WaveLAN

PC-AT Installation and Operation

July 1993

This manual, in conjunction with the *WaveLAN PC-AT Installation and Configuration* card, describes how to install and operate the WaveLAN card in a PC-AT or PC/ISA compatible. This manual is intended for the hardware installer and the network manager.

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Part Number: EK-DEIWA-IN. C01

EK-DEIWA-IN. C01

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Federal Communications Commission (FCC) Radio Frequency Interference Statement

The following statement applies only to the WaveLAN 915MHz Network Interface Card:

This device complies with Part 15 of FCC Rules. Operation of this device is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference that might cause undesired operation.

Information to User

This device must be installed and used in strict accordance with the manufacturer's instructions. However, there is no guarantee that interference to radio communications will not occur in a particular commercial installation. If this device does cause interference, which can be determined by turning the host equipment off and on, the user is encouraged to consult the instruction manual of the host equipment or the local device supplier. In case the device does cause harmful interference with an authorized radio service, the user/operator shall promptly stop operating the device until harmful interference has been eliminated

Digital Equipment Corporation is not responsible for any radio or television interference caused by unauthorized modification of this device or the substitution or attachment of connecting cables and equipment other than specified by Digital Equipment Corporation. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

Statement of Compliance per Government of Canada Department of Communication TRC–76

"Spread Spectrum systems in the band 902–928 MHz cannot claim protection from other users or cause interference to authorized users or services operating in the same or adjacent bands, that is, they operate on a "no-interference no-protection" basis. Authorized services are listed in the Canadian Table of Frequency Allocations or as determined by the Department of Communications from time to time."

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Safety ⚠

Any warning or caution that appears in this manual is defined as follows:

Warning	Contains information to prevent personal injury.
Caution	Contains information to prevent damage to equipment.
Vorsicht	Enthält Informationen, die beachtet werden müssen, um den Benutzer vor Schaden zu bewahren.
Achtung	Enthält Informationen, die beachtet werden müssen, um die Geräte vor Schaden zu bewahren.
Danger	Signale les informations destinées à prévenir les accidents corporels.
Attention	Signale les informations destinées à prévenir la détérioration du matériel.
Aviso	Contiene información para evitar daños personales.
Precaución	Contiene información para evitar daños al equipo.

The cautions that must be observed for the hardware described in this manual are listed below in English, German, French, and Spanish. The pages on which these safety messages appear are also listed.

WARNING ⚠

Do not attempt to install the interface card without disconnecting the power cord and other cables from your personal computer. If you fail to take this precaution, you could receive a severe electrical shock or cause damage to your personal computer. [Page 3–10]

VORSICHT

Bevor Sie die Schnittstellenkarte installieren, müssen Sie das Netzkabel und alle anderen am Computer angeschlossenen Kabel unbedingt herausziehen. Bei Mißachtung dieser Sicherheitsmaßnahme besteht Elektrisierungsgefahr und die Möglichkeit, Ihren Personalcomputer schwer zu beschädigen.

DANGER

N'essayez pas d'installer la carte sans débrancher le cordon d'alimentation ni les autres câbles de votre ordinateur. Si vous ne prenez pas cette précaution, vous risquez d'être électrocuté ou d'endommager votre ordinateur.

AVISO

No intente instalar la tarjeta de la interfaz sin desconectar el cable de alimentación y los demás cables de su ordenador personal. Si no toma esta precaución, podría recibir una descarga eléctrica grave o causar daños a su ordenador personal.

CAUTION ⚠

Static electricity can severely damage the interface card. To prevent damage when unpacking and handling the interface card, make sure you touch a grounded metal surface, such as the chassis of your personal computer, to discharge the excess static electricity from your body. [Page 3–1, 3–10]

ACHTUNG

Die elektronischen Teile der Schnittstellenkarte könnten durch statische Elektrizität schwer beschädigt werden. Berühren Sie vor dem Auspacken und Einbauen der Karte ein geerdetes Metallteil, zum Beispiel das Gehäuse Ihres Computers, um eventuell in Ihrem Körper angesammelte statische Elekrizität zu entladen.

ATTENTION

L'électricité statique peut endommager la carte d'interface. Pour éviter tout risque lors du déballage et de la manipulation de la carte, touchez une surface métallique mise à la terre, par exemple le boîtier de votre ordinateur, afin de vous décharger de l'électricité statique.

PRECAUCIÓN

La electricidad estática puede dañar seriamente la tarjeta de la interfaz. Para evitar daños al desempaquetar y manejar dicha tarjeta, asegúrese de tocar una superficie metálica conectada a tierra, como puede ser el chasis de su ordenador personal, a fin de descargar el exceso de electricidad estática que su cuerpo haya podido adquirir.

CAUTION ⚠

Before installing the WaveLAN Network Interface Card (NIC), be sure to turn off the power to the personal computer. Refer to the safety advisory in the WaveLAN PC-AT Installation and Operation guide. [*WaveLAN PC-AT Installation and Configuration card*, Page 4]

ACHTUNG

Schalten Sie den Computer aus, bevor Sie die Netzwerkkarte WaveLAN installieren. Beachten Sie die Sicherheitsvorschriften in der Installations- und Betriebsanleitung für die Netzwerkkarte WaveLAN PC-AT.

ATTENTION

Avant d'installer la carte d'interface réseau WaveLAN, mettez l'ordinateur hors tension. Reportez-vous aux conseils de sécurité qui figurent dans le guide d'installation et de fonctionnement de la carte d'interface réseau WaveLAN.

PRECAUCIÓN

Antes de instalar la Tarjeta de Interfaz de Red (NIC) de WaveLAN, asegúrese de cortar la alimentación del ordenador personal. Véase el aviso de seguridad del manual de instalación y funcionamiento de WaveLAN PC-AT.

Preface

About This Manual

This manual explains how to install and use the WaveLAN® Network Interface Card in an Industry Standard Architecture (ISA) Personal Computer AT® (PC-AT) or PC/ISA compatible, running in a Network Driver Interface Standard (NDIS) compatible network environment, such as PATHWORKS™ or Microsoft® LAN Manager or a Novell® NetWare® network environment.

The WaveLAN Network Interface Card (NIC) is available in the following two variants:

- The WaveLAN North America NIC operates in the 915 MHz ISM band. Throughout this manual, this NIC is referred to as the WaveLAN 915.
- The WaveLAN International NIC operates in the 2400 MHz (2.4 GHz) band. Throughout this manual, this NIC is referred to as the WaveLAN 2400.

This manual describes the installation and operation of both the WaveLAN 915 and the WaveLAN 2400 products.

Who Should Use This Manual

This manual is intended for the hardware installer and the network manager. This manual assumes you have a working knowledge of basic PC operations and are familiar with network driver installation procedures.

Conventions

The following conventions are used in this manual:

Example	Description
Enter	The Enter key is shown with an intial capital letter.
INSTCONF.EXE	MS-DOS™ filenames and directories are shown in upper-case type.
instconf -a3e0	MS-DOS command line entries are shown in lowercase bold type.
10H	Hexadecimal numbers are represented by the letter "H" which immediately follows the number.

Overview of This Manual

Chapter 1	Introduces you to WaveLAN networking concepts and describes the system components.
Chapter 2	Lists the installation steps and what you should consider before you begin.
Chapter 3	Describes how to set up and install the WaveLAN Network Interface Card in a PC, and how to connect and position the antenna.
Chapter 4	Describes how to use the configuration utilities to install user-selectable configuration options.
Chapter 5	Describes the characteristics of radio-frequency operation and how to optimize network performance. Introduces the diagnostic utilities.
Chapter 6	Describes how to use the Point-to-Point Diagnostics utility to optimize antenna placement and verify proper operation of the WaveLAN card and antenna.
Chapter 7	Describes how to use the Node Diagnostics utility to monitor network performance and pinpoint problem areas.
Chapter 8	Describes error and warning messages displayed by the Configuration utilities, the network drivers, and the Diagnostics utilities.

Appendix A	Provides information to install WaveLAN network drivers in a Novell NetWare environment.
Appendix B	Describes the steps required to install the WaveLAN Network Driver Interface Specification (NDIS) driver in NDIS-compatible network environments, such as PATHWORKS or LAN Manager.
Appendix C	Describes how to install the Microsoft Windows for Workgroups driver.
Appendix D	Allows you to keep a hardcopy record of the installation.

Further Information

The README.TXT file on the WaveLAN software diskette contains information not available when this manual was printed.

The DISKETTE.TXT file lists all directories and files on the diskette, with a short description of each entry.

1

Overview of WaveLAN

1.1 Introducing WaveLAN

WaveLAN® provides cable-free departmental local area networking for personal computers. This gives you the flexibility to relocate people and equipment, or to add more stations to your network, without the planning effort and cost of recabling.

Because WaveLAN uses spread-spectrum communications technology, it provides a level of data security.

1.2 Typical Network Configurations

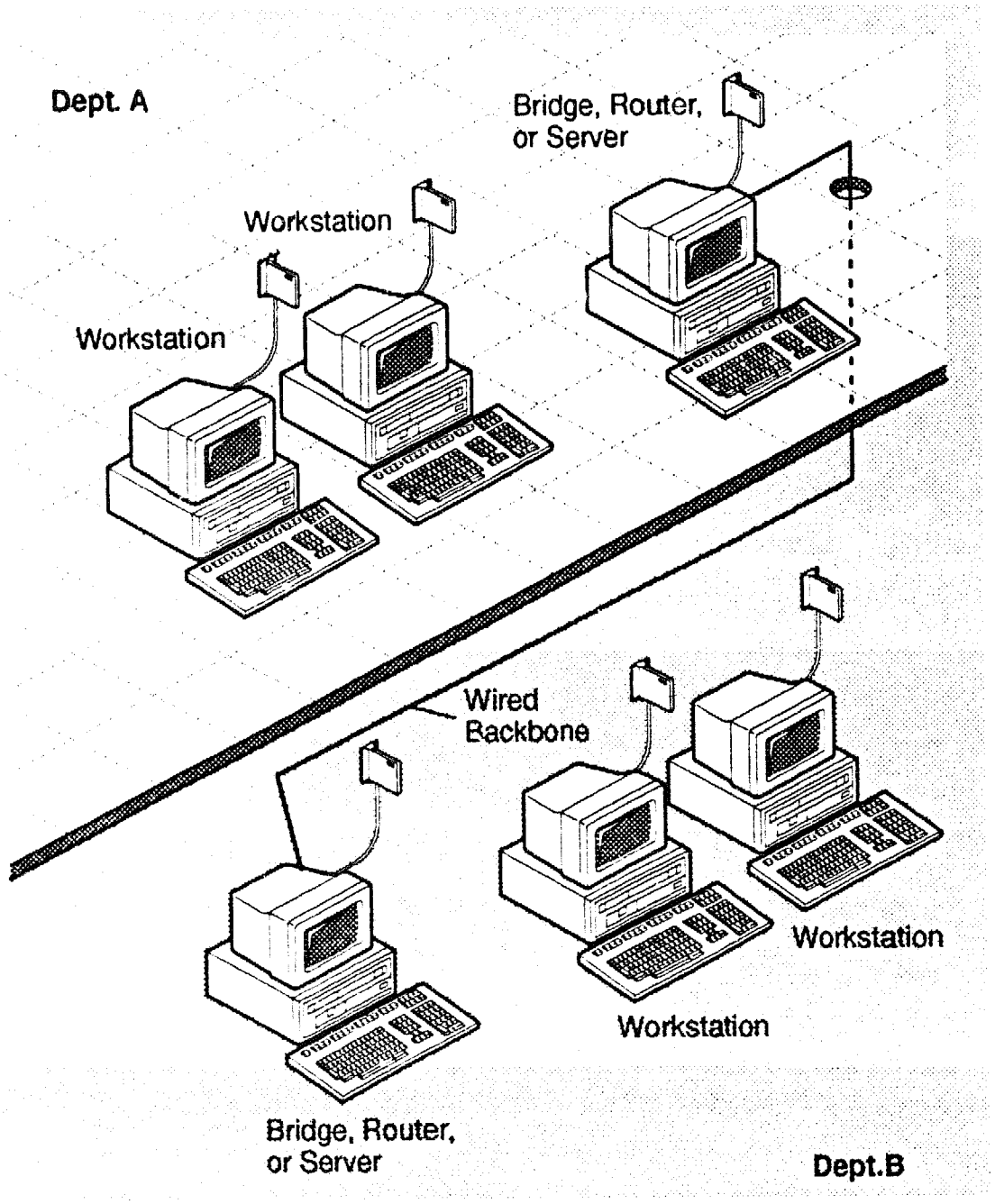
Your WaveLAN Network Interface Card (NIC) and driver software have been developed for use with common industry-standard networking systems, including systems supporting the Network Driver Interface Standard (NDIS), such as PATHWORKS™ and LAN Manager as well as Novell® NetWare®.

Typical configurations include:

- Standalone WaveLAN network, including one or more servers with clients.
- Physically separated WaveLAN networks (for example: on different floors of the same building) connected by means of a wired backbone (Figure 1–1).
- Wired network with a bridge allowing connection into the network from one or more WaveLAN stations.
- A wireless bridge connecting two wired LANs (overcoming physical obstacles to a wired connection).

WaveLAN NICs can be configured with different network identifiers to allow multiple networks to share the same work area. This type of configuration allows a workstation to be easily switched from one network to another.

Figure 1–1: WaveLAN Networks Connected by Means of Wired Backbone



1.3 WaveLAN Components

The WaveLAN adapter kit contains the basic set of components required to install WaveLAN in a PC. This kit includes:

- WaveLAN NIC
- Omnidirectional Antenna Module kit
- WaveLAN software diskette (3.5-inch or 5.25-inch)
- *WaveLAN PC-AT Installation and Operation* guide
- *WaveLAN PC-AT Installation and Configuration card*

  Figure 1–2 shows the basic WaveLAN component set.

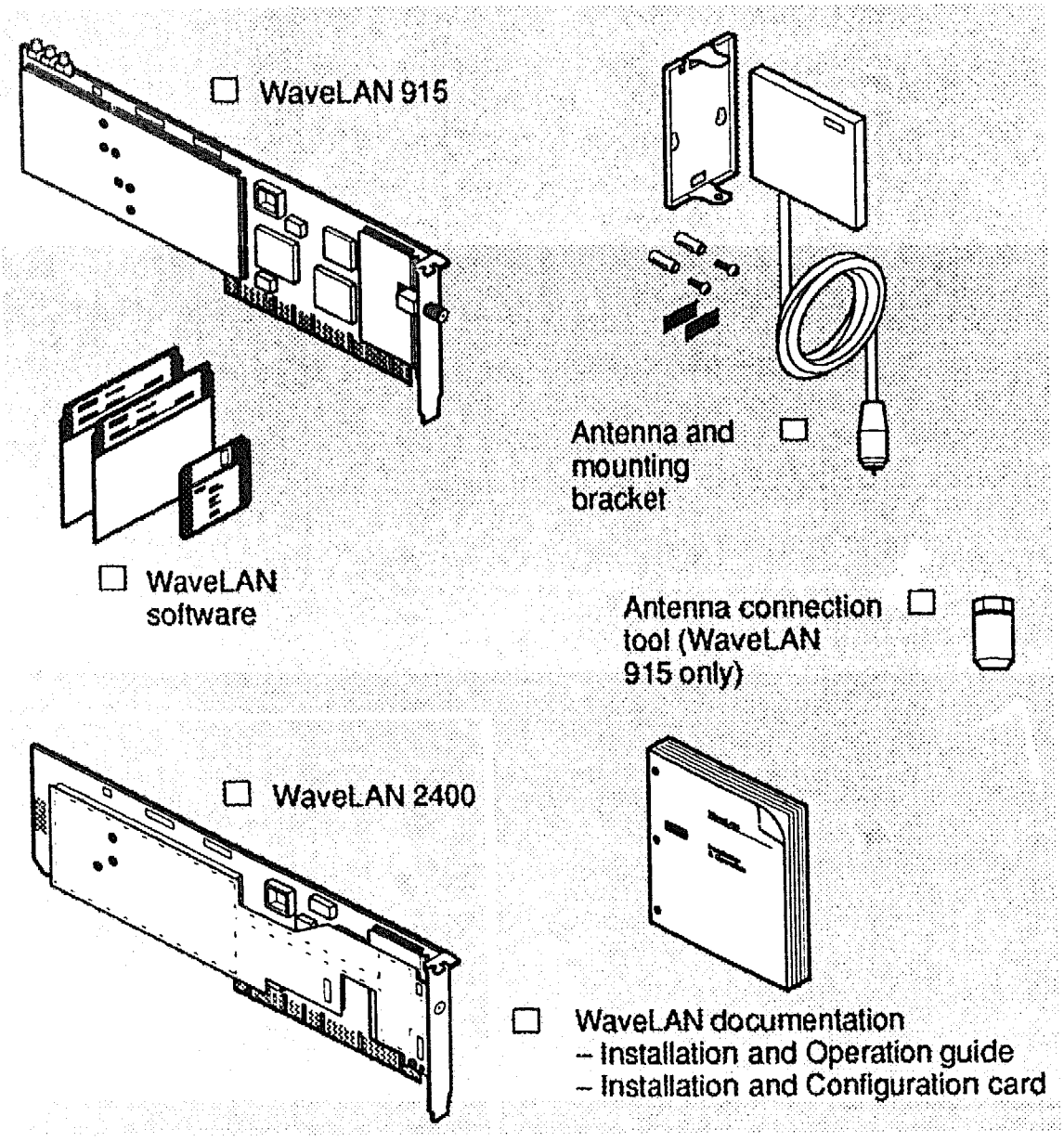
- Optional WaveLAN components include:
  - Encryption Security feature kit.
  - Directional Antenna kit for interfacility communications. This option is available only for the WaveLAN 915.
  - 30-foot (9-meter) Antenna Extension Cable kit (available only for the WaveLAN 915).
  - Remote Boot feature (available only for the WaveLAN 2400).
  - Wireless Network Connect products.

1.3.1 The WaveLAN Network Interface Card

The WaveLAN NIC is a printed circuit board which acts as an interface between your PC and the rest of the network. The NIC is installed in an ISA slot inside the PC. It contains a radio-frequency modem in addition to the circuitry needed to process the signals exchanged between your PC and other stations on the network. The NIC also contains a socket for the optional security chips.

The WaveLAN 2400 also contains a socket for the optional Remote Boot ROM.

Figure 1–2: **Basic WaveLAN Component Set**



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1.3.2 The Omnidirectional Antenna Module Kit

The Omnidirectional Antenna Module kit includes a coaxial cable and tool for attachment to the NIC. The module is accompanied by a mounting bracket that you can use to attach it to the wall or stand it upright on a flat horizontal surface, such as a PC base, desktop, wall, or filing cabinet.

1.3.3 WaveLAN Software Diskette

The WaveLAN software diskette consists of:

- Utilities to configure your NIC after it is installed in the PC
- Network driver files enabling you to use your NIC in a NetWare or NDIS-compatible environment
- Diagnostic utilities allowing you to position workstations and antennas for best performance, and to monitor and diagnose your network

1.3.4 WaveLAN PC-AT Installation and Operation Guide

This document provides the necessary information to install and operate WaveLAN.

1.3.5 WaveLAN PC-AT Installation and Configuration Card

This card provides a quick overview to install and configure WaveLAN.

1.3.6 Optional WaveLAN Components

The optional components for the WaveLAN 915 include the following:

- The encryption security feature — used to provide extra network security by encrypting all data transmitted on the network. If this option is selected, it must be installed in all stations in the WaveLAN network.
- The Directional Antenna kit — allows wireless interfacility communications up to 5 miles (8 km) range.
- The Antenna Extension Cable — used to move the antenna away from areas of excessive interference, or to increase its height to provide a better transmission path in difficult environments. (30 feet).
- Wireless Network Connect — used to connect a WaveLAN to a wired Ethernet Local Area Network (LAN).
- Remote Wireless Network Connect — used to connect two Ethernet LANs in different buildings, up to 5 miles apart, using a wireless, radio frequency connection.

The optional components for the WaveLAN 2400 include the following:

- The encryption security feature — used to provide extra network security by encrypting all data transmitted on the network. If this option is selected, it must be installed in all stations in the WaveLAN network.
- Remote Boot ROM for NetWare — enables a NetWare client to boot from the server.
- Wireless Network Connect — used to connect a WaveLAN network to a wired Ethernet Local Area Network (LAN).

1.4 Card Specifications

Table 1–1 describes the specifications for the WaveLAN card.

Table 1–1: WaveLAN Card Specifications

	WaveLAN 915	WaveLAN 2400
Frequency:	902 – 928 MHz band	2.4 GHz band
Modulation technique:	(RF) Direct Sequence Spread Spectrum – (Information) Differential Quadrature Phase Shift Keying (DQPSK)	
Output power:	500 mW	100 mW
Data rate:	2 Mbps	2 Mbps
Medium access protocol:	CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance)	
Bit error rate:	Better than 10^{-8} @ –72 dBm receiver threshold	
Power consumption		
+ 5V:	1500 mA (maximum)	1600 mA (maximum)
– 12V:	32 mA (maximum)	40 mA (maximum)
+ 12V:	330 mA (maximum)	175 mA (maximum)
Hardware strapping:	I/O Base Address	I/O Base Address, Remote Boot Base Address
Regulations:	FCC – Type approved per Part 15.126	User or site license may be required. Check country specific requirements.
LED indicators:	Card Power Receive Data Activity Transmit Data Activity	N/A

1.5 Range

The range of the WaveLAN NIC, with the attached Omnidirectional Antenna, varies according to a number of environmental factors, such as building construction, building layout, furniture, and antenna positioning. Typical performance in different environments is given below:

Range	WaveLAN 915	WaveLAN 2400
Open office:	800 foot (244 meter)	400 foot (120 meter)
Semi-open office:	200 foot (60 meter)	100 foot (30 meter)
Closed office:	105 foot (32 meter)	50 foot (15 meter)

The environment definitions listed are defined as follows:

Open office — Antennas can see each other (for example, there are no physical obstructions between them).

Semi-open office — Work space is divided by shoulder-height, hollow wall elements; antennas are at desktop level.

Closed office — Fully enclosed work space with nonmetallic, nonconcrete walls from floor to ceiling.

2

Preparing for Installation

2.1 What You Need

To install a WaveLAN® network station, you must have the following:

- A PC-AT compatible with a free ISA card slot
- MS-DOS™ Version 3.2 or higher or OS/2® Version 1.2x or higher
- One of the following network operating environments:
  - Any network operating system supporting the NDIS standard, such as PATHWORKS™ or LAN Manager
  - Novell® NetWare® Version 2.1x or higher, Version 3.1x, Version 4.0 or NetWare Lite
- The basic WaveLAN component set, which consists of a Network Interface Card (NIC), an Omnidirectional Antenna Module kit, and software diskette(s)
- The appropriate tool for removing the cover of your PC

2.2 Installation Steps

1. Install the WaveLAN NIC.

   If desired, install the optional encryption chip (and the optional Boot ROM for the WaveLAN 2400 only) on the WaveLAN NIC. Verify the I/O base address. Then, install the card in a PC and connect the antenna. These steps are described in Chapter 3.

