocol that is capable of up to 2:1 compression.

modem (modulator/demodulator). A device that converts digital data from a computer to an analog signal that can be transmitted in a telecommunication line, and converts the analog signal received to data for the computer.

National ISDN-1 (NI-1). The Bellcore/Regional Bell Operating Company's defined protocols and services on the BRA interface. It is the first step in establishing a uniform ISDN definition for the US and it allows NI-1 compliant ISDN devices to connect to any switch that supports NI-1, regardless of the manufacturer.

Network Termination 1 (NT1). A unit that provides physical and electromagnetic termination of the U-interface two-wire transmission

line, converts between layer 1 formats used at the U and T reference points, and performs some maintenance functions. (N)

passive bus. The customer premises wiring that allows multiple ISDN devices to be connected to an ISDN line.

protocol. A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. (I)

Reference Diskette. A diskette shipped with the IBM Personal System/2 computers with Micro Channel architecture. The diskette contains code and files used for configuration of options and for hardware diagnostic testing.

Regional Bell Operating Company (RBOC). One of the regional phone companies formed from the deregulation of AT&T.

Request For Comment (RFC 1294). A communications standard for sending multiple protocols over a frame relay network. WaveRunner Adapter provides a limited implementation of this standard for communication over ISDN.

RJ-11 jack. A four pin modular connector used to physically connect an NT1 to an ISDN line at the U-Interface.

RJ-45 jack. An eight pin modular connector used to physically connect to an NT1 at the S/T-Interface.

Serial Line Internet Protocol (SLIP). An asynchronous protocol used for sending Internet Protocol data through a serial (COMM) port.

Service Profile ID (SPID). A parameter provided by the telephone company when requesting ISDN service. It associates an ISDN directory number with a specific profile of service characteristics stored within the network.

Signaling System #7 (SS7). A standard for digital out-of-band signaling between central offices; also called Common Channel Signaling #7 (CCS7). (N)

T-interface. Synonym for *T-reference point*.

T-reference point. Performs the same function as the S-interface but uses an NT1 rather than an NT2.(N) Synonymous for T-interface.

terminal. A device attached to the end of an ISDN line. Also known as *terminal equipment (TE)* or *terminal equipment type 1 (TE1)*.

Terminal Endpoint Identifier (TEI). A value used to identify a specific connection endpoint within a service access point. (N)

Transmission Control Protocol/Internet Protocol (TCP/IP). A set of protocols that allow cooperating computers to share resources across a heterogeneous network. Typically, this protocol is used for

communicating over the Internet network.

U-Interface. A twisted pair subscriber loop that connects the NT1 reference point to the ISDN network. This interface provides Basic Rate Access with an operating frequency of 160 kbps and an information rate of 144 kbps. Under US regulations, this also marks the line of demarcation between customer-owned equipment and the public network. (N)

V.120. Terminal rate adaptation protocol for the B channel. (N)

V.21. Modem protocol for 300-bps communications outside the USA.

V.22. Modem protocol for 1200-bps communications outside the USA.

V.22bis. International standard modem protocol for 2400-bps communications.

V.32. International standard modem protocol for 4800- and 9600-bps communications.

V.32bis. International standard modem protocol for 4800-, 7200-, 9600-, 12000-, and 14400-bps communications.

V.42. International standard for data compression that is capable of up to 4:1 compression.

V.42bis. International standard for data compression that is capable of up to 4:1 compression.

2B+D. Synonym for Basic Rate Access (BRA).

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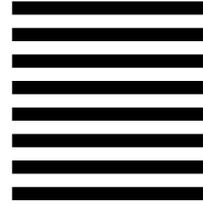


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