2. Set the Network Configuration Parameters.

   Run the Configuration Setup utility to set the Network Configuration parameters and create a Card Configuration diskette. Do this only once per network. This step is described in Chapter 4.

3. Configure the WaveLAN NIC.

   Using the Card Configuration diskette, run the Configuration Install utility to install the Network Configuration parameters on each WaveLAN card. This step is described in Chapter 4.

4. Test the Communications Path (optional).

   When you have installed at least two WaveLAN NICs, and before installing any network drivers, use the Point-to-Point Diagnostics utility to check your WaveLAN installation. This step is described in Chapter 6.

5. Install the Network Drivers.

   Install or generate a network driver. The procedure is different for each network operating system. Refer to the appropriate appendix for information about installing drivers.

Refer to...	For Information About...
Appendix A	installing NetWare drivers
Appendix B	installing NDIS compatible drivers, including examples for the PATHWORKS, LAN Manager, PC/TCP™, StarLAN, and LAN Server environments
Appendix C	Microsoft Windows for Workgroups

2.3 The Installation Worksheet

The Installation Worksheet, located in Appendix D, is designed to help you carry the information you need through the various installation steps. It also serves as a hard-copy record of your installation, which will help you maintain your WaveLAN network or adapt it to meet changing requirements.

3

Installing the Network Interface Card

3.1 Unpacking the Network Interface Card

Use the following guidelines when handling the WaveLAN® Network Interface Card (NIC) (Figure 3–1):

1. Carefully open the antistatic shipping bag.

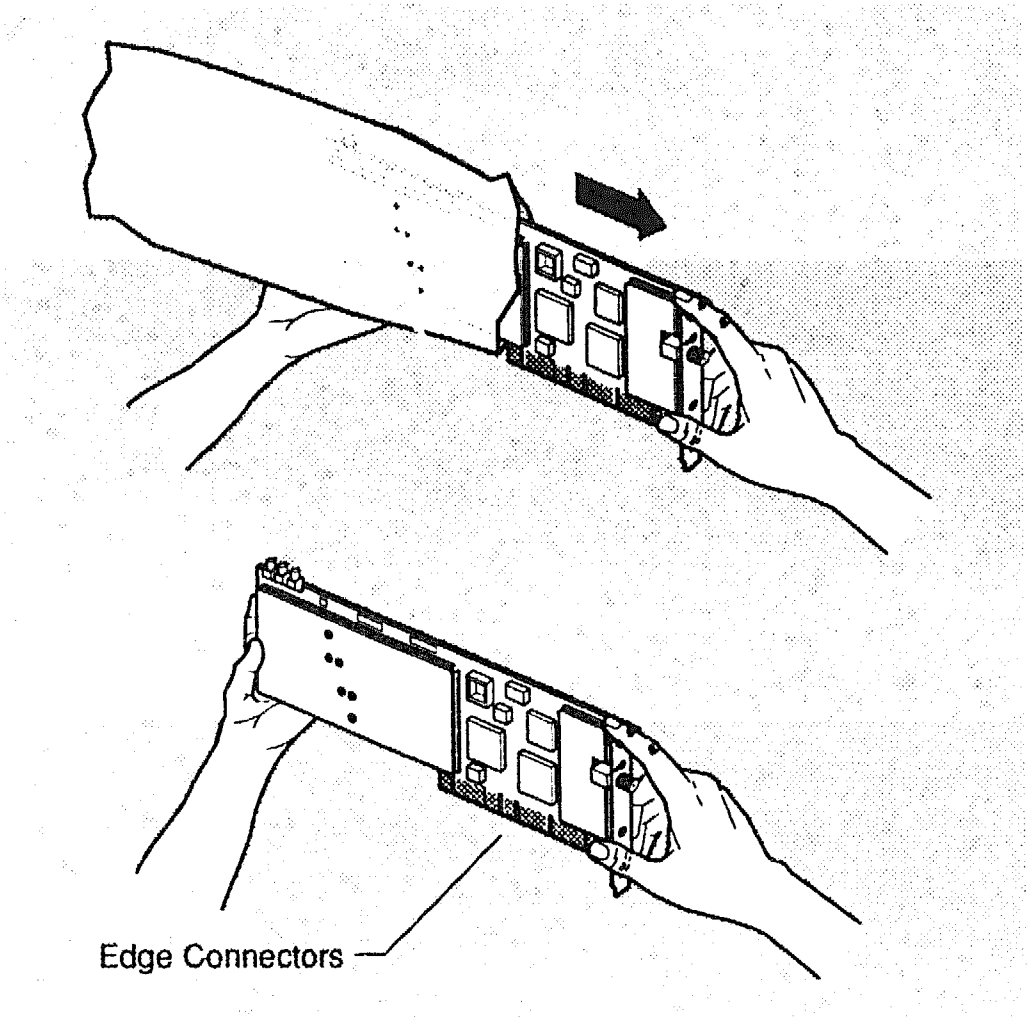
CAUTION ⚠

Static electricity can severely damage the interface card. To prevent damage when unpacking and handling the interface card, you should make sure you touch a grounded metal surface, such as the chassis of your PC, to discharge the excess static electricity from your body.

2. Hold the NIC by its edges when you remove it from its shipping bag. Do not touch any of the components or the edge connectors along the bottom of the NIC.

3. Place the NIC on the antistatic bag on a flat surface.

Figure 3–1: Handling the Network Interface Card



3.2 Installing the Security Feature

To use the optional encryption feature in your WaveLAN network, you need to install the encryption chip in each NIC.

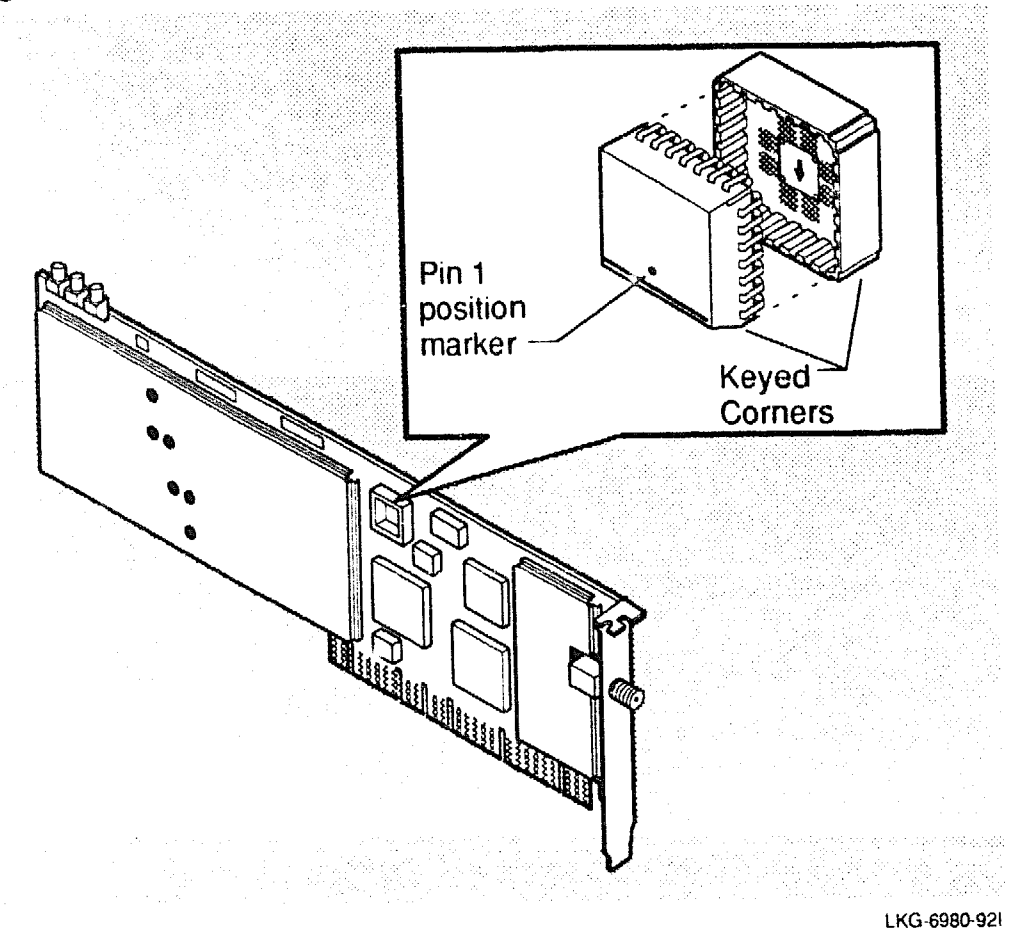
1. Following the precautions described earlier about static electricity, carefully remove the security chip from its antistatic packaging.

2. Examine and familiarize yourself with where the chip and the socket will be installed (Figure 3–2). Note the arrow embossed on the base of the socket and the dot in the middle of the bevelled edge marking the position of Pin 1. Also, note the keyed corner of the chip and its corresponding socket.

3. Make sure the chip is correctly aligned, with the arrow in the socket base pointing to the dot marking the Pin 1 position and the keyed corners in line.

4. Carefully push the chip into its socket.

Figure 3–2: Installing the Security Feature



NOTE

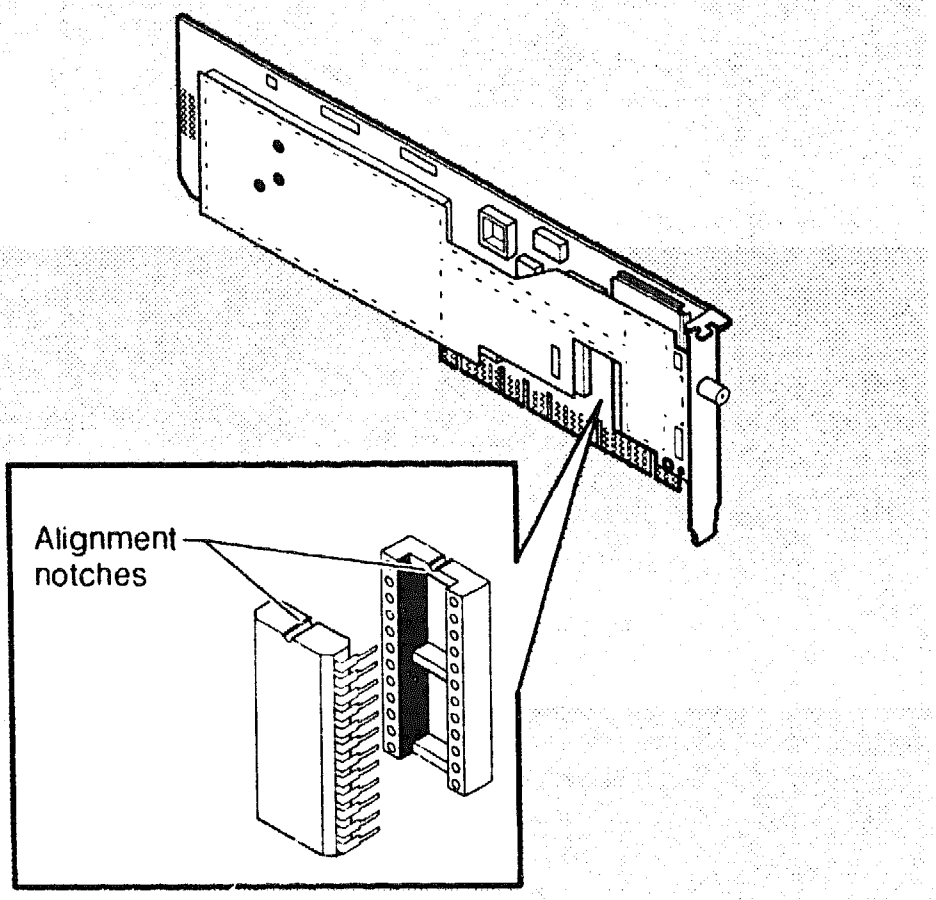
Figure 3–2 shows the security chip installation on the WaveLAN 915. Use the same instructions to install the security chip in the WaveLAN 2400.

3.3 Installing the Remote Boot Feature

To install the Remote Boot ROM on the WaveLAN 2400, follow these steps:

1. Following the instructions described in Section 3.1 about static electricity, carefully remove the Boot ROM from its antistatic packaging.
2. Examine and familiarize yourself with the chip and the socket where it will be installed (see Figure 3–3). Make sure that none of the connection pins are bent.
3. Make sure the chip is correctly aligned. The notch at one end of the chip should line up with the notch in the socket. (This correctly orients Pin 1 in the socket with Pin 1 on the Boot ROM.)

Figure 3–3: Installing the Boot ROM



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4. Holding the chip lengthways between the finger and thumb, engage the pins on one side with the corresponding row of holes in the socket, and gently manipulate the chip until the pins on both sides are engaged. Carefully push the chip into its socket.

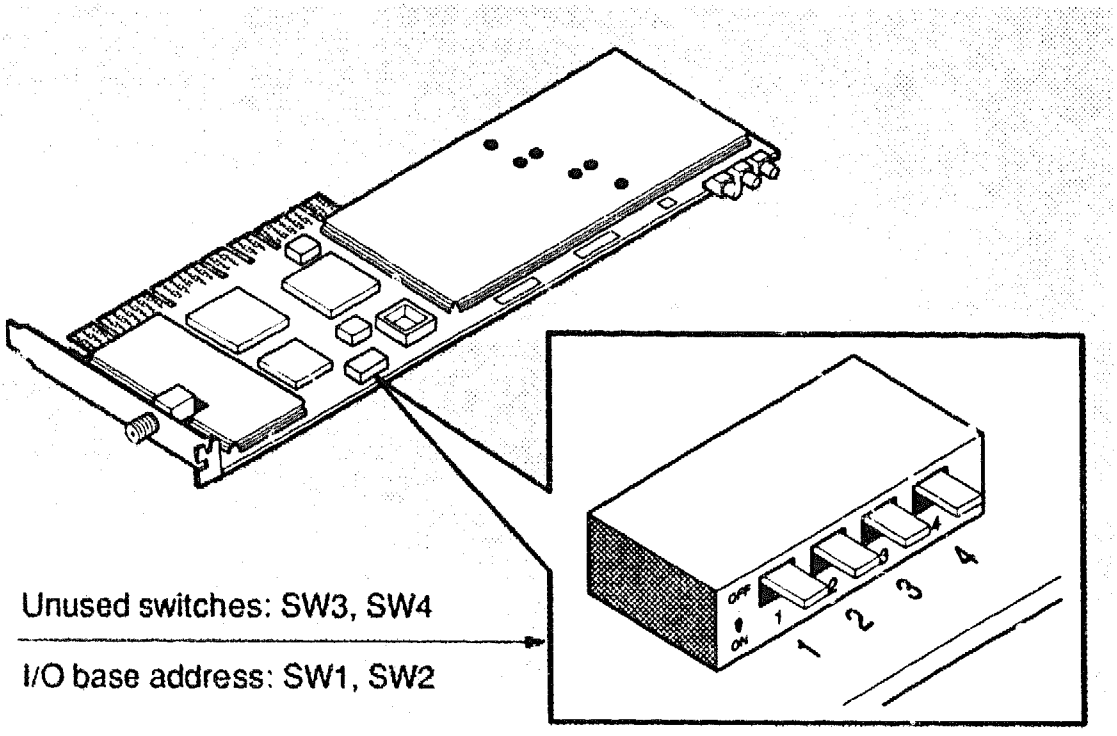
3.4 Verifying the Hardware Configuration Switches

The WaveLAN NICs have a switch block containing four switches.

3.4.1 Verifying the WaveLAN 915 Configuration Switches

Figure 3–4 shows the WaveLAN 915 switch block. The first two switches (switches 1 and 2) are used to set the card's I/O base address. Switches 3 and 4 are not used on the WaveLAN 915.

Figure 3–4: WaveLAN 915 Hardware Configuration Switches



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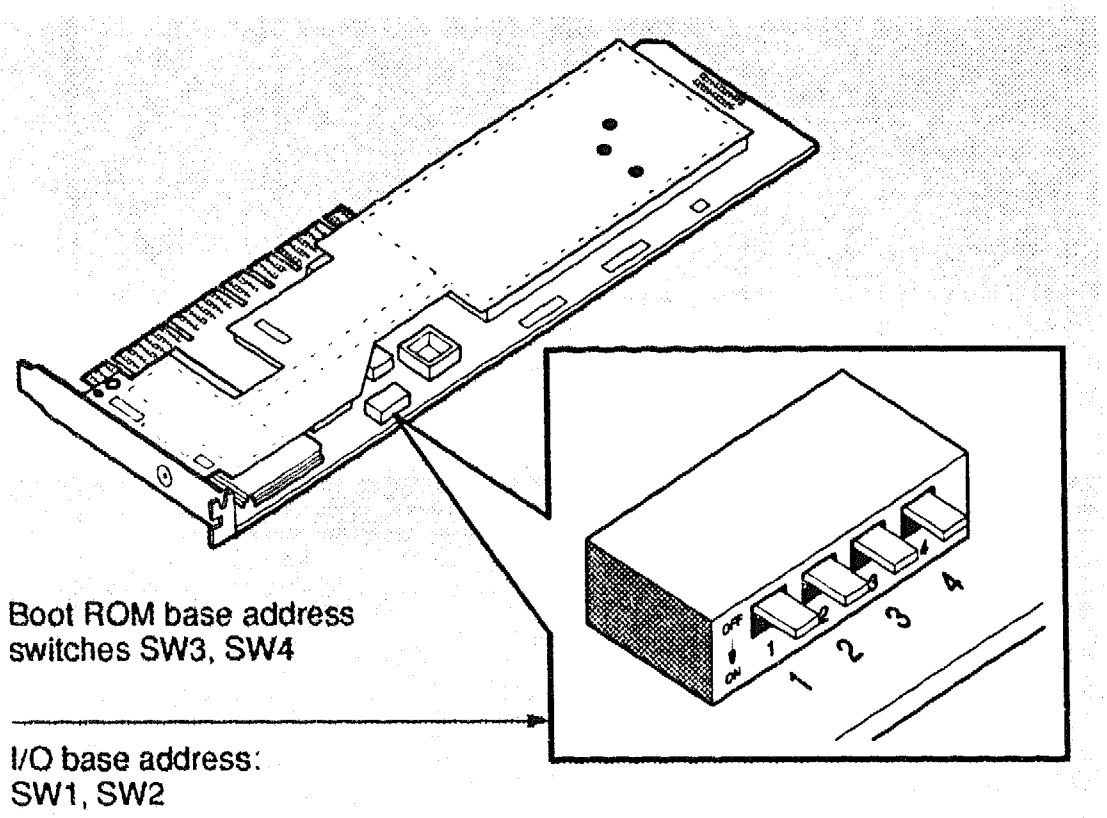
3.4.2 Verifying the WaveLAN 2400 Configuration Switches

Figure 3–5 shows the WaveLAN 2400 switch block. The first two switches (switches 1 and 2) are used to set the card's I/O base address. Switches 3 and 4 are used to select the Remote Boot address or to disable the Remote Boot ROM.

Figure 3–5: WaveLAN 2400 Hardware Configuration Switches



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3.5 Setting the I/O Base Address

The I/O base address switches are factory preset to address **0300H**. Change this setting only if another device already installed in your computer is using this address. Use a small flat-blade screwdriver to set the switches. Record the settings on the Installation Worksheet in Appendix D. Table 3–1 shows the available I/O base addresses.

Table 3–1: I/O Base Address Switch Settings

I/O Address	Switch 1	Switch 2
0300H	OFF	OFF (Default)
0390H	OFF	ON
03C0H*	ON	OFF
03E0H	ON	ON

NOTE

*I/O Address 03COH is used by many EGA and VGA video adapter cards. If your video adapter is using this I/O Address, do not use it for the WaveLAN NIC.

3.6 Setting the Remote Boot Base Address

If you are using the Remote Boot feature for the WaveLAN 2400, use the information in this section to set the Remote Boot base address.

The remote boot address switches are factory preset to disable remote boot. Change this setting only if you have installed the Remote Boot ROM and plan to use it immediately. Table 3–2 shows the available remote boot addresses.

Table 3–2: Remote Boot Base Address Switch Settings

Base Address	Switch 3	Switch 4
Disabled	OFF	OFF (Default)
C8000H	OFF	ON
D0000H	ON	OFF
D8000H	ON	ON

To set the switches, use a small flat-blade screwdriver. Record the settings on the appropriate installation worksheet in Appendix D.

NOTE

If you have installed the Remote Boot ROM, but are not going to use this feature immediately, or if you later discontinue using it, make sure to set or reset the switches to disable remote boot.

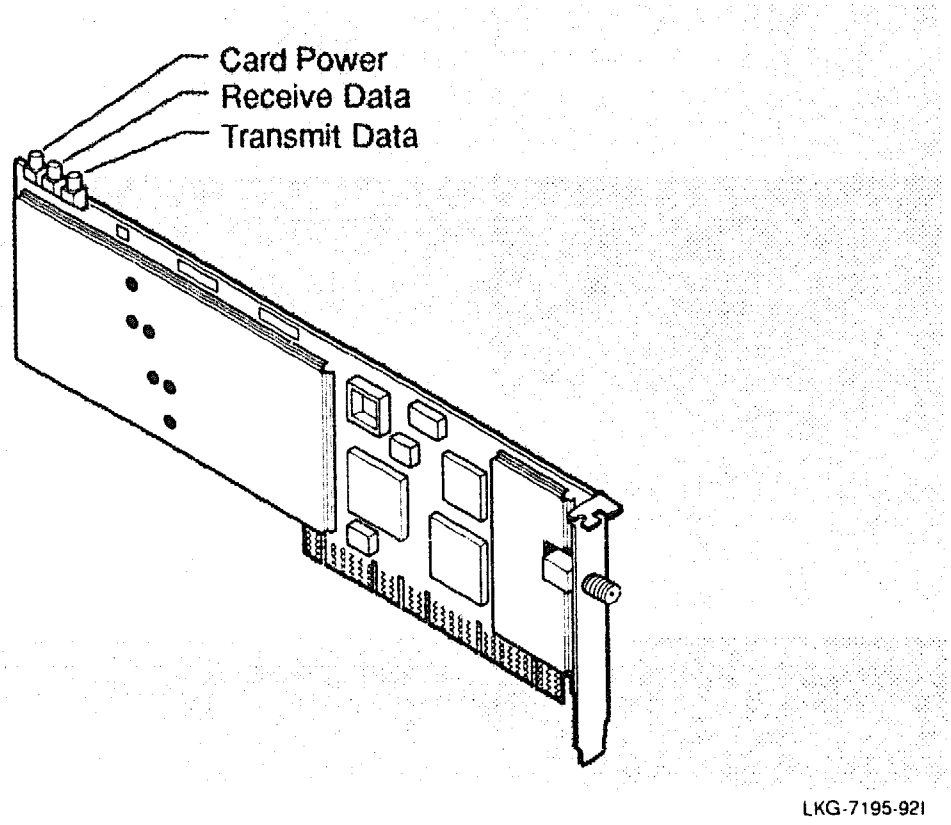
3.7 Using LEDs

The WaveLAN 915 has three Light Emitting Diodes (LEDs) that provide a visual indication of the status of the card (Figure 3–6). Table 3–3 describes the functions of the LEDs.

Table 3–3: Function of LEDs for the WaveLAN 915

LED display	Status	Description
First LED	Continuous light	Card has power
Second LED	Flashing light	Receive data activity
Third LED	Flashing light	Transmit data activity

Figure 3–6: WaveLAN 915 LEDs Display



NOTE

The WaveLAN 2400 does not have any Light Emitting Diodes (LEDs) indicators.

3.8 Installing the Interface Card in Your PC

The following directions apply to most PCs. See your PC owner's manual for more information on how to install an adapter board.

CAUTION ⚠

Static electricity can severely damage the interface card. To prevent damage when unpacking and handling the interface card, you should make sure you touch a grounded metal surface, such as the chassis of your PC, to discharge the excess static electricity from your body.

1. Turn off the power switch and disconnect cables.

   Turn off the power to your PC and any attached devices. Disconnect the power cord and other cables.

WARNING ⚠

Do not attempt to install the interface card without disconnecting the power cord and other cables from your PC. If you fail to take this precaution, you could receive a severe electrical shock or cause damage to your PC.

2. Remove the cover of your PC.

   Refer to your PC owner's manual for specific instructions about removing the cover.

3. Choose an ISA expansion slot and remove the I/O cover plate.

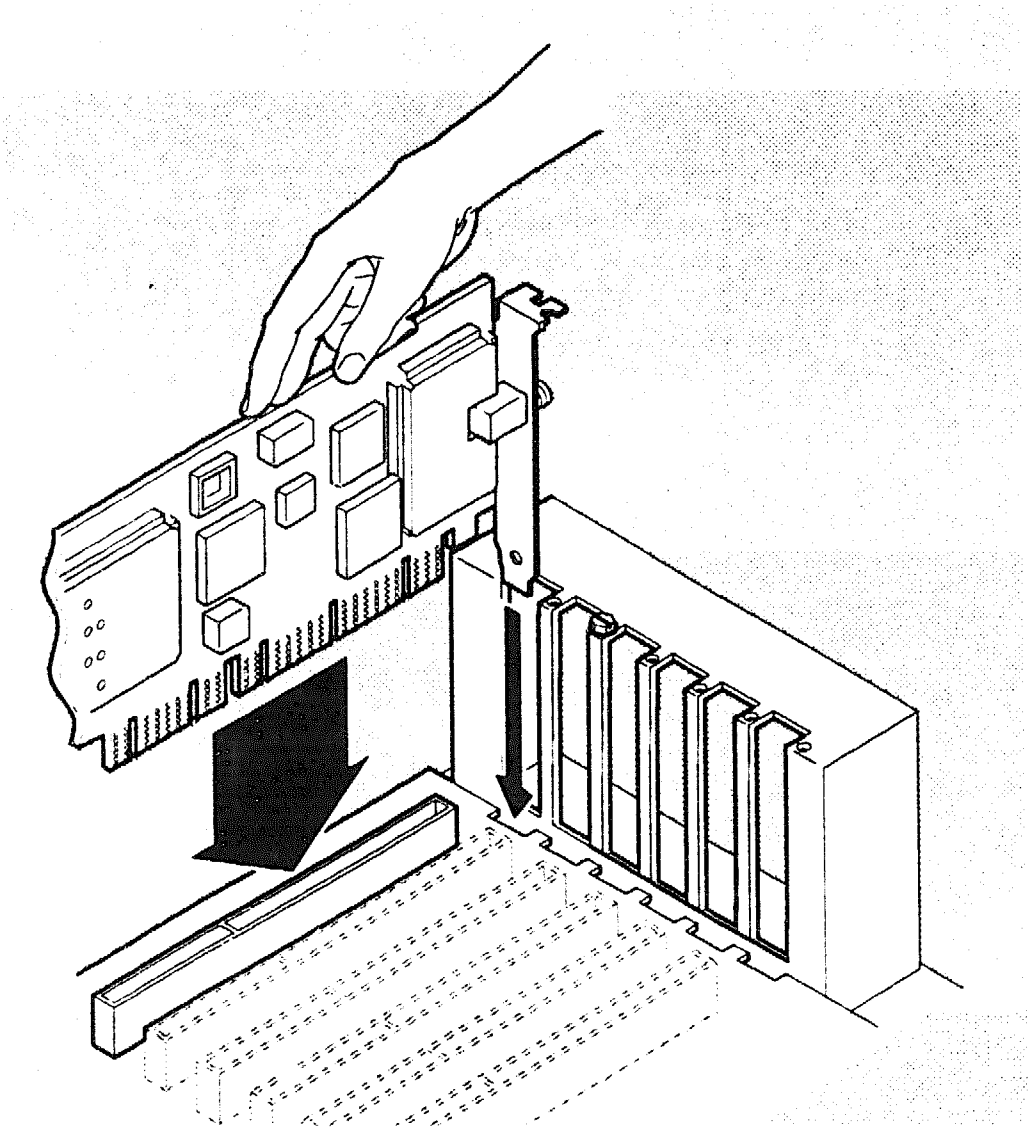
   Prepare the expansion slot to hold your NIC by removing the slot's I/O cover plate. The I/O cover plate is attached by a single screw on the top.

4. Remove the blank I/O cover plate for the expansion slot you have chosen.

5. Insert the NIC.

   Align the edges of the card with the expansion slot and gently press on the top of the card until the edge connector is seated in the slot (Figure 3–7).

Figure 3–7: Inserting the Network Interface Card



6. Insert and tighten the retaining screw in the I/O cover plate of the WaveLAN NIC.

7. Install the antenna.

   Refer to Section 3.9 for detailed information about connecting the antenna to a WaveLAN NIC.

3.9 The OmniDirectional Antenna

The Omnidirectional Antenna is a compact, high-performance antenna designed for easy installation and flexible usage in an indoor work group environment, such as an office or department store. The antenna module is fitted with a coaxial cable which allows it to be placed on the desktop or mounted on a wall or other surface adjacent to the PC.

The antenna kit includes:

- Antenna module with cable
- Support bracket for vertical or horizontal placement
- Support bracket mounting accessories:
  - Screws and wall anchors
  - Adhesive backed Velcro® fastening strips
- Cable attachment tool (available only for the WaveLAN 915)

An optional 30-foot (9-meter) Antenna Cable Extension kit is also available for the WaveLAN 915.

3.9.1 Connecting the WaveLAN 915 Antenna

To connect the antenna to the WaveLAN 915, screw the male F-type connector to the female connector protruding from the WaveLAN card end bracket. Connect the antenna using the following steps (Figure 3–8):

1. Screw the antenna cable connector onto the card's antenna connection until hand tight.

On some PCs you may have difficulty doing this with fingers alone In that case, use the antenna attachment tool provided. Slip the attachment tool (the large end first) over the cable connector and push the connector through until it seats snugly in the tool. The connector should protrude about .1 inch (2 mm) from the small end of the tool. You can now use the attachment tool to screw the cable connector home. (The tool remains on the cable after fitting.)

2. Reinstall the cover and attach the cables.

   Reattach the PC's cover. Move your PC to its intended location, and attach the power cord and other cables.

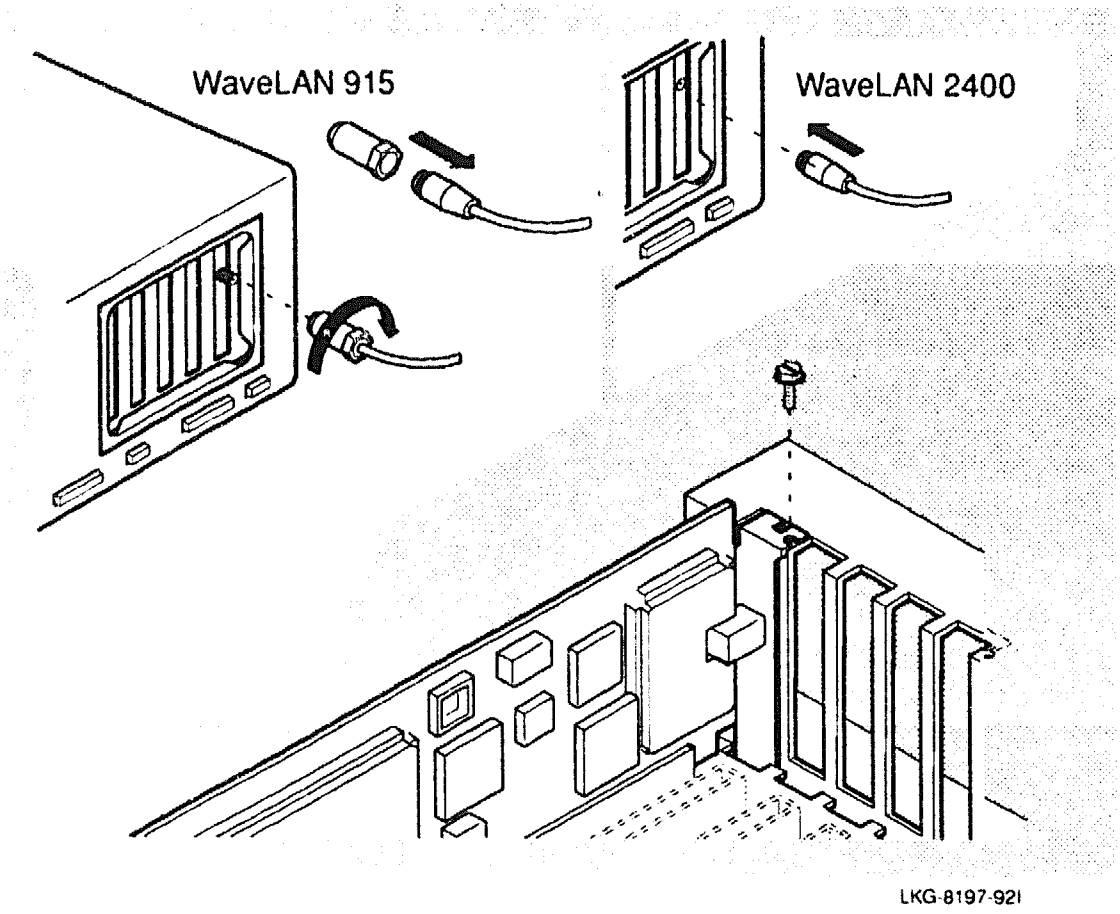
3.9.2 Connecting the WaveLAN 2400 Antenna

Use these steps to connect the WaveLAN 2400 antenna (Figure 3–8):

1. To connect the antenna to the WaveLAN 2400, simply push the cable end connector onto the connector situated in the middle of the card's end bracket until it clicks into place.

2. Reattach the PC's cover. Move your PC to its intended location, and attach the power cord and other cables.

Figure 3–8: Connecting the Antenna

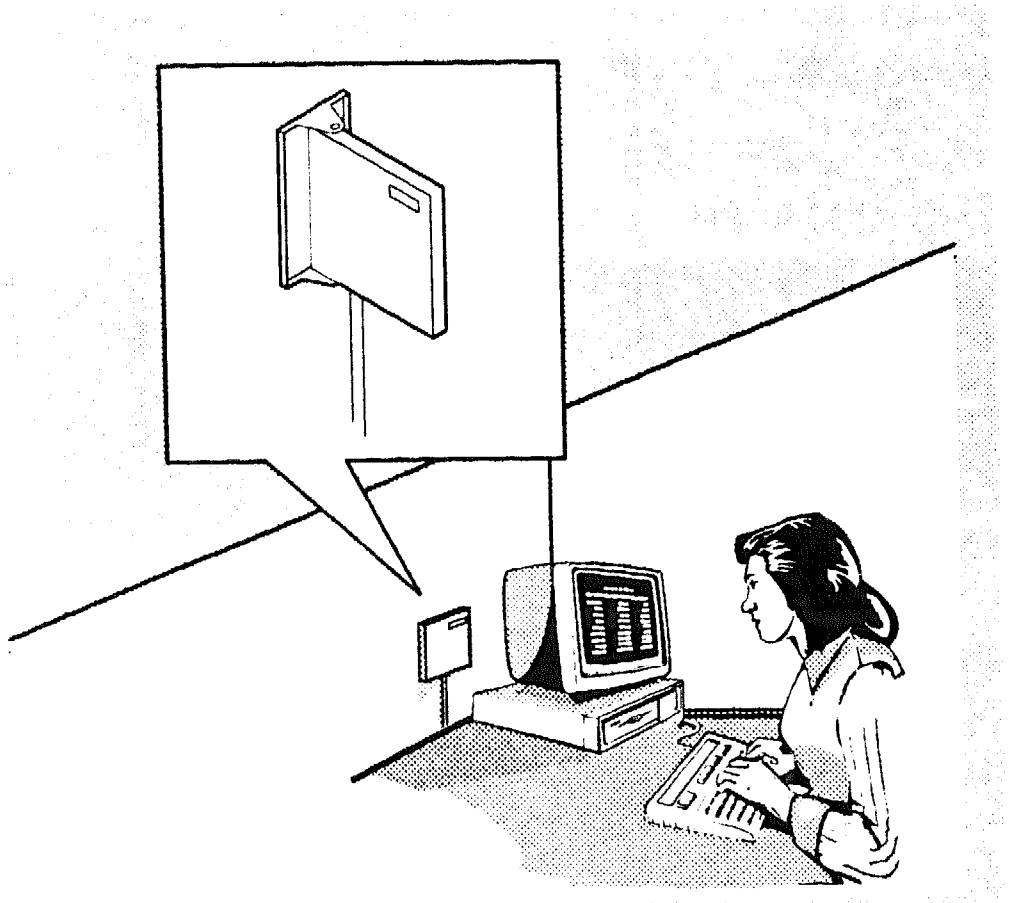


3.10 Antenna Placement

The antenna performs best in an open environment with as few obstructions as possible (Figure 3–9). Signal strength can be significantly affected by closeness to metal surfaces and, to a lesser extent, by concrete walls, thick masonry walls, and solid, high-density materials. To ensure the best performance:

- Ensure the antenna is securely connected to the WaveLAN NIC in your PC.
- Position the antenna at right angles to the mounting surface.
- Place the antenna as high as possible.
- Avoid leaving the antenna where it may be concealed by working materials such as books or papers.
- Avoid placing the antenna flat against a metal, concrete, or masonry surface.

Figure 3–9: Typical Antenna Position



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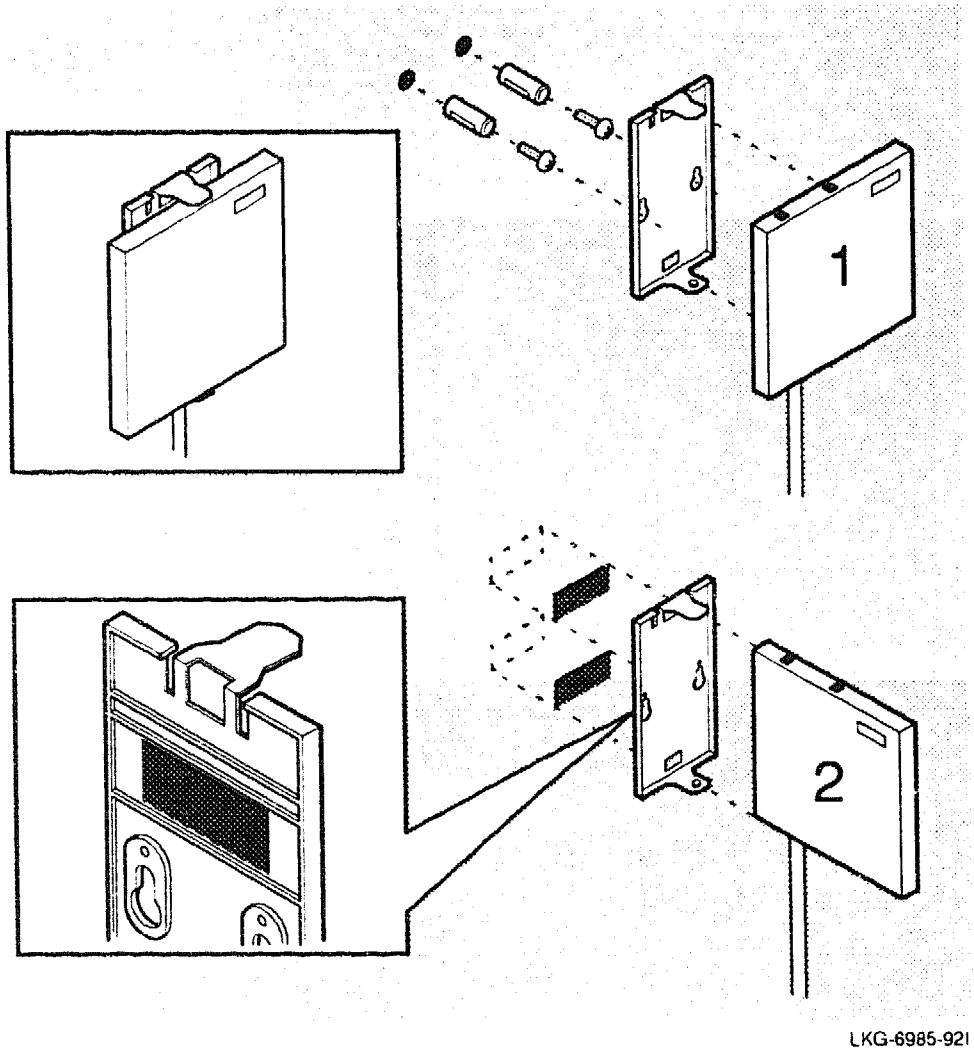
3.11 Using the Antenna Support Bracket

The antenna module is constructed to snap onto its support bracket in one of two positions (Figure 3–10):

1. At its midpoint, allowing the module to sit flat against the support bracket. This method is suitable for windows and light hollow partitions. It is not recommended for metal, concrete, masonry, or solid wood surfaces.

2. At its edge, taking a position at right angles to the support bracket. This is the normal and preferred method, allowing the antenna module to hang from a vertical surface or stand on a horizontal one.

Figure 3–10: Using the Antenna Mounting Bracket



You can affix the support bracket to a vertical surface in one of two ways:

- With the wall anchors and screws provided. This method is recommended for concrete and masonry walls, papered or with a rough surface.
- With the Velcro fastening strips. Use this method for smooth hollow surfaces, such as half-height office dividing walls and filing cabinets or windows. On cloth-covered walls, attach only the Velcro to the antenna.

4

Software Installation and Card Configuration

4.1 Before You Begin

Use the MS-DOS™ DISKCOPY command to create a working copy of your WaveLAN® diskette. Use your working copy in all card configuration and driver installation procedures. Store the original diskettes in a safe place.

4.2 Configuration Parameters

You need to define and install the configuration parameters before your WaveLAN Network Interface Card (NIC) can operate in your environment. These parameters include:

- Network ID – Used to differentiate one WaveLAN network from another if more than one network is located in the same area. All stations on a network must have the same Network ID.
- Medium Access Control (MAC) Address Type – Identifies the type of addressing used to differentiate one station from another in the same network. This can be UNIVERSAL (which is the default), in which case the unique value factory-installed on the NIC will be used, or Local, in which case you can assign a value to the MAC address.
- MAC Address – Used only if Local address type is selected. You can assign an address value when the configuration is being installed. The value you assign must be unique within the network.

- Interrupt Request Line Number (IRQ) – You can select one of eight IRQ values 3, 4, 5, 7, 10 (default), 11, 12, 15. You must select an IRQ not in use by another device in your PC.

Optional features include:

- Datalink Security – If you intend to use data encryption and have installed the security chip on the WaveLAN NIC, this parameter allows you to enable and disable encryption.
- Encryption Key – If encryption is enabled, you can specify a key value or have one generated automatically. The encryption key must be the same for all stations in the network.
- Remote Boot – If you are using the WaveLAN 2400, you can use the Remote Boot feature. (Refer to your Remote Boot User's Guide for more information.)

There are two ways you can configure the WaveLAN NIC's network parameter values:

- Automatically create a card configuration disk by running the INSTALL program on the distribution media (Section 4.3).
- Manually set the configuration using the SETCONF.EXE and INSTCONF.EXE utilities (Sections 4.4 – 4.7).

4.3 Automatically Creating a Card Configuration Disk

Use the following procedure to create a card configuration disk:

1. Use the DOS FORMAT/S command to create a bootable MS-DOS diskette.
2. Place the WaveLAN distribution diskette in drive A and type A:INSTALL. This procedure prompts you for the following:

Prompt	Response Options
Network ID	*nn–nn*
MAC Address Type	Universal*/Local
Datalink Security	Disable*/Enable (Encryption option)

*Default

3. The Installation procedure prompts you to put your bootable MS-DOS diskette in the drive. Once the diskette is in the drive, the procedure writes out the file INSTCONF.EXE to your diskette.

   Now you can use this newly created configuration diskette to load the network parameter values on each WaveLAN NIC in the network.

4. Place this new configuration diskette in drive A and type A:INSTALL (or reboot with this diskette).

4.4 Manually Configure Using the SETCONF and INSTCONF Utilities

Configuring the WaveLAN NIC is a two-step procedure:

1. Use the Configuration Setup utility SETCONF.EXE to set the parameter values common to all stations in the network (for example, all parameters except MAC Address and IRQ). The values you set are written to the executable Configuration Install file INSTCONF.EXE (or to another name you assign).

   NOTE

   You need only perform step 1 once. The parameter values you select apply to all WaveLAN NICs in the network.

2. Run the executable Configuration Install file (INSTCONF.EXE) at each PC to install the parameter values on the NIC. In this step, you must select an IRQ (default=10). You can also assign a local MAC Address if you selected the Local option during Configuration setup.

   NOTE

   If you installed the Remote Boot feature on the WaveLAN 2400, see your Boot ROM User's guide for details on how to install a configuration.

4.5 Setting the Configuration Parameters

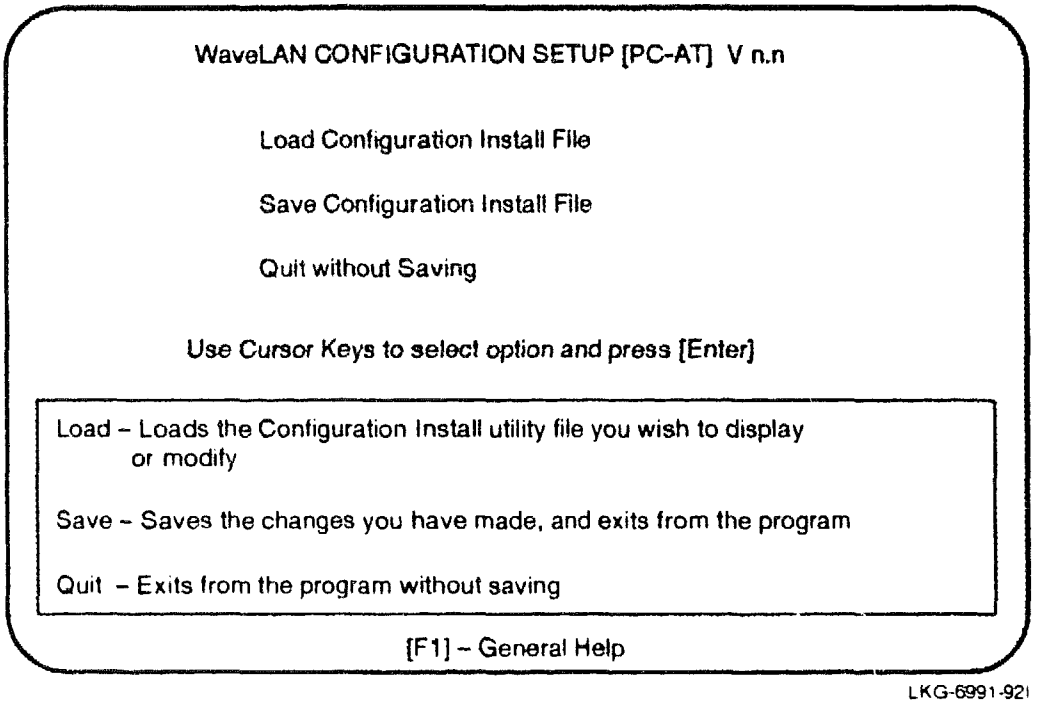
To set the configuration parameters, you need a PC running MS-DOS and equipped with a floppy disk drive. The WaveLAN NIC does not have to be installed.

Place your working copy of the WaveLAN software diskette in the floppy disk drive. Change to directory \CONFIG.DOS on the floppy drive. Type **setconf** and press Enter. The initial screen appears (Figure 4–1).

NOTE

If your PC is equipped with a monochrome monitor, or if the screen display is difficult to read, display quality may be improved if you use the Monochrome Command Line Option set. Type **setconf –m** at the DOS prompt.

Figure 4–1: Opening Screen of SETCONF.EXE



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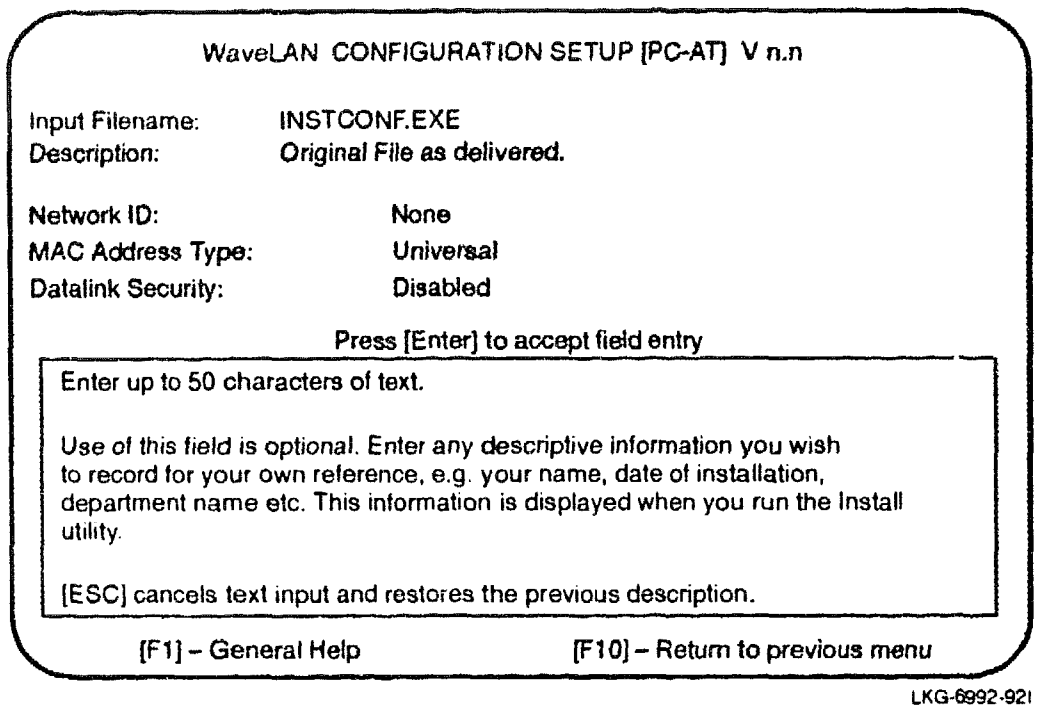
Use the cursor keys, or type **L**, to load the Configuration Install file. You are then asked for the name of the file to load. If you are installing a board for the first time, enter: **instconf** (or the name that you assigned to the Install Configuration file).

NOTE

INSTCONF.EXE is the name of the unmodified configuration installation file supplied on the WaveLAN software diskette.

After the Configuration Install file is loaded, you see the Parameter Entry screen (Figure 4–2).

Figure 4–2: SETCONF Parameter Entry Screen



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NOTE

Figure 4–2 shows the parameter entry screen for the factory default Configuration Install file. If you have previously installed a configuration using INSTCONF.EXE, the last parameter values used will be displayed.

4.5.1 Description

Enter the information you think might be useful to help you manage your WaveLAN configuration. The information you enter is displayed when you install the configuration, and also, if you run the setup utility again, using the same input file. If you maintain multiple networks or frequently reconfigure stations, this information becomes valuable reference data. This entry is optional.

4.5.2 Network Identifier

A unique network identifier (Network ID) logically connects the stations in a WaveLAN network (as cabling physically connects stations in a wired network). The Network ID is used to distinguish this network's traffic from other radio-frequency signals in the vicinity, such as traffic for another nearby WaveLAN network. All nodes in a network must have the same Network ID.

You must enter a Network ID the first time you run the Configuration Setup utility. You can enter a hexadecimal number up to 4 digits, or press F2 to generate a random value.

4.5.3 MAC Address Type

Every WaveLAN NIC contains a unique factory-installed address conforming to the universal MAC address convention. If you prefer to use a locally determined addressing system, select the Local option.

4.5.4 Datalink Security

Use this parameter to turn encryption on or off. A selection here is meaningful only if the optional security feature is installed on the WaveLAN NIC.

If you select ENABLED, the program displays the current value of the encryption key. If this value is NONE (which is the case when you use the program for the first time), you must enter a valid 16-hexadecimal key value. The easiest way to accomplish this is to use F2 to generate one.

NOTE

Guidelines for valid key values are given in the documentation that comes with your security feature kit. If you intend to manually enter the encryption key, please read these guidelines carefully before you do so.

4.6 Saving the Configuration Parameters

When you are satisfied with the entries you have made on the Data Entry screen, press F10 to return to the closing screen and select the Save option.

You can save your changes to the file that you loaded at the beginning of the Setup program, in which case, existing parameter values are overwritten, or you may choose to have the new values written to a different file. If you direct the values to a different file, the program prompts you for the new filename.

NOTE

If you are going to install this configuration on multiple WaveLAN NICs, you should copy the Configuration Install file to a bootable diskette. You can then use this diskette to install the configuration parameters on each WaveLAN NIC in the network.

To create a diskette that you can use to install the configuration parameters on each WaveLAN NIC, follow these steps:

1. Prepare an MS–DOS bootable diskette (use the DOS FORMAT command with the /S option).
2. Copy the Configuration Install file you have just created to the bootable diskette.

NOTE

You can maintain multiple Configuration Install files. This facilitates flexible resource-switching between networks or regular reconfiguration for security or other reasons. A network-switching example is described in Section 4.9.

4.7 Installing a Configuration

You used the Configuration Setup utility to set parameter values in the executable Configuration Install file. Now you must run this file to install the configuration values on the WaveLAN NIC.

To complete this part of the configuration process, you must already have installed the WaveLAN NIC in a PC. You also need to know:

- I/O Base Address (set by switches on the NIC when it was installed – default value is 300)
- Interrupt Request Line number (required to run the NIC's startup diagnostics before configuration – default value is 10)

NOTE

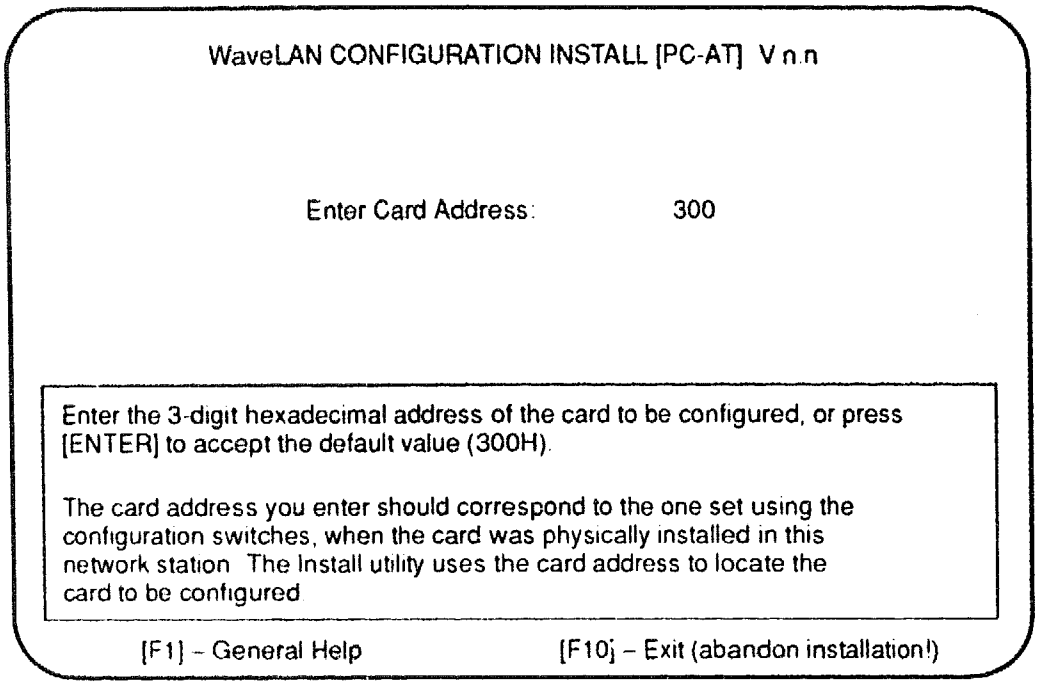
The following pages describe the full-screen operation of the installation utility. You can bypass some screen operations by using command line options, described in Section 4.8.

NOTE

The Configuration Install utility performs startup diagnostic routines which preempt normal operation of the WaveLAN NIC. Do not attempt to install a configuration while the network driver is running.

Place the diskette containing the Configuration Install file in the floppy disk drive. Make sure the DOS prompt matches the drive you have selected. Type **instconf** (or the name you used to save the parameter setup) and press Enter. The initial screen appears (Figure 4–3).

Figure 4–3: Configuration Install Utility – Initial Screen



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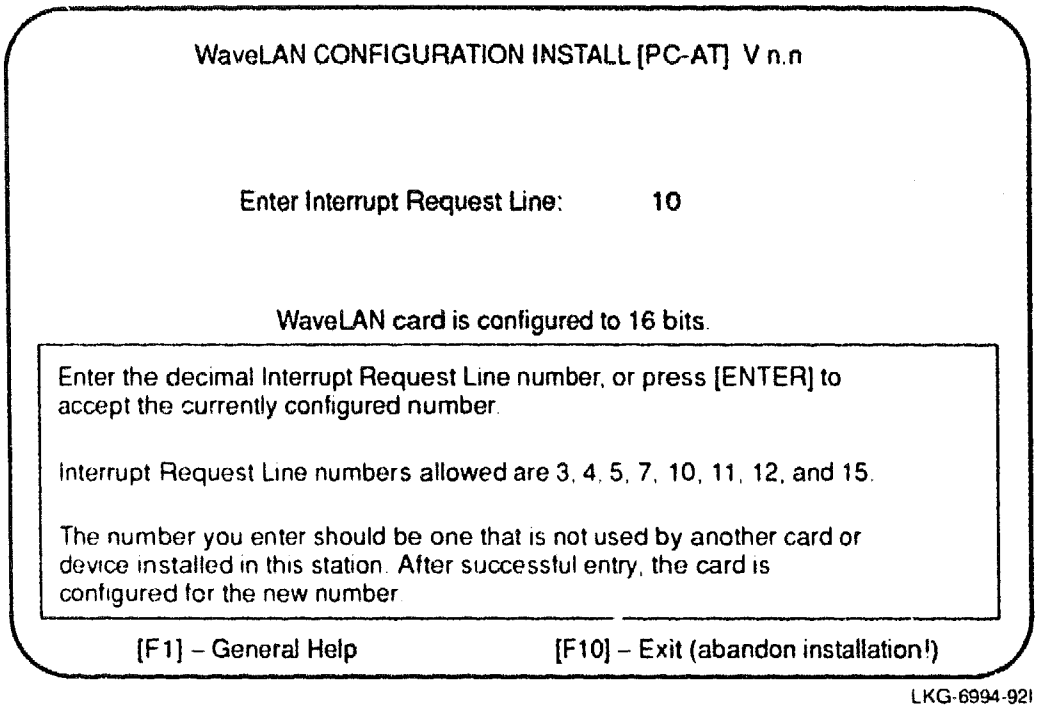
Use this screen to indicate the I/O base address of the WaveLAN NIC. The address should match the one set on the card (Section 3.4). To accept the default value, press Enter.

The program now begins the card's startup diagnostics. If this is successful, the Interrupt Request Line screen is displayed (Figure 4–4).

Figure 4–4: Configuration Install Utility – IRQ Screen



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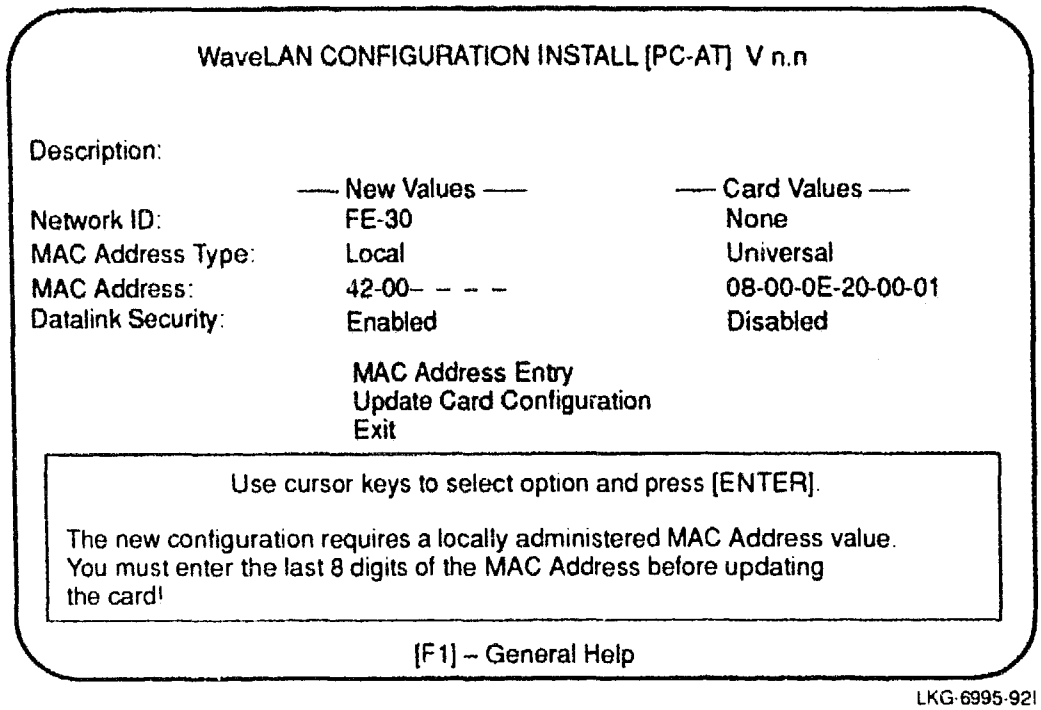
You can use this screen to change the Interrupt Request Line number. If the configuration is being installed for the first time, the value shown is the factory default (10). To accept the default value, press Enter. The startup diagnostics will now continue. On successful completion, the Configuration Update screen is displayed (Figure 4–6).

The Update screen displays:

- The current configuration parameter values. In Figure 4–5, the screen displays the original values.
- The new values that the Configuration Install utility will install.

Regardless of whether security is enabled or not, the value of the encryption key is never displayed.

Figure 4–6: Configuration Install Utility – Update Screen



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When the new MAC Address Type is Local, a Local MAC address must be present before the update can take place. In the above example, the MAC address field is partially blank, indicating that a Local MAC address has not yet been entered. In this case, select MAC Address Entry from the menu before selecting Update.

When the new MAC Address Type is Universal, you will not have to enter a new MAC address. When both old and new MAC Address Types are Local, a new Local MAC address is not required. The MAC address entry consists of 8-hexadecimal digits, and must be a unique value (within this network).

Select Update to install the new configuration parameters. Select Exit to leave the program after Update, or to exit the program at any time.

This completes the Hardware Configuration.

4.8 Parameter Options for Batch Operation

Command line options are designed to allow the Install utility to run in batch mode. For example, a station with a single WaveLAN NIC installed could participate in two separate networks at different times of the day by running batch files containing different Configuration Install utility files, each installing a different Network ID.

Command line options allow you to:

- Select batch mode of operation (not full-screen)
- Indicate the NIC's I/O Base Address
- Set the Interrupt Request Line number
- Set the Local MAC Address (when Local MAC addressing is used)
- Select monochrome display mode

The following parameters are shown in uppercase for clarity. You can also use lowercase characters.

-B	Selects batch mode. In batch mode the full-screen displays are suppressed. Therefore, you must also specify all other configuration parameters which normally would be entered. The NIC's I/O base address and IRQ are required when in batch mode.
-A*nnn*	Identifies the NIC's I/O base address (***nnn*** is the hexadecimal value) to allow access to the NIC. Required in batch mode. When not in batch mode, this parameter suppresses display of the Install utility's initial screen.
-I*nn*	Sets the Interrupt Request Line number (***nn*** is the decimal value). Required in batch mode. When not in batch mode, it suppresses the Install utility's IRQ entry screen.
-L*nnnnnnnn*	Sets the Local MAC Address (***nnnnnnnn*** is the hexadecimal value). In batch mode, if MAC addressing is being changed from Universal to Local, this parameter is required.

–M Sets the video mode to monochrome. Used for some monochrome monitors and certain video adapters. Its application in batch mode is to ensure that error messages are properly displayed.

NOTE

When an error occurs in batch mode, the program reverts to full-screen mode to report the error. You cannot correct parameter errors at this point. You must repair the batch file and rerun, or restart the program without parameters. Also, when an error occurs, the program terminates with the DOS ERRORLEVEL exit code set to 1. This allows you the possibility of executing alternative batch file commands. You can find more information on using DOS exit codes in the *MS–DOS User's Reference Manual.*

Command line parameters are placed on the DOS command line directly after the filename of the Configuration Install utility file. Parameters are separated from the filename and from each other by at least one space. Parameters may occur in any order.

Example: **instneta –a300 –b**

This command automatically installs the configuration represented by INSTNETA.EXE in a NIC with I/O base address **300H** and where the IRQ will not change. No screens are displayed.

Example: **instnetb –a3e0 –i10**

This command begins configuration installation on a NIC with I/O base address **3E0H** and set the IRQ to 10. The first and second screens are not displayed.

4.9 Switching Workstations Between Networks

To switch a workstation from one network to another, you must rerun the Configuration Install utility to change the workstation's Network ID. This should be done only when the workstation's LAN driver is not active (for example, during a warm or cold reboot).

One way to easily switch a workstation between networks on a regular basis is to execute the Configuration Install utility as a command on a bootable DOS diskette. The following example shows how a workstation can sometimes be assigned to network NET1 and at other times to network NET2.

Example

1. Create a bootable DOS diskette.
2. Run the Configuration Setup utility twice to create two Configuration Install utility files: INSTNET1 and INSTNET2, differing only in their Network IDs. For example:

INSTNET1.EXE:	Network ID	= 0A01
	MAC Address Type	= Universal
	Datalink Security	= Disabled
INSTNET2.EXE:	Network ID	= 0A02
	MAC Address Type	= Universal
	Datalink Security	= Disabled

3. Create two .BAT files, one for each network. For example:

NET1.BAT:	instnet1 -b -a300
NET2.BAT:	instnet2 -b -a300

4. To switch networks, do the following:

To switch to NET1:	Reboot using the bootable diskette
	Run net1 **Example: c:\net1**
	Reboot from your standard disk
To switch to NET2:	Reboot using the bootable diskette
	Run net2 **Example: c:\net2**
	Reboot from your standard disk

5

Radio-Frequency Network Operations

5.1 Radio-Frequency Network Operations

In general, operating a radio-frequency Local Area Network (LAN) is the same as most other types of LANs. However, due to the nature of the transmission medium, radio-frequency networks are more sensitive to:

- Signal interference (noise)
- Signal attenuation

5.1.1 Signal Interference

Signal interference (or noise) is radio-frequency signals, detected by a receiving antenna, that are not transmitted by any station in the receiving station's network. The source of the interfering signal may be:

- An adjacent WaveLAN network with a different Network ID
- Another (not WaveLAN) radio-frequency network
- Non-network sources, such as:
  - Security gates (like those often placed near the entrances of shops and department stores)
  - Elevator motors
  - Photocopiers
  - Microwave ovens

For most non-network noise sources the effect is localized and can be eliminated by antenna or station relocation.

5.1.2 Signal Attenuation

Signal attenuation is a loss of signal strength, which occurs naturally over distance, but which also can be caused by radio-frequency barriers in the signal path. Examples of barriers are:

- Metal surfaces surrounding an antenna
- Enclosed locations with concrete walls, floor, and ceiling

Nearly every object (partitions, furniture, people) in the path of the signal causes some degree of attenuation. In most cases, this does not have a significant effect on network performance. Careful placement of the antenna minimizes the effect on network performance.

5.1.3 Signal-to-Noise

A station's communications capability is significantly reduced when the noise level perceived by that station regularly exceeds the strength of signals received.

5.2 Optimizing Network Performance

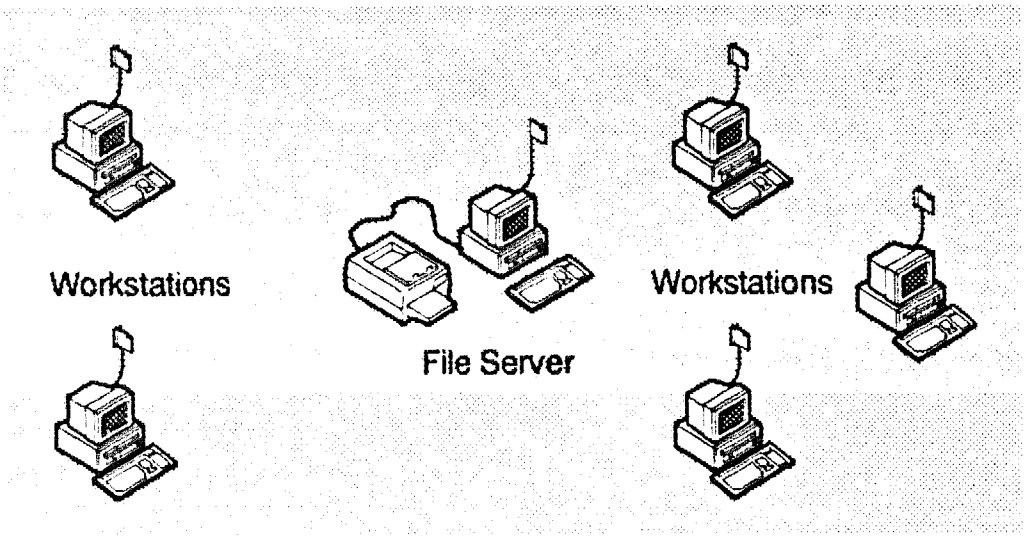
You can optimize network performance through careful placement of servers and workstations, taking into account the radio-frequency characteristics of the work environment. These depend on a large number of factors, including:

- Construction materials
- Office plan (closed or open)
- Presence of windows

It is not possible to predict exactly how the environment will affect network performance, if at all. The following are some general guidelines for network station arrangement.

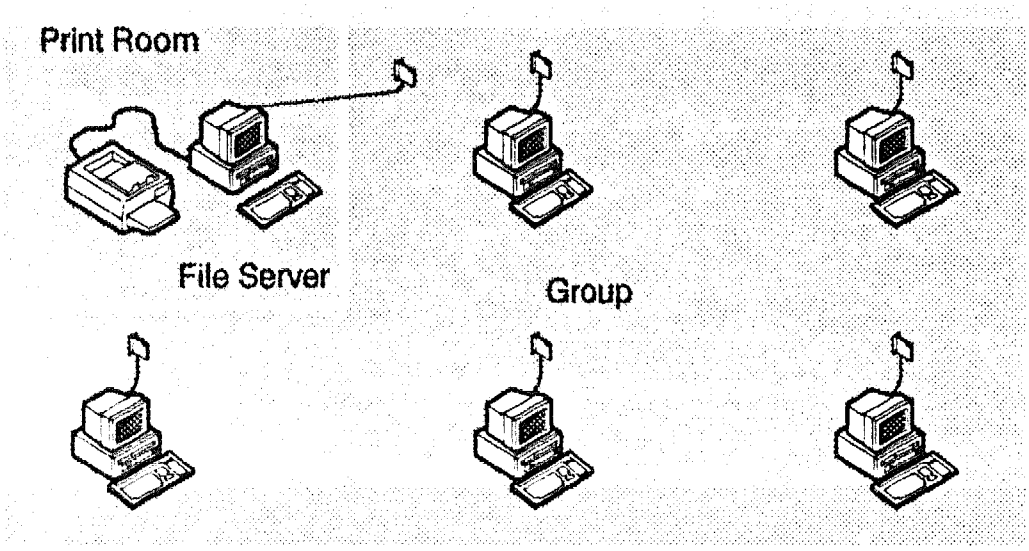
A file server is often the busiest station on a network. In an open or semi-open work area, it is recommended that you arrange the network in such a way that file servers occupy a central position (Figure 5–1).

Figure 5–1: Station Placement in an Open Office



If your network server is kept in an area with other potentially noisy equipment (for example, a photocopier), you should consider using an antenna extension cable (available only for the WaveLAN 915) to enable the antenna to be placed outside the noisy area (Figure 5–2). This reduces the effect of background noise from the server's local environment.

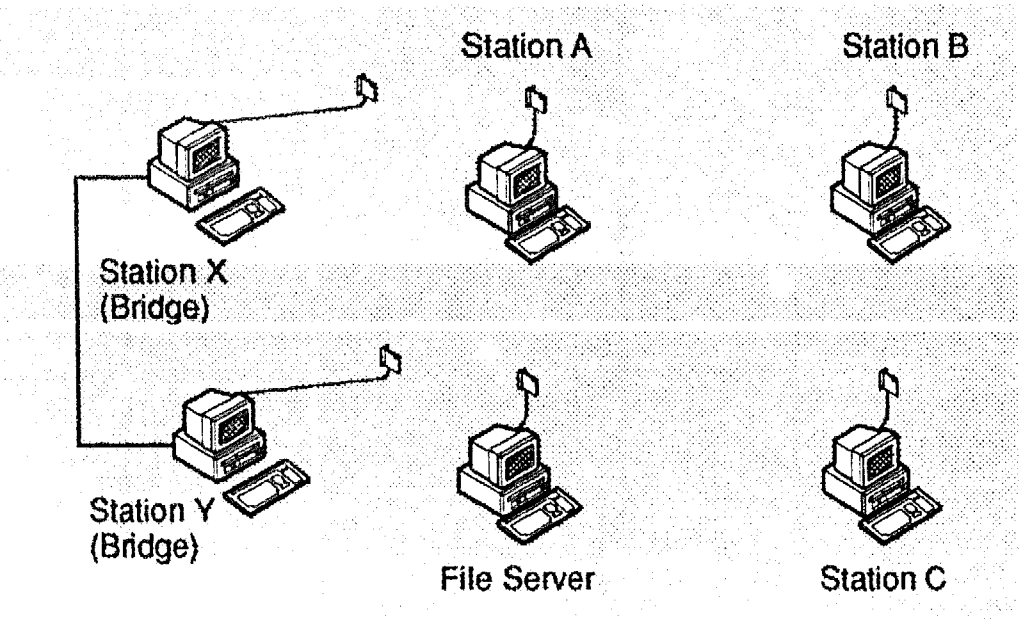
Figure 5–2: Using an Antenna Extension



When a network is dispersed across two or more work groups, separated by a large open space or situated on different floors, it may be necessary to use a bridge to overcome signal attenuation (Figure 5–3).

Due to a combination of distance and signal-blocking floors and walls, the path between the server and stations A and B suffers attenuation, making communication difficult. An ethernet adapter with the appropriate software must be installed in the bridges enabling them to act as a bridges. Stations A and B then communicate with the server by means of stations X and Y.

Figure 5–3: Bridging in a Dispersed Network



You can use the Point-to-Point Diagnostics utility to determine if a bridge is really necessary.

5.3 Problem Determination

Problems in a WaveLAN network can be related to:

- Component failure (of card or antenna)
- Environment and operation

5.3.1 Component Failure

Component failure is normally detected by a startup diagnostics routine built into three programs which use the WaveLAN NIC. These programs are:

- WaveLAN network driver
- Configuration Install utility
- Point-to-Point Diagnostics utility

The startup diagnostics routine which, as its name implies, is run at program startup, checks out all the major hardware components on the WaveLAN NIC before allowing its calling program (the network driver, for instance) to continue. The following components are tested:

- PC bus interface
- The card's memory
- Parameter storage area
- LAN controller
- RF (radio-frequency) modem
- Security feature (only if the card is configured for Datalink Security)

A component failure causes an error message to be displayed.

NOTE

The startup diagnostic routine does not test the antenna. To detect antenna failure, you need to run the Point-to-Point Diagnostic utility.

5.3.2 Environment and Operation

Environment and operation-related problems can be caused by one or more of the following:

- Poor station or antenna placement (Section 3.10)
- A difficult network environment

- Path defects (antenna, cable, connection)
- Competition from adjacent networks
- Network loading

You can use the diagnostic utilities to diagnose and resolve environmental and operational problems.

5.4 Diagnostic Utilities

There are two diagnostic utility programs:

- Point-to-Point

  The Point-to-Point Diagnostics utility allows you to verify the communications path between two stations. You can use it to measure local noise and to find the best antenna position. Refer to Chapter 6 for more information about the Point-to-Point Diagnostic utility.

- Node

  The Node Diagnostics utility allows you to display and process a workstation's diagnostic counters, which are maintained by the network driver. It provides a means to check the WaveLAN network and to determine the cause of poor network performance in general or to pinpoint stations where performance is poor in relation to the network average. Refer to Chapter 7 for more information about the Node Diagnostic utility.

5.5 Troubleshooting List

This list identifies some common symptoms and solutions for environmental or operational problems.

5.5.1 Unable to Communicate with the Server

1. Check that:
   - The antenna is securely connected
   - The workstation and server have the same Network ID
   - Security is disabled at both stations, or security is enabled and both stations are using the same key
2. Run Point-to-Point Diagnostics between this station and another nearby station to verify the station can communicate.
3. Run Point-to-Point Diagnostics between this station and the server or bridge to test the communications path. You must take the server or bridge off line to do this.

5.5.2 Poor Station Performance Relative to the Network Average

1. Run Node Diagnostics. The diagnostic counter values can indicate possible causes (for example, local noise is high).
2. Run Point-to-Point Diagnostics between this station and the server to verify the path (for example, attenuation between server and this station is too high).

5.5.3 Overall Network Performance Is Poor

1. Run Node Diagnostics on every station. The diagnostic counter values can indicate possible causes (for example, overall noise is high, network load is high, or interference from another wireless LAN).
2. If counter values show that some stations have significantly higher percentages of lost packets than others, run Point-to-Point Diagnostics between those stations and the server.

6

The Point-to-Point Diagnostics Utility

6.1 Running Point-to-Point Diagnostics

The Point-to-Point Diagnostics utility allows you to verify that:

- Cards and antennas function correctly to allow exchange of messages.
- Antenna positioning is optimal.
- Stations are within operating range of each other.

You can also use the utility to get information about local noise and environmental suitability. Measurement data can be saved to a disk file. The Point-to-Point Diagnostics utility is run out-of-service, that is, the participating stations are not logged in to the normal WaveLAN® network. They are instead, set up as a dedicated communications link, using a special dedicated Network ID, for the duration of the test.

6.2 Installing the Point-to-Point Diagnostics Utility

You cannot run the Point-to-Point Diagnostics utility while the network driver is running. To run the utility, you must reboot the station without starting the network driver. You also must run the utility between two stations at the same time.

Digital recommends that you install the Point-to-Point Diagnostics utility on a bootable diskette. Follow these steps to install the Point-to-Point Diagnostics utility:

1. Prepare an MS-DOS™ bootable diskette.

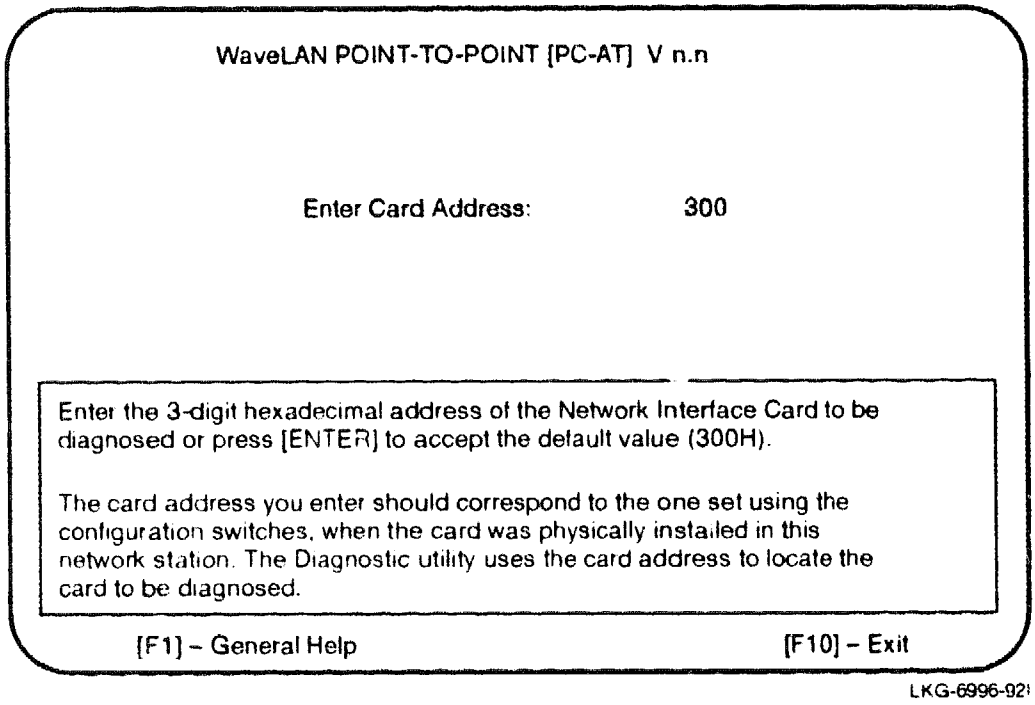
2. Copy the file PTPDIAG.EXE from directory \PTPDIAG.DOS on the WaveLAN software diskette to the bootable diskette.

6.3 Running the Point-to-Point Diagnostics Utility

Because the Point-to-Point Diagnostics utility tests the communications path between two stations, you must run the utility on two stations at the same time. For each station, you must know the I/O Base Address of the WaveLAN NIC, which was set when the NIC was installed.

To run the utility, place the MS–DOS bootable diskette in drive A of the workstation or server and reboot. Type **ptpdiag** and press Enter. You should see the utility's start-up screen (Figure 6–1). You can use this screen to identify the I/O base address of the WaveLAN NIC. To accept the default value (**0300H**), press Enter.

Figure 6–1: Point-to-Point Diagnostics Initial Screen



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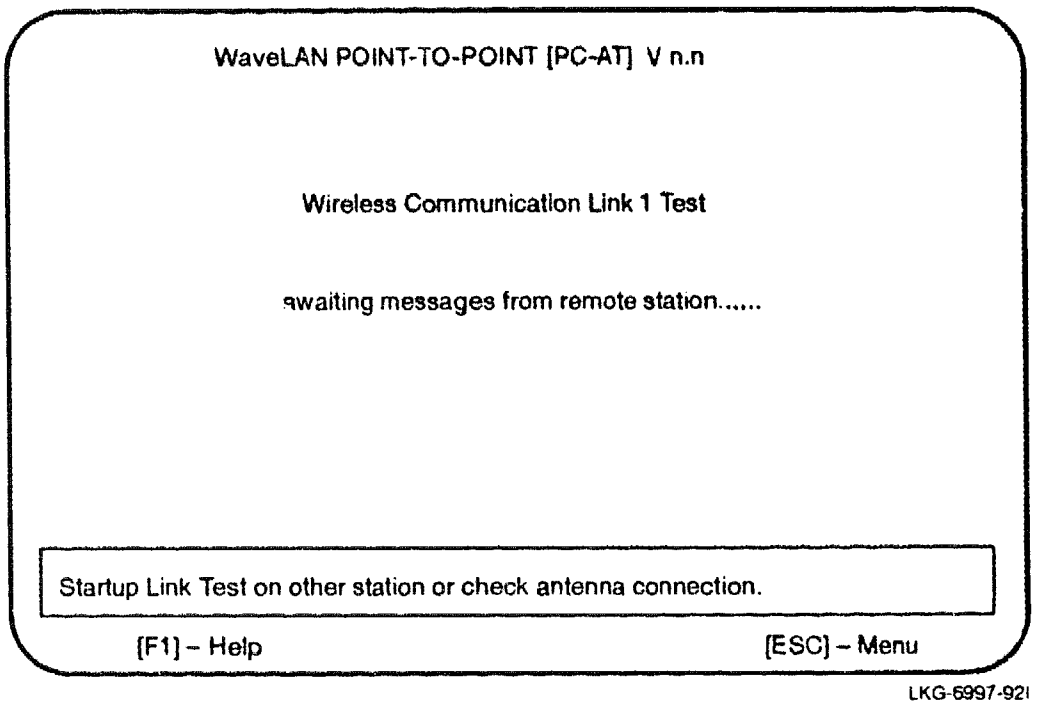
At the next (menu) screen, you can choose to run Card Diagnostics, Wireless Communication Link Test, or exit from the program.

The Card Diagnostics option allows you to rerun the card's startup diagnostics to verify the card's hardware components. This test was already run at utility startup and is the same test as is run at network driver startup and also when you installed the station configuration.

The Wireless Communication Link Test tests the communications path between two stations. A special "Diagnostic Link ID" is used to prevent interference from other stations not involved in the test. After a link has been established, the program executing at each participating station begins to measure signal reception conditions. Based on these measurements, the utility displays an assessment of the link quality. You can continue to a second screen to display the measurement details.

When you start the test from the first station, a screen is displayed similar to that shown in Figure 6–2. You must start the test at a second station before communication can take place between the stations. When one station detects transmission from another station executing the test, measurement begins.

Figure 6–2: No Other Station Is Active Yet



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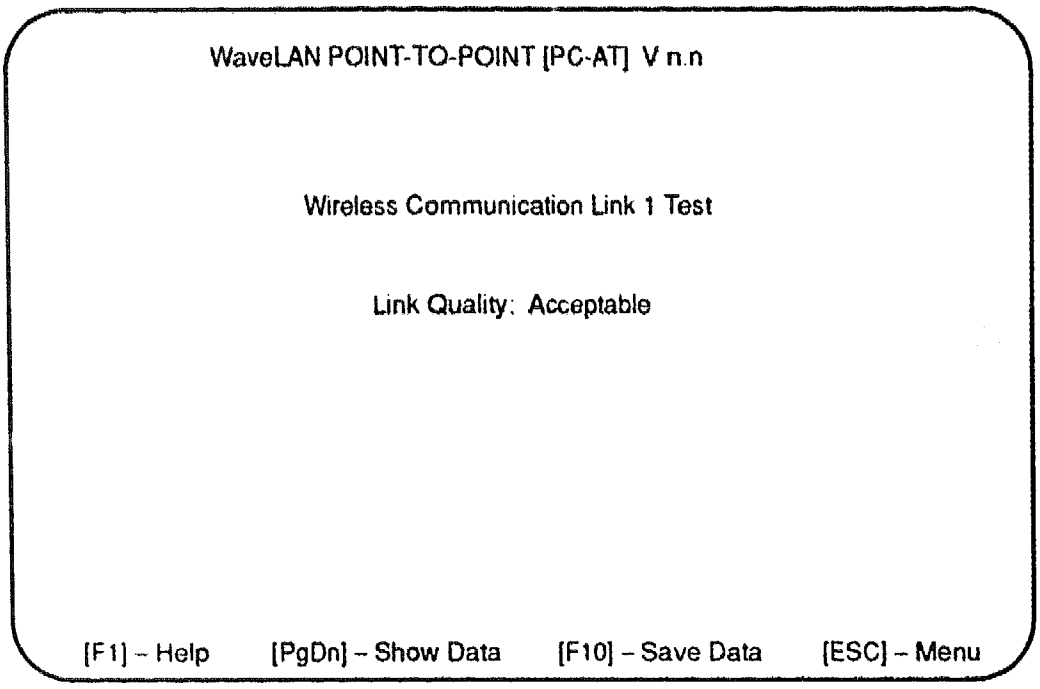
After a few seconds, the link quality assessment is displayed (Figure 6–3). Link quality ratings are good, acceptable, or poor.

Figure 6–3: Link Quality Assessment Display



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You can investigate the link quality in more detail by pressing the PgDn key to display the Measurement Data screen (Figure 6–4). If you start the Link Test on more than one station, the message "awaiting messages ..." is displayed. The problem could be:

- Antenna not properly connected.

  Action: Check the antenna connection.

- Signal too weak. The antenna is completely shielded by a radio-frequency barrier or the stations are too far apart.

  Action: Relocate the antenna and/or the station. You do not need to restart the test, measurement begins automatically when signals from the other station are detected.

- Local noise level too high for signal measurement. The antenna is too close to a local noise source.

  Action: Relocate the antenna and/or the station or eliminate the local noise source.

- WaveLAN NIC or antenna defective.

  Action: Replace the antenna and/or the NIC.

- Security feature mismatch. If the optional encryption security feature has been implemented, it is possible that one of the stations does not have encryption enabled or that the encryption key values are different.

  Action: Check your installation records. Ensure both stations have security enabled and are using the same security key, or both stations are configured to have security disabled.

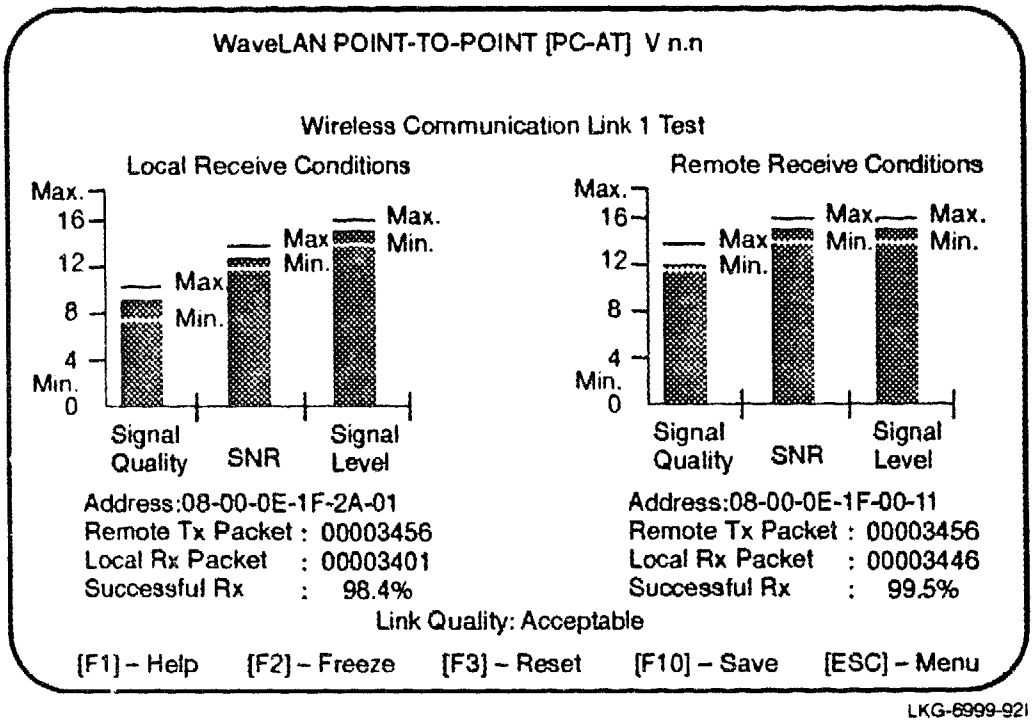
- Diagnostic Link ID mismatch. If you are using Command Line parameters to set the Link ID, this must be the same for both stations.

  Action: Check the setting if used.

6.3.1 The Measurement Data Display

The utility displays measurement data for both the local and remote stations. Each station is identified by its MAC address (Figure 6–4).

Figure 6–4: Link Measurement Data Display



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For each station, six measurements are displayed:

- Signal quality
- Signal-to-noise ratio (SNR)
- Signal level
- Packets transmitted from the remote station
- Packets received at this station
- Percentage successful packets received

The link quality assessment is based on the signal quality and SNR measurements.

Signal Quality	Signal quality is an indication of the clarity of signals received. This can be affected by the number and position of radio-frequency reflecting surfaces (such as exposed steel structural components of some buildings) in the environment of the signal path.
SNR	Signal-to-noise ratio is based on the strength of the received signal relative to the local noise. The received signal level is displayed alongside the SNR measurement.

6.3.2 Antenna Positioning

The signal quality and SNR displays give you an opportunity to interactively determine the best antenna placement, by watching the display as you try out various positions.

Some environments cause pockets of reduced signal quality to occur in an unpredictable way. A small relocation of the antenna is often enough to give a significant improvement.

If SNR is poor and signal level is high, the antenna is too close to a local noise source.
Action: Relocate the antenna and/or the station or eliminate the local noise source.

If SNR is poor and signal level is low, the problem is most likely signal attenuation caused by antenna shielding or stations too far apart.
Action: Remove shielding or relocate the antenna and/or the station.

6.3.3 Logging the Measurement Data

By pressing F10, you can save the measurement data to a log file. You can choose between spreadsheet compatible Comma-Separated Value (CSV) or ASCII format. An example of measurement data saved in ASCII format is shown in Figure 6–5.

Figure 6–5: Example Saved Measurements

*****LINK TEST REPORT*****
Description : Description
Link Quality : Good
Start Link test : 19 September 1992, 13:50
End Link test : 19 September 1992, 13:51

		Local station			Remote station		
Address:		08000E20006D			08000E200226		
		Mean	Min.	Max.	Mean	Min.	Max.
% Successful Rx		100.0	–	–	99.9	–	–
Signal quality (3-18)		16	15	16	15	15	17
SNR (0-18)		18	18	18	17	17	18
Signal level (0-18)		18	18	18	17	16	18
		Date		Time	Date		Time
Signal quality,	Max. at	19/09/92		13:51	19/09/92		13:51
	Min. at	19/09/92		13:51	19/09/92		13:51
SNR	Max. at	19/09/92		13:51	19/09/92		13:51
	Min. at	19/09/92		13:51	19/09/92		13:51
Signal level	Max. at	19/09/92		13:50	19/09/92		13:51
	Min. at	19/09/92		13:50	19/09/92		13:51

*****END LOG*****

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You can append data to an existing file or save to a new file, and you can choose to save the data only once or at regular intervals during the test.

6.3.4 Parameter Options for Batch Operation

You can use parameter options on the MS–DOS command line to specify:

- An I/O base address.
- A Diagnostic Link ID.
- Monochrome display mode.

The following parameters are shown in uppercase for clarity. You can also use lowercase characters.

-A*xxx*	Identifies the card's I/O base address (*xxx* is the hexadecimal value) to allow access to the card. This parameter suppresses display of the diagnostic utility's initial screen.
-N*xx*	Sets the Diagnostic Link ID (*xx* is the decimal value in the range 01 – 10). You can use this parameter to run two Point-to-Point tests on different pairs of stations simultaneously. When not used, the default value (01) is used. Station pairs must have the same Link ID set.
-M	Sets the video mode to monochrome. Used for some monochrome monitors and nonstandard video adapters. Use this parameter if you have difficulty viewing the display.
Example:	**ptpdiag -a300 -n10**

This command runs Point-to-Point diagnostics on a WaveLAN NIC at address **300H**. The Diagnostic Link ID is set to 10. To successfully run the test, you should start the utility on another station, with the Diagnostic Link ID also set to 10.

7

The Node Diagnostics Utility

At every workstation in a WaveLAN® network, the network driver maintains an extended set of diagnostic counters. Counter values are set to zero when the driver boots and accumulate until the next reboot.

The Node Diagnostics utility allows you to display the values of a workstation's diagnostic counters. You can also save the counter values to a disk file. The Node Diagnostics utility runs while the workstation LAN driver is active.

The Node Diagnostics utility provides a means to check the WaveLAN network and to determine the cause of poor network performance or station performance. By collecting counter values periodically, you can build a profile of network capability. This can help you assess the performance impact of network changes or external events.

Separate Node Diagnostics utilities are provided for the following drivers:

- NetWare® IPX and DOS ODI drivers (Refer to Section 7.1)
- NetWare OS/2 Requester driver (Refer to Section 7.2)
- Network Driver Interface Standard (NDIS) driver (Refer to Section 7.3)

7.1 Node Diagnostics for the NetWare IPX and DOS ODI Driver

To install the NetWare IPX/ODI Node Diagnostics utility, copy all the files on the WaveLAN software diskette into the directory \NODEDIAG\NETWARE. This directory is located on the workstation's hard disk or on a network server accessible from the workstation.

NOTE

The Node Diagnostics utility runs only on a workstation. You cannot run the Node Diagnostics utility on a NetWare server.

You can run the IPX/ODI Node Diagnostics utility interactively or in batch mode. In interactive mode, the counters are displayed on the workstation's screen. When exiting the program, you can save the data in a file. In batch mode, the counters are written directly to a file. For information on how to run the Node Diagnostics Utility in batch mode, refer to Section 7.1.4.

To run the Node Diagnostics in interactive mode, change to the directory where the Node Diagnostics utility files are stored, type **ndipxdos**, and press Enter at the MS-DOS prompt.

If a single WaveLAN IPX or DOS ODI driver is active in the workstation, the program will display the diagnostic counters for that driver. If more than one WaveLAN DOS ODI driver is active in the workstation, a card selection screen is displayed to allow you to specify which WaveLAN card statistics should be displayed.

7.1.1 Counter Information

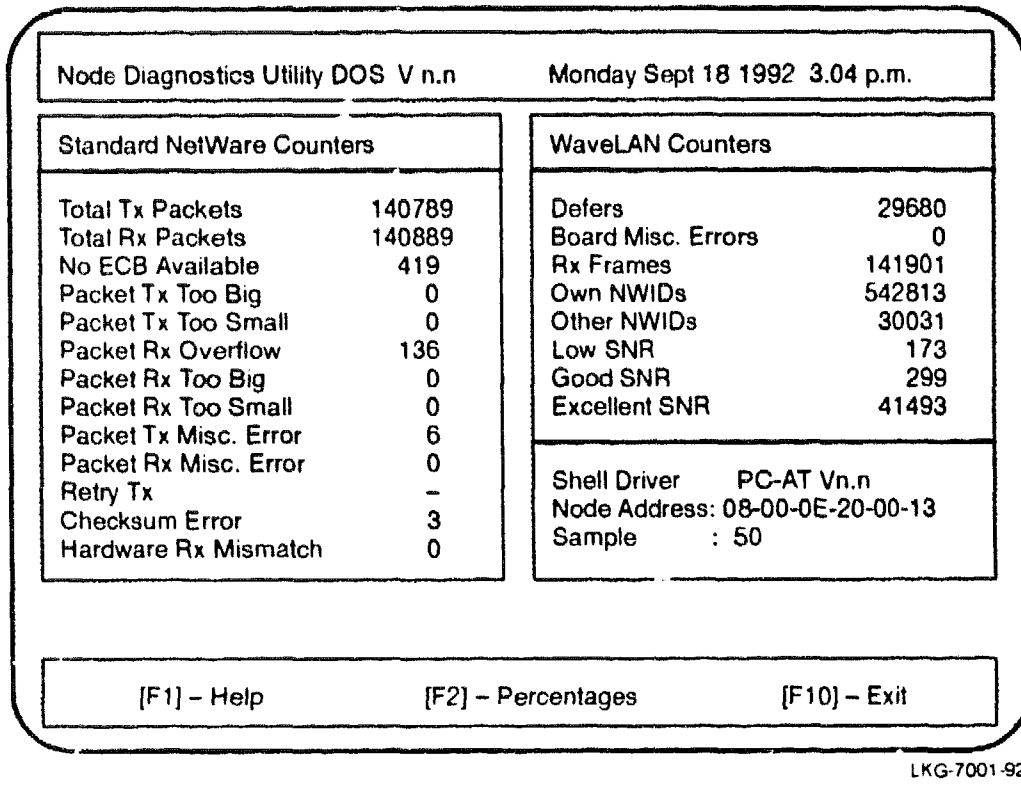
Figure 7-1 illustrates the diagnostic counter display for the IPX driver. The DOS ODI counter display is similar. The screen display shows two sets of counters. On the left side of the screen, you can see the standard set of NetWare driver-maintained counters. The four counters used in network problem determination are:

Total Tx Packets	The total number of packets successfully transmitted by this workstation since network driver startup.
Total Rx Packets	The total number of packets successfully received by this workstation since network driver startup.

Packet Rx too small — Number of times a packet received from the network was smaller than the smallest size packet that can be transmitted. Activity on this counter can indicate Signal Interference.

Checksum Error — Number of Cyclic Redundancy Check errors and alignment errors that occurred while receiving packets. Activity on this counter can indicate Signal Interference or collisions occurring frequently.

Figure 7–1: Node Diagnostic Counters – NetWare IPX Driver



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The right side of the screen shows a set of counters specially maintained for WaveLAN cards. A description of these counters follows:

Defers — Total number of times a packet to be transmitted was delayed by the WaveLAN card to prevent a collision with a packet from another station. Activity on this counter is related to the volume of traffic in the air.

Board Misc Error	Number of times the board was unable to transmit a packet due to an unspecified board failure. This may indicate a transient problem (one that may not impact performance to a significant degree). If the value of this counter is regularly nonzero, you should consider replacing the card.
Rx Frames	Number of packets that have been successfully received at this workstation since network driver startup. (This counter is not displayed in DOS ODI Node Diagnostics.)
Own NWIDs	Number of packets from the local WaveLAN that have been detected by the board. This counter shows the total of all packets detected, including those addressed to other stations on this network.
Other NWIDs	Number of packets from other WaveLANs or corrupted packets that have been detected by the board. (Noise can cause this counter to increment.)
SNR	Number of signal-to-noise ratio (SNR) samples that were taken, per category, on incoming packets with own NWID. Signal-to-Noise sampling takes place at the station at regular intervals (about 18 times per second) while the network driver is running. All network traffic detected by this station is sampled. The result increments one of three counters corresponding to Low, Good, and Excellent.

7.1.2 Driver Statistics

The utility uses these counters, with the four NetWare counters already described, to provide a set of driver statistics that you can use to diagnose network problems.

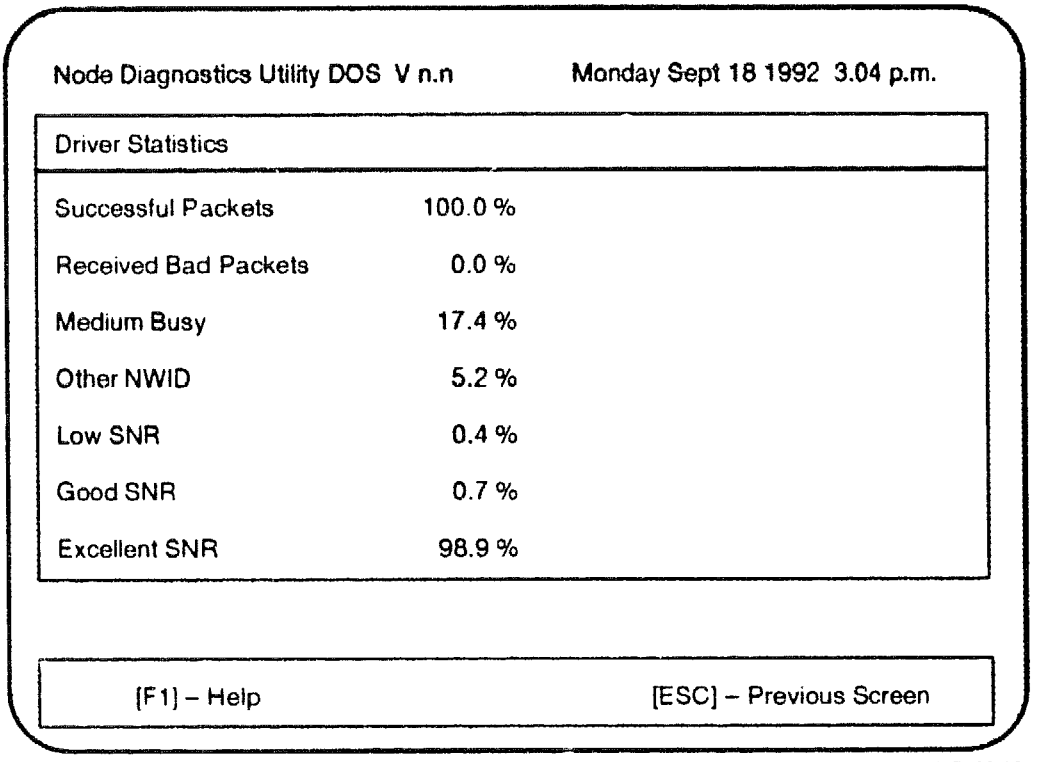
The driver statistics are summarized below:

% Successful Packets	The percentage of packets transmitted to this station that were acknowledged as received.
% Received Bad Packets	The percentage of all frames received that were in error (for example, checksum errors and packets too small).

% Medium Busy	The percentage of all attempts to transmit that were deferred to prevent collisions.
% Other NWID	The percentage of all frames detected at this station that did not originate in this network.
% SNR Categories	The percentage of all signal-to-noise samples taken that incremented a particular SNR category. The SNR categories are Low, Good, and Excellent.

To see the driver statistics, press F2. Figure 7–2 shows the driver statistics screen.

Figure 7–2: Driver Statistics – NetWare IPX Driver



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7.1.3 Saving the Diagnostic Data

Upon exiting from the Diagnostics Counter display, you can choose to Save the counter values to a disk file, or Quit the program without saving. If you select Save, you are asked to enter the name of a disk file to save to. You can append the data to an existing file or specify a new filename.

The diagnostic counters are saved in an ASCII Comma-Separated Value (CSV) file that can be read and processed by many spreadsheet programs. The program also saves the workstation's node address and the system date/time stamp. The data is saved in the following format:

"Driver Name","Driver name text"
"Driver Version","major version.minor version"
"Card Address","card-address-value"
"Node Address","node-address-value"CrLf
"Date",MMDDYYYYCrLf,
"Hour",HHCrLf
"Minutes",MMCrLf
"tally-name",tallyvalueCrLf
"tally-timesname",tallyvalueCrLf
etc.
CrLf

NOTE

CrLf is equivalent to Carriage return Linefeed (hexadecimal 0D0A).

Figure 7–3 shows how the counters displayed in Figures 7–1 and 7–2 are saved on disk:

Figure 7–3: Saved Counter Set – NetWare IPX

```
"Driver Name","Shell Driver PC-AT"
"Driver Version","n.n"
"Card Address","0300"
"Node Address","08000E200001"
"Date",05191992
"Hour",15
"Minutes",04
"Total Tx Packets",140789
"Total Rx Packets",140889
"No ECB Available",420
"Packet Tx Too Big",0
"Packet Tx Too Small",0
"Packet Rx Overflow",136
"Packet Rx Too Big",0
"Packet Rx Too Small",0
"Packet Tx Misc. Error",6
"Packet Rx Misc  Error",0
"Retry Tx","-"
"Checksum Error",3
"Hardware Rx Mismatch",0
"Defers",29680
"Board Misc. Error",0
"Rx Frames",141005
"Own NWIDs",549091
"Other NWIDs",30035
"Low SNR",173
"Good SNR",300
"Excellent SNR",41901
"% Successful Packets",100.0
"% Received Bad Packets",0.0
"% Medium Busy",17.4
"% Other NWID",5.2
"% Low SNR",0.4
"% Good SNR",0.7
"% Excellent SNR",98.9
```

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NOTE

For DOS ODI, the "Rx Frames" value captured is "–".

7.1.4 Parameter Options for Batch Operation

By using parameter options on the MS–DOS command line, you can run the Node Diagnostics utility in batch mode. The screen display is suppressed and the counters are saved directly to a specified disk file.

The batch mode of operation enables you to combine data collection and subsequent processing in one MS–DOS .BAT file that you can run at regular intervals (for example, daily, before workstation shutdown).

Parameter options are shown in uppercase for clarity. You can also use lowercase characters.

–B	Selects batch mode. Full-screen display is suppressed. This is a required parameter – if missing, all other parameters are ignored.
F*path*	Required parameter, ***path*** is the full pathname, including filename and extension, of the file to save the counter values in. If an extension is not specified, .CSV is used.
–A	Optional parameter. Indicates that data is to be appended to the file. If the file is new, this parameter is ignored.
C*nnnn*	If multiple WaveLAN cards are installed, selects the card with I/O Base Address ***nnnn***.

NOTE

I/O Base Addresses are displayed when you start the utility in interactive mode.

Example: **ndipxdos –b –fc:\diag\counters –a**

This command will run the Node Diagnostics utility in batch mode and append the counter values to file COUNTERS.CSV in directory \DIAG on drive c:. For further information, refer to Section 7.4.

7.2 Node Diagnostics for the NetWare OS/2 Requester

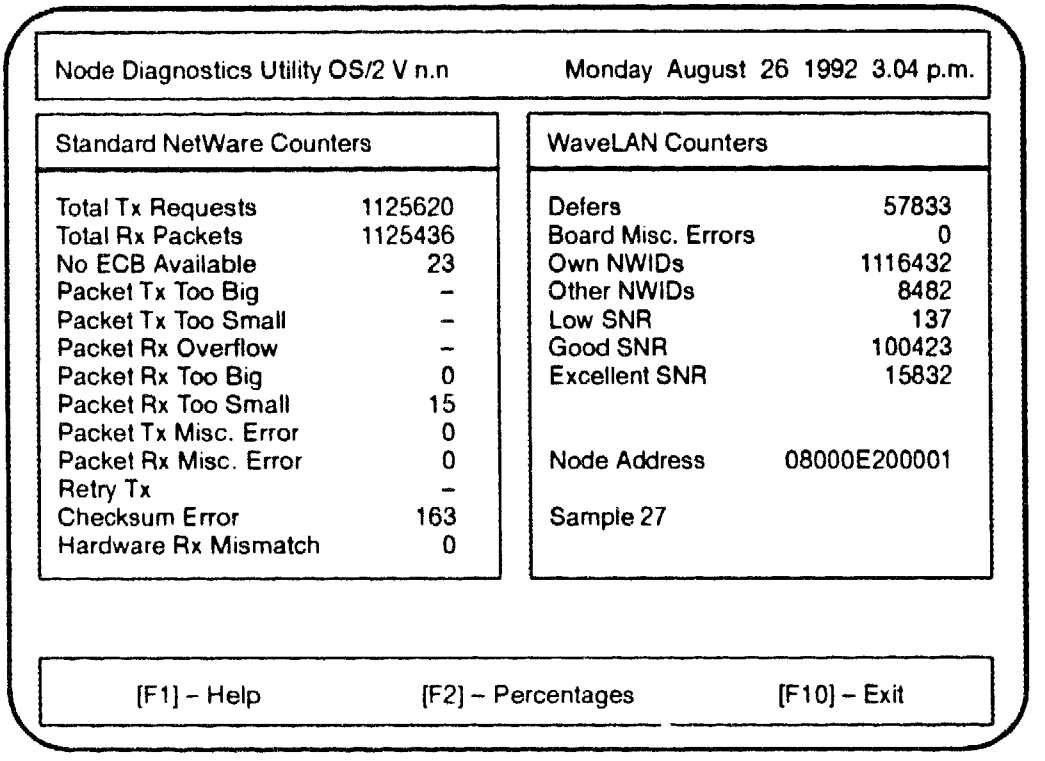
To install the Node Diagnostics utility for the NetWare OS/2 Requester, copy all the files on the WaveLAN software diskette into the directory \NODEDIAG\NETWARE. This directory is located on an OS/2 workstation's hard disk or on a network server accessible from the workstation.

You can run the Node Diagnostics utility interactively or in batch mode. In interactive mode, the counters are displayed on the workstation's screen. Upon exiting from the program, you can choose to save the displayed data to a disk file. In batch mode, the counters are written directly to a disk file without being displayed on the screen. For information on how to run the Node Diagnostics utility in batch mode, refer to Section 7.2.2.

7.2.1 Counter Information

To run the Node Diagnostics in interactive mode, change to the directory where the Node Diagnostics utility files are stored, type **ndipxos2**, and press Enter at the OS/2 Full-Screen prompt. Figure 7–4 displays the diagnostic counters.

Figure 7–4: Diagnostic Counters – NetWare OS/2 Requester



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The screen display shows two sets of counters. On the left side of the screen, you can see the standard set of NetWare driver-maintained counters. The four counters used in network problem determination include:

Total Tx Requests	Total number of packets this workstation requested to transmit since network driver startup.
Total Rx Packets	Total number of packets successfully received by this workstation since network driver startup.
Packet Rx too small	Number of times a packet received from the network was smaller than the smallest size packet that can be transmitted. Activity on this counter can indicate Signal Interference.
Checksum Error	Number of Cyclic Redundancy Check errors and alignment errors that occurred while receiving packets. Activity on this counter can indicate Signal Interference or collisions occurring frequently.

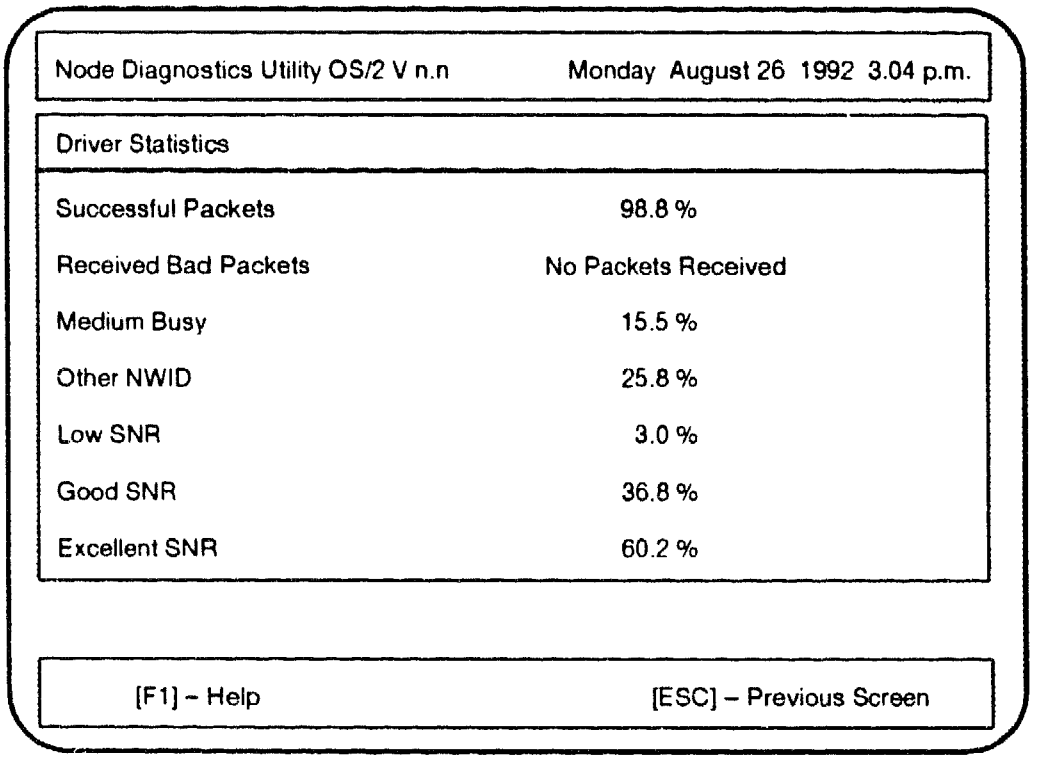
The right side of the screen shows a set of counters specially maintained for WaveLAN cards. The following is a description of the counters that are used:

Defers	Total number of times a packet to be transmitted was delayed by the WaveLAN card to prevent a collision with a packet from another station. Activity on this counter is related to the volume of traffic in the air.
Board Misc Error	Number of times the board was unable to transmit a packet due to an unspecified board failure. This may indicate a transient problem (for example, one that may not impact performance to a significant degree). If the value of this counter is regularly nonzero, you should consider replacing the card.
Own NWIDs	Number of packets from the local WaveLAN that have been detected by the board. This counter shows the total of all packets detected, including those addressed to other stations on this network.

Other NWIDs	Number of packets from other WaveLANs or corrupted packets that have been detected by the board. (Noise can cause this counter to increment.)
SNR	Number of signal-to-noise ratio (SNR) samples that were taken, per category, on incoming packets with own NWID. Signal-to-Noise sampling takes place at the station at regular intervals (about 18 times per second) while the network driver is running. All network traffic detected by this station is sampled. The result increments one of three counters corresponding to Low, Good, and Excellent.

The utility uses these counters, along with the four NetWare counters already described, to provide a set of driver statistics that you can use to diagnose network problems. To see the driver statistics, press F2 (Figure 7–5). The driver statistics are summarized in Section 7.1.2.

Figure 7–5: Driver Statistics – NetWare OS/2 Requester



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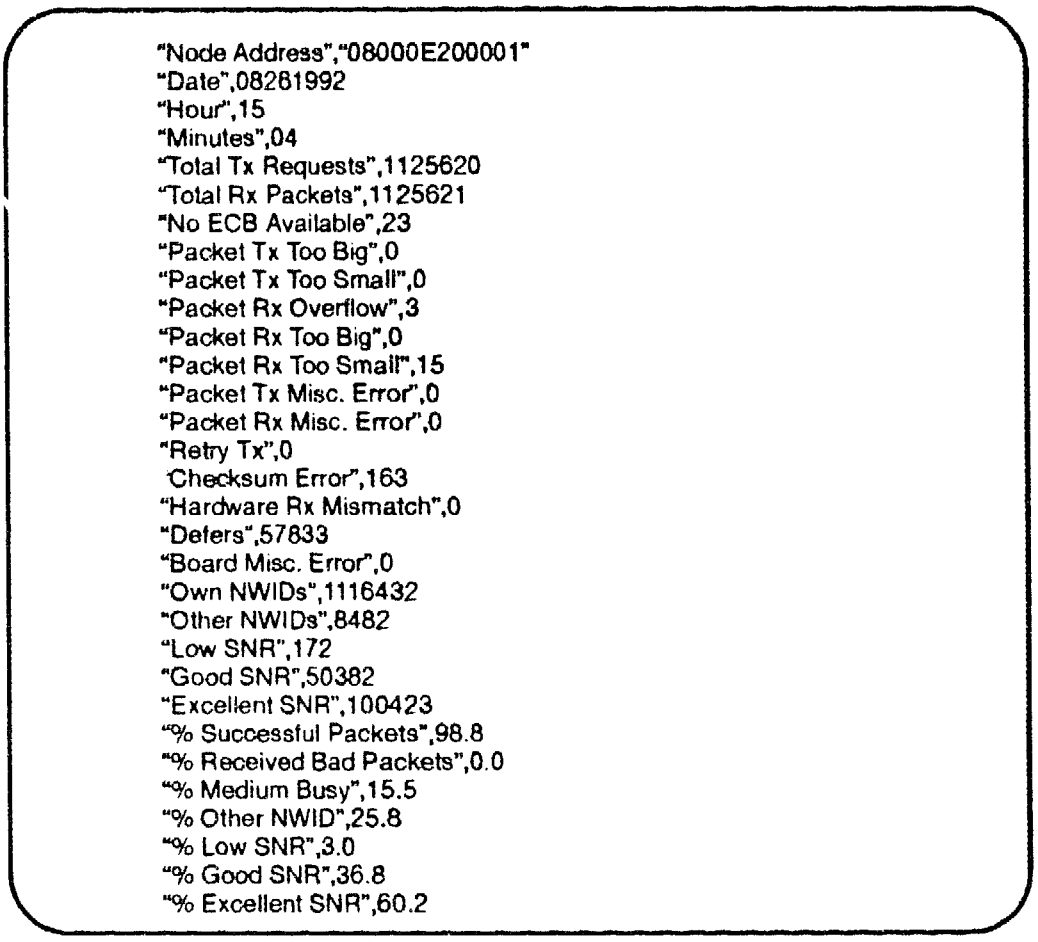
7.2.2 Parameter Options for Batch Operation

By using parameter options on the OS/2 Full-Screen command line, you can run the Node Diagnostics utility in batch mode. The screen display is suppressed and the counters are saved directly to a specified disk file.

The batch mode of operation enables you to combine data collection and subsequent processing in one OS/2 .CMD file that you can run at regular intervals (for example, daily, before workstation shutdown). For information on saving the Diagnostic Data, refer to Section 7.1.3.

Figure 7–6 shows how the counters are saved on disk.

Figure 7–6: Saved Counter Set – NetWare OS/2



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The following parameter options are shown in uppercase for clarity. You can also use lowercase characters.

–B	Selects batch mode. Full-screen display is suppressed. The following parameter, the filename to save to, is required.
F*path*	Required parameter, ***path*** is the full pathname, including filename and extension, of the disk file to save the counter values to. If an extension is not specified .CSV is used.
–A	Optional parameter, used with the **–F** parameter. Indicates that data is to be appended to the file. If the file is new, this parameter is ignored.
C*nnn*	Optional parameter for both batch and interactive operation. When more than one WaveLAN card is installed in a workstation, this parameter is used to select the card for which driver diagnostic counters are to be displayed. ***nnn*** is the card's I/O Base Address. If this parameter is omitted, counters are displayed for the last driver loaded.

Example: **ndipxos2 –b –fc:\diag\counters –a**

This command will run the Node Diagnostics utility in batch mode and append the counter values to file COUNTERS.CSV in directory \DIAG on drive c:.

Example: **ndipxos2 –c3e0**

This command will run the Node Diagnostics utility interactively and display the diagnostic counters for the driver using the WaveLAN card at I/O Base Address **03E0H**. For further information, refer to Section 7.4.

7.3 Node Diagnostics for the NDIS Driver

You can install the NDIS Node Diagnostics utility on an MS–DOS workstation, OS/2 workstation, or OS/2 server. For information on parameter options for batch operation, refer to Section 7.3.4.

MS–DOS: Copy the file NDNDIDOS.EXE from directory \NODE-DIAG\NDIS.DOS on the WaveLAN software diskette to a workstation's hard disk or to a network server directory accessible from the workstation.

OS/2: Copy the file NDNDIOS2.EXE from directory \NODEDIAG\NDIS.OS2 on the WaveLAN software diskette to a workstation's hard disk or to a network server directory accessible from the workstation.

The Node Diagnostics utility displays the extended set of diagnostic counters maintained by the WaveLAN NDIS driver.

To display the counters at an MS–DOS workstation, change to the directory where the Node Diagnostics utility is installed, type **ndndidos**, and press Enter at the MS-DOS prompt.

To display the counters at an OS/2 workstation, switch to OS/2 Full-Screen or an OS/2 Window, then change to the directory where the Node Diagnostics utility is installed, type **ndndios2**, and press Enter.

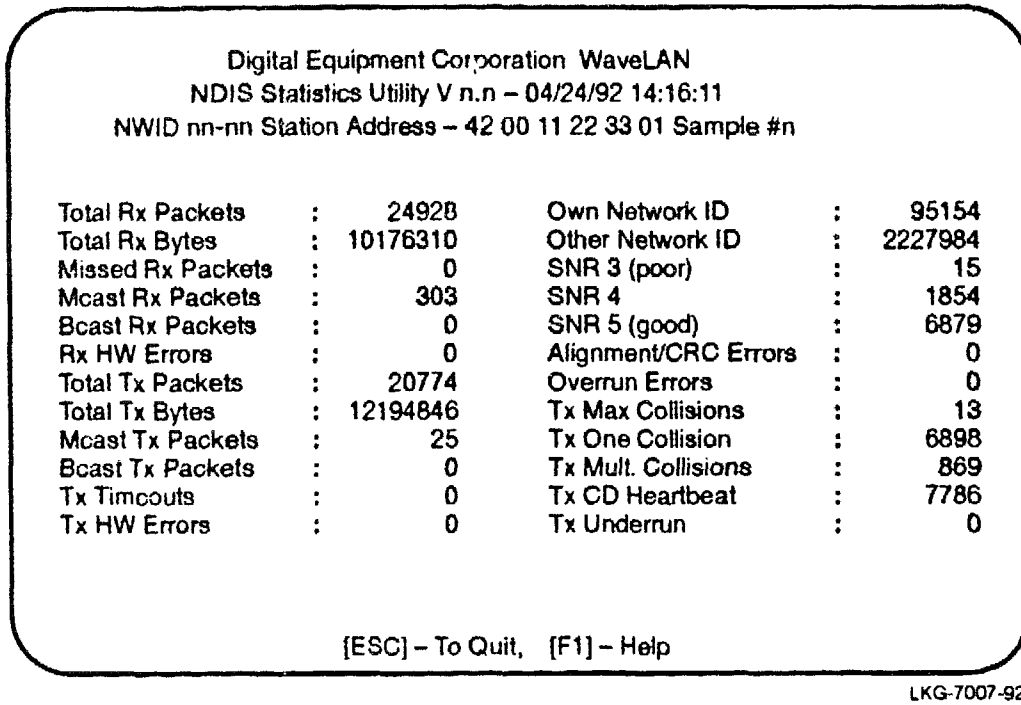
7.3.1 Counter Information

The counters used in WaveLAN network problem determination include:

Total Tx Packets	Total number of packets successfully transmitted by this workstation since network driver startup.
Total Rx Packets	Total number of packets successfully received by this workstation since network driver startup.
Alignment/ CRC Errors	Total number of receive packets rejected because of an alignment or Cyclic Redundancy Check (CRC) error. Activity on this counter is usually due to collisions or to signal interference.

Figure 7–7 shows the diagnostic counters.

Figure 7–7: NDIS Node Diagnostic Counters



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Tx Max Collisions — Total number of times a packet was not transmitted because the maximum number (15) of collisions was exceeded.

Own Network IDs — Number of packets from the local WaveLAN that have been detected by the board.

This counter shows the total of all packets detected, including those addressed to other stations on this network.

Other Network IDs — Number of packets from other WaveLANs or corrupted packets that have been detected by the board. (Noise can cause this counter to increment.)

SNR n

Number of signal-to-noise ratio (SNR) samples that were taken, per category, on incoming packets with own NWID.

Signal-to-noise sampling takes place at the station at regular intervals (about 4 times per second) while the network driver is running. All network traffic detected by this station is sampled. The result increments one of three couners corresponding to Poor (SNR 3), Acceptable (SNR 4), and Good (SNR 5).

7.3.2 Diagnostic Indicators

From the diagnostic counters, you can develop some indicators to help determine the reasons for performance problems. The following indicators are useful:

- Percentage bad packets received
- Percentage medium busy
- Percentage packets received with a different Network ID
- Percentage SNR Categories

% Rx Bad Packets

The percentage of all frames received that were in error (for example, alignment and Checksum errors). To calculate this value, use the formula:

$$\%\ \text{RX Bad Packets} = \frac{\text{Alignment/CRC Errors}}{\text{Alignment/CRC Errors + Total RX Packets}} \times 100$$

% Medium Busy

The percentage of all attempts to transmit that were deferred to prevent collisions. To calculate this value, use the formula:

$$\%\ \text{Medium Busy} = \frac{\text{Tx MaxCollisions}}{\text{TX Max Collisions + Total TX Packets}} \times 100$$

% Other NWID — The percentage of all frames detected at this station that did not originate in this network. To calculate this value, use the formula:

$$\%\ \text{Other NWID} = \frac{\text{Other NWIDs}}{\text{Other NWIDs} + \text{Own NWIDs}} \times 100$$

% SNR Categories — Three indicators – the percentage of SNR samples in each category (SNR 3, SNR 4, SNR 5) relative to the total number of samples. To calculate this value, use the formula:

$$\%\ \text{cat. SNR n} = \frac{\text{Total SNR N}}{\text{Total (SNR 3 + SNR 4 + SNR 5)}} \times 100$$

7.3.3 Saving the Diagnostic Data

You can save the diagnostic counter values to a disk file by using the –o command line parameter. The counters, with date, time and sample number, are saved in Comma-Separated Value (CSV) form that can be read and processed by many spreadsheet programs. The format is:

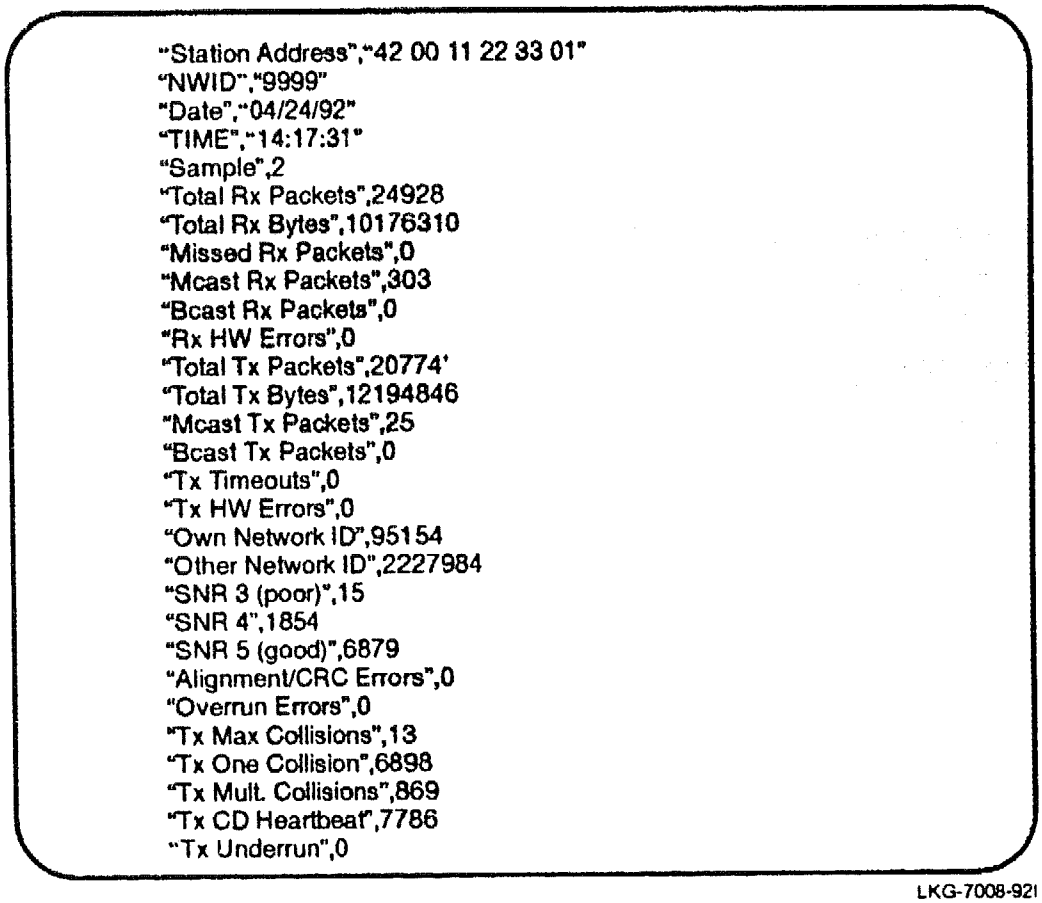
"Station Address","xx xx xx xx xx xx"CrLf
"NWID","xxxx"CrLf
"Date","MM/DD/YY"CrLf
"Time",hh:mm:ssCrLf
"Sample",samplenumberCrLf
"counter-name",countervalueCrLf
etc.

NOTE

CrLf is equivalent to Carriage return Linefeed (hexadecimal 0D0A).

Figure 7–8 shows how the diagnostic counters displayed are saved on disk.

Figure 7–8: Saved NDIS Counter Set



LKG-7008-921

7.3.4 Parameter Options for Batch Operation

You can use command line parameters at program execution to:

- Dynamically update the display
- Change the refresh frequency
- Write the counters to a disk file or to the standard output device (STDOUT)
- Specify an alternative driver (the default is WVLAN$)
- Display Help information

The following parameter options are case sensitive. You must use lowercase.

o[*path*]	Outputs the counter values to STDOUT, or optionally to a file specified by ***path***, which is the full pathname, including filename and extension, of the disk file to save the counter values to. **path** can include the redirection character ">>" followed by the full pathname. When ">" is used, the screen display is suppressed. When ">>" is used, the screen display is suppressed and the data is appended to an existing file. You can use this parameter to combine data collection and subsequent processing in one MS–DOS .BAT file (or OS/2 .CMD file) that you can run at regular intervals to map traffic and performance over time.
–c	Indicates that the screen display is to be updated at regular intervals. The default interval is one second if the **–r** parameter is not used.
–r*nnn*	Specifies the number of seconds between screen updates. **nnn** is the number of seconds.
–d*n*	Indicates an alternative network driver. The default driver name is WVLAN$. Alternative driver names are WVLAN2$ through WVLAN9$, where **–d2** specifies driver WVLAN2$ and **–d3** specifies WVLAN3$, and so forth.
–h	Displays help information about the counters. Disables all other command line parameters and also suppresses the normal screen display.
Example:	**ndndidos –c –r60**

This command runs the Node Diagnostics utility on an MS–DOS workstation and refreshes the screen display once every 60 seconds.

7.4 Interpreting the Data

This section suggests how the diagnostic indicators can be used to assess performance and obtain information about possible causes of degraded performance.

The percentage Successful Packets indicator can confirm your own observation that a station's performance is degraded. Performance is degraded when % Successful Packets is less than 95%.

NOTE

This measurement is not valid for LAN Manager.

Use the following indicators to determine the reason for poor performance:

- Percentage received bad packets
- Percentage medium busy
- Percentage packets received with a different Network ID
- Percentage SNR Categories

% Rx Bad Packets	A high value (over 5%) could indicate a Noise problem. You can confirm this by running the Point-to-Point Diagnostics utility.
% Medium Busy	A high value (30%) indicates that the transmission medium is busy, which may be due to a high volume of transactions in this network, or traffic on another nearby WaveLAN network. You can determine if another network's traffic is the problem by examining the % Other NWID indicator.
% Other NWID	If more than one WaveLAN network share the same physical space or are adjacent to each other, they will also share bandwidth. Traffic on one network will reduce medium availability for another network. The % Other NWID shows the actual impact on medium availability. A value of less than 5% is not significant. If % Medium Busy and % Other NWID are both high, this could be an indication that two WaveLAN networks in close proximity are degrading each other's performance. Relocating one or both networks to move them further apart or to take advantage of a radio-frequency barrier should be considered. If this is not possible, efforts should be made to reduce network traffic.

% SNR Categories

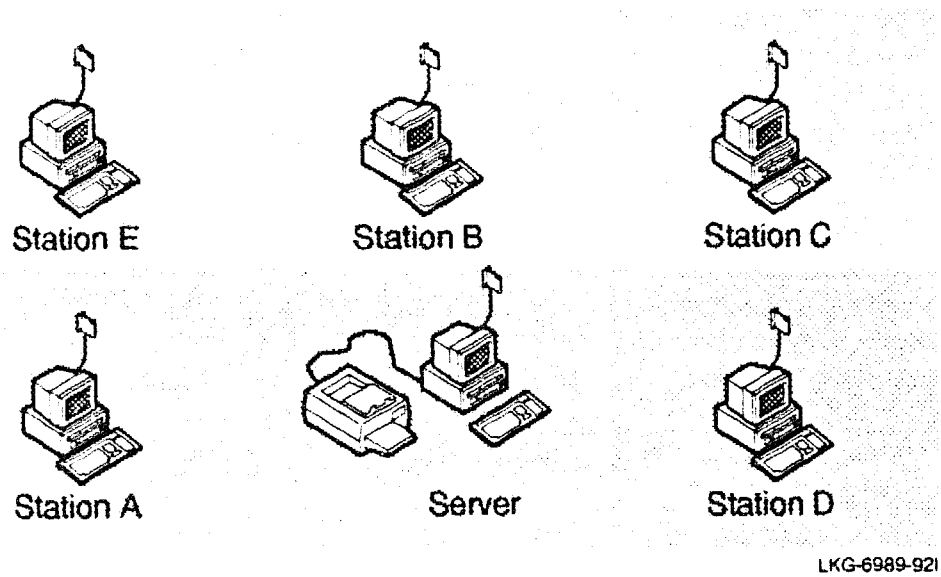
If the % SNR indicators show that SNR is mostly Low or Poor, the communications capabilities of this station may be less than optimal, which could be due to a high local Noise level or signal attenuation. Use Point-to-Point Diagnostics to investigate the path between this station and the server.

NOTE

You can investigate the communications path between a station and the network server by taking advantage of slack periods when network traffic is very low (for example, early in the morning). By starting up the station and copying a file from the network server, you can capture SNR information specific to the station/server path. This avoids having to take the server off line to run Point-to-Point Diagnostics.

For a workstation, a low communications capability as indicated by poor SNR does not necessarily imply loss of performance. For example, Figure 7–9 shows a situation where station A can barely detect signals from Stations C and D, and therefore shows poor SNR. The path between station A and the server is satisfactory. Because all stations in this network communicate only with the server, station A's inability to talk to stations B and C does not affect its performance.

Figure 7–9: SNR Example



8

Messages

This chapter contains error and warning messages displayed by the Configuration utilities, the network drivers, and the Diagnostic utilities. The chapter is organized into four sections:

1. Messages displayed by the Configuration Setup utility (Section 8.1)
2. Messages displayed by the Configuration Install utility and the network drivers (Section 8.2)
3. Messages displayed by the Node Diagnostics utility (Section 8.3)
4. Messages displayed by the Point-to-Point Diagnostics utility (Section 8.4)

Messages may be displayed with a prefix or suffix, depending on the displaying program. This chapter shows only the body of the message.

This chapter shows: **Card not found**

The Configuration Install utility displays: **Card not found – press [ENTER]**

The workstation driver displays: **WaveLAN: Card not found**

The NetWare Version 2 (server) operating system displays: **Error initializing LAN driver: Card not found**

8.1 Configuration Setup Utility Messages

Datalink Security enabled – Encryption Key entry required

Cause: On the parameter entry screen, Datalink Security Enabled has been selected. You attempted to return to the main menu without having entered an Encryption Key value.

Action: Press Enter to acknowledge the message and return the cursor to the Encryption Key entry field. You can then either:

1. Enter a key value or press F2 to generate a unique value key. Be sure that all nodes in the network have the same key value or they will not be able to communicate with each other.
2. Return to the Datalink Security entry by using the up arrow key and reset Datalink Security to Disabled.

Drive not ready or file not found

Cause: The Install utility file you tried to load could not be read because the drive or pathname you specified was wrong, the file does not exist, or there is a physical reason, such as an open drive door prevented the file from being read.

Action: Verify that the correct drive, path or filename is specified. If a floppy disk drive is specified, check that the drive contains a disk and that the drive door is closed.

Drive not ready or pathname invalid

Cause: The Install utility file to save could not be written because the drive or directory specified does not exist, or a physical reason, such as an open drive door prevented the file from being written.

Action: Verify that the correct drive and directory is specified. If a floppy disk drive is specified, check that the drive contains a disk and that the drive door is closed.

Encryption Key entry incomplete

Cause: An Encryption Key consists of 16 hexadecimal digits. Not all 16 digits were entered.

Action: Complete entry of the 16-digit key, or press F2 to generate a unique value. (This value must be the same for all nodes in the network.)

Encryption Key invalid

Cause: The key value entered is considered weak or dual according to the Data Encryption Standard, and cannot be accepted by the program.

Action: Enter a key value which is not weak or dual or press F2 to generate a unique value. The key value generated using F2 is always valid.

Error writing to disk – file not saved

Cause: A hardware problem occurred while attempting to save the modified Configuration Install file to disk. The problem could be with the disk drive or the disk, or the disk may be full or write protected.

Action: If saving to a diskette, try using another diskette. If that fails, you will have to repair or replace the defective drive and run the Configuration Setup utility again.

File not found

Cause: The Install utility file to be loaded could not be read because the filename could not be found in the directory specified.

Action: Verify that the correct path and filename is specified.

Incompatible Configuration Install utility

Cause: The Install utility file to be loaded is a different version to the Setup utility. The Install utility cannot be processed.

Action: Make sure that you use the same version of both Setup and Install utilities. You can verify this by checking the version numbers displayed on the screens.

Invalid Configuration Install utility

Cause: The file to be loaded is not an executable Configuration Install utility file.

Action: Verify the name of the Install utility file you want to modify, or use the working copy of the original file supplied as part of the Installation software set.

Network ID must be 0100 or greater

Cause: A Network ID value in the range **0 – 0FFH** has been entered. Only values greater than **0FFH** are accepted.

Action: Enter a Network ID value of **0100H** or greater, or press F2 to generate a unique value. The value generated using F2 is always valid. (All nodes in a network must use the same Network ID.)

Network ID must be set

Cause: An original, unmodified Configuration Install utility file is loaded, and F10 has been entered to return to the Main menu before the Network ID has been entered.

Action: Enter a Network ID value of **0100H** or greater, or press F2 to generate a unique value.

No Configuration Install utility has been loaded

Cause: Save Configuration Install file was selected before Load Configuration Install file.

Action: Select Load Configuration Install file to load a file, or Quit without saving to exit the program.

Not enough memory to run this program

Cause: There is insufficient memory available to load the Configuration Setup utility. The Setup utility requires 64K bytes to run.

Action: Make memory available by closing down other applications.

Path name invalid

Cause: The Install utility file you tried to save could not be written because either the pathname specified is invalid or the directory does not exist.

Action: Verify that you have entered the pathname correctly.

8.2 Configuration Install Utility and Network Driver Messages

ACR parameter must be 2 for server or 6 for workstation

Cause: The Accelerated Contention Resolution parameter value in the LAN Manager PROTOCOL.INI file is illegal. It must be 2 or 6.

Action: Edit the PROTOCOL.INI file. See Appendix B for details.

Card installed in a 8-bit slot

Cause: The WaveLAN card has been found in an 8-bit expansion slot. The card can only function if it occupies a 16-bit slot.

Action: Remove the card and reinsert it in a 16-bit expansion slot. Be sure to follow the precautions for handling the card that are described in Chapter 3.

Card in use by another program

Cause: Another program was using the WaveLAN card when this program attempted to access it. The most likely occurrence of this message is when an attempt is made to install a configuration or start a diagnostic program while the network driver is running.

Action: Disable automatic startup of the driver, and reboot the PC. Run this program again.

Card not found

Cause: A WaveLAN card was not found at the I/O Base expected. Either the address is wrong or the card's address switches have not been set correctly.

Action: Verify that the card address selected when running the Install utility or when installing the network driver matches the address switch settings on the card.

Card not functioning correctly

Cause: Startup diagnostics detected a malfunction in one of the card components and the card cannot be used.

Action: This may be a transient or permanent problem. Try the program reporting the error again. If the message persists, replace the card. If possible, try the card in another PC to verify that the problem is with the card and not the environment.

Configuration Install utility has not been run

Cause: The card cannot be used because it has not been properly configured.

Action: Run the Configuration Install utility to configure the card.

Configuration Setup utility has not been run

Cause: The Configuration Install utility file being run has never been updated by the Configuration Setup utility. An unmodified Install utility file is not usable.

Action: Run the Configuration Setup utility to set the configuration parameters in the Install utility.

Error writing new configuration to the card

Cause: A hardware malfunction prevented the card configuration from being updated.

Action: This may be a transient or permanent problem. Try to install the new configuration again. If the message persists, replace the card. If possible, try the card in another PC to verify that the problem is with the card and not the environment.

Invalid Card Address

Cause: The Card Address specified is not a valid address. Valid addresses are in the range **0200H – 03F0H** with the last digit always zero.

Action: Specify an address in the above range. Be sure the address you specify agrees with the address set by switches on the card.

Invalid Card Address passed on Command Line

Cause: The **-A** command line option did not specify a Card Address value in the valid range. Valid addresses are in the range **0200H – 03F0H** with the last digit always zero.

Action: Run the Install utility again with a valid card address in the command line. Be sure the address you use agrees with the address set by switches on the card.

Invalid IRQ number

Cause: The Interrupt Request Line (IRQ) number specified is not a valid IRQ number. Valid IRQ numbers are 03, 04, 05, 07, 10, 11, 12, and 15.

Action: Specify a valid IRQ number. Be sure the number you specify agrees with that used to generate the network driver.

Invalid IRQ number passed on Command Line

Cause: The **-I** command line option did not specify a valid IRQ number. Valid IRQ numbers are 03, 04, 05, 07, 10, 11, 12, and 15.

Action: Run the Install utility again with a valid IRQ in the command line. Be sure the number you specify agrees with that used to generate the network driver.

Invalid MAC Address passed on Command Line

Cause: The **-L** command line option did not specify a local MAC address value of 8 hexadecimal digits.

Action: Run the Install utility again, including an 8-digit hexadecimal MAC address in the command line.

IRQ conflict on IRQ number

or

IRQ conflict or card not functioning correctly

Cause: The IRQ number used by the network driver or Install utility is also being used by another device, or there is a malfunction on the card.

Action: Check the configurations of all other devices installed in the PC. Even if no apparent conflict exists, try using a different IRQ. If the problem persists, replace the card.

IRQ mismatch between card and driver

Cause: The IRQ number configured on the card by the Configuration Install utility differs from the IRQ number selected when generating the network driver.

Action: Rerun the Configuration Install utility, making sure the IRQ number used agrees with the value used to generate the driver, or regenerate the network driver.

Local MAC Address type specified – address entry required

Cause: The card configuration includes LOCAL MAC addressing, but no MAC address has been entered.

Action: Enter an 8-digit hexadecimal LOCAL MAC address, or rerun the Configuration Setup utility to change MAC addressing to UNIVERSAL.

MAC Address entry incomplete

Cause: The card configuration includes LOCAL MAC addressing, but less than 8 digits of the MAC address have been entered.

Action: Complete the entry of an 8-digit hexadecimal MAC address.

MAC Address passed on Command Line when not required

Cause: The **–L** command line option has been used to set a LOCAL MAC address value but the new MAC Address Type is UNIVERSAL.

Action: Check that you are using the correct Install utility file. If so, remove the **–L** option from the command line and rerun.

No Card Address passed on Command Line

Cause: The Install utility is being run in Batch Mode (**–B** command line option) but the Card Address (**–A** option) was missing from the command line. The Card Address is required in Batch Mode.

Action: Rerun specifying the Card Address in the command line.

No MAC Address passed on Command Line

Cause: The Install utility is being run in Batch Mode (**–B** command line option), the configuration installation changes the card's MAC Addressing from UNIVERSAL to LOCAL, but the LOCAL MAC Address (**–L** option) was missing from the command line.

Action: Rerun specifying the LOCAL MAC address on the command line, or run without the **–B** option. In the latter case, you can enter the MAC address during program execution.

Security Feature not functioning correctly

Cause: Startup diagnostics have determined that the Security Feature is defective.

Action: Replace the Security Feature.

Security Feature not available

Cause: The configuration installed on the card indicates that Datalink Security is enabled, but the Security Feature has not been installed on the card.

Action: Install the Security Feature on the card, or run the Configuration Setup utility to disable Datalink Security. If you disable Datalink Security, you must reinstall this configuration on every card in the network.

Software incompatible with Card

Cause: The program version you are using does not match the version of the card installed.

Action: Use only software from the diskettes which were supplied with the WaveLAN card.

Unrecognized parameter on Command Line

Cause: The command line contained a string which did not match the MS-DOS conventions for program filenames and which was not a valid command line parameter.

Action: Correct the command line. Valid parameters are: **–B, –L, –A,–M**. Formats and values are described in Chapter 4.

8.3 Node Diagnostics Utility Messages

Cannot open

Cause: The file specified in the **–o** command line parameter cannot be opened for some reason (for example, it is a read-only file).

Action: Check the pathname specified. Check the file attributes with the **ATTRIB** command.

Card not found

Cause: The WaveLAN driver is not active for the card at the address specified in the command line.

Action: Correct the **–c** command line parameter. To see what cards are active, start the utility in full-screen mode (no parameters).

Could not open WaveLAN driver

Cause: The WaveLAN driver is not active, or the driver specified in the **–d** option is not active.

Action: Check the command line parameters. If running in a LAN Manager environment, check PROTOCOL.INI and CONFIG.SYS to verify which driver should be active.

Drive not ready

Cause: The program attempted to write to a file on a disk drive but, the drive was not ready.

Action: Check that the pathname is correct, the drive contains a disk, and the drive door is closed.

Driver number must be in the range 2–9

Cause: The **–d** command line parameter is used when more than one WaveLAN driver is running (for example, in an OS/2 server). If a driver is specified it should specify a value between 2 and 9.

Action: Correct the parameter.

Error: Cannot allocate memory for a screen buffer

Cause: The station does not have enough free memory to store the screen information in an internal buffer (30K bytes are required).

Action: Check the amount of free memory in the station with the **CHKDSK** command. If possible, free up memory by terminating other memory-resident processes.

Error: drive not ready. Abnormal exit

Cause: The program attempted to write to a file on a disk drive, but the drive was not ready.

Action: Check that the pathname is correct, the drive contains a disk, and the drive door is closed.

Error: output file error. Abnormal exit

Cause: An error occurred (for example, the disk is full) while writing to the file, specified in the **–o** command line parameter option.

Action: If saving to a diskette, try using another diskette.

Error writing to disk

Cause: An error occurred (for example, the disk is full) while writing to the file, specified in the **–f** command line parameter option.

Action: If saving to a flex diskette, try using another diskette.

Filename already exists

Cause: In batch mode the command line specified an existing file, but did not include the append option.

Action: To append the counter values to an existing file, specify **–a** in the command line. For a new file, specify a different filename with the **–f** command line parameter.

Must specify a driver number

Cause: The **–d** command line parameter is used when more than one WaveLAN driver is running (for example, in an OS/2 server). If a driver is specified, it should specify a value between 2 and 9.

Action: Correct the parameter.

Must specify a repeat rate (seconds)

Cause: The **–r** command line parameter defines the interval between samples. It must be numeric.

Action: Correct the parameter.

No WaveLAN Driver found

Cause: WaveLAN NetWare Version 2.x Shell or DOS ODI Driver is not active at this station.

Action: The Node Diagnostics utility is designed to run during normal network operations. It can only run when a WaveLAN network driver is active.

Program Initialization Failure – Execution Terminated

Cause: The file ERR$TAL.DAT could not be found, possibly because the program was run from a directory other than the one where the program files are stored.

Action: Change to the directory where the program was installed and retry.

The system message library file Sys$tal.dat could not be opened

Cause: The program was run from a directory other than the one where the program files are stored.

Action: Change to the directory where the program was installed and retry.

This old LSL version is not supported

Cause: The NetWare Link Support layer installed does not provide the required support functions. This message may occur with some prerelease versions of Novell software.

Action: Check with your Novell software supplier to verify that you have the correct NetWare or NetWare Lite software.

Unable to open file

Cause: The pathname specified is invalid or the drive or directory does not exist.

Action: Verify the drive and directory are correct.

Unknown option

Cause: A character on the command line was not preceded by "–".

Action: Correct the command line.

Unknown switch

Cause: A character following "–" on the command line was not a valid parameter (**h**, **r**, **o**, **c**, or **d**).

Action: Correct the command line.

Unrecognized parameter on Command Line

Cause: The command line contains a **–b** parameter, but other parameters present could not be interpreted.

Action: Correct the command line.

8.4 Point-to-Point Diagnostics Utility Messages

Card in use by another program

Cause: Another program was using the WaveLAN card when this program attempted to access it. The most likely occurrence of this message is when an attempt is made to start the Point-to-Point Diagnostics program while the network driver is running.

Action: Disable automatic startup of the driver, and reboot the PC. Run this program again.

Card installed in an 8-bit slot

Cause: A WaveLAN card has been found in an 8-bit expansion slot. The card can only function if it occupies a 16-bit slot.

Action: Remove the card and reinsert it in a 16-bit expansion slot. Be sure to follow the precautions for handling the card which are described in Chapter 3.

Card not found

Cause: A WaveLAN card was not found at the I/O Base Address expected. Either the address is wrong or the card's address switches have not been set correctly.

Action: Verify that the card address selected while running Point-to-Point Diagnostics matches the address set by switches on the card.

Card not functioning correctly

Cause: Startup diagnostics has detected a malfunction in one of the card components and the card cannot be used.

Action: This may be a transient or permanent problem. Try running the Card Diagnostics option. If the message persists, replace the card. If possible, try the card in another PC to verify that the problem is with the card and not the environment.

Configuration Install utility has not been run

Cause: The card cannot be used because it has not been properly configured.

Action: Run the Configuration Install utility to configure the card.

Interference from station xx-xx-xx-xx-xx-xx

Cause: During signal-level measurement, a message was detected from a station not involved in the test. This can occur if Point-to-Point Diagnostics are started in neighboring networks at the same time. The first station of the second network starts transmitting before the second station of the first network, and this is detected by the first station of the first network.

Action: Coordinate testing on each network to avoid overlap.

Invalid Card Address

Cause: The Card Address specified is not a valid address. Valid addresses are in the range **0200H – 03F0H** with the last digit always zero.

Action: Specify an address in the above range. Be sure the address you specify agrees with the address set by switches on the card.

Invalid Card Address passed on Command Line

Cause: The **–A** command line option did not specify a valid Card Address value. Valid addresses are in the range **0200H – 03F0H** with the last digit always zero.

Action: Run the utility again with a valid card address in the command line. Be sure the address you use agrees with the address set by switches on the card.

Invalid Link ID passed on Command Line

Cause: The **–N** command line option did not specify a Diagnostic Link ID value in the range 1 – 10.

Action: Run the utility again with a valid Link ID in the command line, or omit the parameter to use the default Link ID (= 1).

IRQ conflict or card not functioning correctly

Cause: The IRQ number used by the startup diagnostics (or Card Diagnostics) is also being used by another device, or there is a malfunction on the card itself.

Action: Check the configurations of all other devices installed in the PC. Even if no apparent conflict exists, consider using a different IRQ (you can change the IRQ by running the Configuration Install utility). If another IRQ solves the problem, you will need to regenerate the network driver for the new IRQ. If the problem persists, replace the card.

Maximum number of packets transmitted and/or received

Cause: The number of messages transmitted or received by one of the participating stations has reached the limit for the test.

Action: There is no action required. Measurement stops. If you wish to continue, you restart the test.

Point-to-Point Diagnostic Link already in use

Cause: When attempting to start Point-to-Point Diagnostics, this station detected that the test was already running between two other stations.

Action: Wait for the test to complete. Coordinate the use of diagnostic links with other parties involved.

Security Feature not functioning correctly

Cause: Startup diagnostics have determined that the Security Feature is defective.

Action: Replace the Security Feature.

Security Feature not available

Cause: The configuration installed on the card indicates that Datalink Security is enabled, but the Security Feature has not been installed on the card.

Action: Install the Security Feature on the card, or run the Configuration Setup utility to disable Datalink Security. If you disable Datalink Security, you must reinstall this configuration on every card in the network.

Software incompatible with Card

Cause: The program version you are using does not match the version of the card installed.

Action: Use only software from the diskettes that were supplied with the WaveLAN card.

Unrecognized parameter on Command Line

Cause: The command line contained a string that did not match the MS–DOS conventions for program filenames and that was not a valid command line parameter.

Action: Correct the command line. Valid parameters are: **–A**, **–M**, **–N**. Formats and values are described in Chapter 6.

Warning: PTP versions not compatible – Press [ENTER]

Cause: Two different versions of Point-to-Point Diagnostics are running; with the older version, possible Network ID and address conflicts are not detectable.

Action: Verify the latest versions are running on both stations.

Warning: Local & Remote NWID not equal – Press [ENTER]

Cause: The stations running the test are configured for different networks.

Action: Make sure you have selected the correct PCs to run the test. If so, you will need to rerun the Configuration Install utility on one of the WaveLAN cards to install the correct Network ID.

Warning: Local & Remote address equal – Press [ENTER]

Cause: The stations running the test have the same MAC address. This may occur if you selected LOCAL MAC addressing when configuring the WaveLAN cards.

Action: Rerun the Configuration Install utility on one of the WaveLAN cards to change the MAC address.

A

NetWare Driver Installation

This appendix provides information on installing WaveLAN network drivers in a Novell NetWare environment. If you are not familiar with NetWare installation procedures, you may need to refer to Novell documentation.

During some driver generation procedures, you will be asked to select a LAN Driver Configuration from a list displayed on the screen. Table A–1 shows the available configurations for the WaveLAN driver.

Table A–1: WaveLAN Driver Configuration Options

#	I/O Address	RAM	DMA	AT-bus	IRQ
0:	**0300H**	No	No	Yes	H/W Configured
1:	**0390H**	No	No	Yes	H/W Configured
2:	**03C0H**	No	No	Yes	H/W Configured
3:	**03E0H**	No	No	Yes	H/W Configured

The WaveLAN software diskette contains driver object and description files for use with NetWare Versions 2.1x, 2.2, 3.1x, NetWare Lite, and the NetWare Requester for OS/2. These files are listed in Table A–2.

Table A–2: WaveLAN Driver Files for NetWare

Directory	File	Description
\(root)	AWVLAN01.OBJ BWVLAN01.OBJ CWVLAN01.OBJ DWVLAN01.OBJ	NetWare Version 2.x Operating System driver modules (for servers, bridges, and routers) for: LAN A, LAN B, LAN C, or LAN D
\(root)	SWVLAN01.OBJ	NetWare Version 2.x Shell driver module (for workstations)
\(root)	WVLAN01.LAN	NetWare Version 2 O.S. Driver Description File for Version 2.15 Rev. C, and later versions
\(root)	WVLAN01.215	Copy of WVLAN01.LAN
\(root)	WVLAN01.21X	NetWare Version 2 O.S. Driver Description File for Versions earlier than Version 2.15
\NETWARE.NW3	WVLAN03.LAN	NetWare Version 3 driver for Version 3.1x (for servers)
\NETWARE.OS2	WVLAN04.SYS	Driver for use with NetWare Requester for OS/2
\NETWARE.DOS	WVLAN05.COM DRIVER.LST	Netware DOS ODI Driver Substitute drivers list file for NetWare Lite

If you are installing WaveLAN in a NetWare 2.1x environment, refer to Section A.1.

If you are installing in a NetWare 2.2 environment, refer to Section A.5.

To install a NetWare Version 3 server, refer to Section A.6.

To install a WaveLAN driver with the NetWare Requester for OS/2, refer to Section A.7.

To install the WaveLAN DOS ODI driver, refer to Section A.8.

A.1 NetWare Version 2.1x Installation

The WaveLAN software diskette has volume label: LAN_DRV_448. You can use the hard disk or standard floppy disk methods of driver generation. If you are going to use the hard disk method:

1. Create a subdirectory of directory \NETWARE, called LAN_DRV_.448.
2. Copy all the files from the root directory of the WaveLAN diskette to the newly created hard disk subdirectory.

NOTE

If you are running a NetWare version earlier than 2.15 Rev C, you should use the file WVLAN01.21X as the driver description file. Use the DOS command:

copy wvlan01.21x wvlan01.lan

to replace the driver description file in your working copy of the installation diskette or LAN_DRV_.448 subdirectory of your hard disk (depending on driver generation method used).

A.2 Workstation Shell Driver Generation

To generate a workstation shell driver:

1. Use the Custom Shell Generation Level of SHGEN.
2. If using the standard floppy disk method, choose Load and Select Item from the LAN Driver Options menu to load the driver file directly from the WaveLAN software diskette.
3. Use the Configure Driver/Resources option to select the correct I/O Base Address from the list of available configurations (refer to Table A–1).

To install the workstation shell driver, you can either:

1. Create a workstation boot diskette, as described in the Novell documentation

or, if the workstation has a hard disk:

2. Copy the Network Shell files created in the Shell Generation step directly to the root directory on the workstation's hard disk. You should copy the files IPX.COM and the NetWare shell file (NET3.COM, NET4.COM, NET5.COM), which corresponds to the DOS version used on the workstation.

A.3 NetWare Operating System Generation

The following guidelines will help you to complete the operating system generation procedure for a WaveLAN card installed in a file server:

1. Use the Default Configuration option of NETGEN.
2. If you are using the standard floppy disk generation method, you should select Load and Select Item from the LAN Driver Options menu to load the WaveLAN drivers from your installation software diskette.
3. Select the LAN driver object file appropriate to the network (A, B, C, D).
4. NETGEN will select a configuration from those listed in Table A–1.

NOTE

The I/O Base Address switch settings on the WaveLAN card must correspond to those selected here. If there is a conflict, you may have to redo some of the WaveLAN installation steps.

A.4 Generating and Installing an External Bridge

If you are installing the WaveLAN card in an external bridge, the following guidelines will help you to complete the bridge generation procedure:

1. Use the Default Configuration option of BRGEN.
2. If you are running BRGEN from floppy disks, you should select Load and Select Item from the LAN Driver Options menu to load the WaveLAN drivers from your installation software diskette.
3. BRGEN will select a configuration from those listed in Table A–1.

NOTE

The I/O Base Address switch settings on the WaveLAN card must correspond to the address selected here. If there is a conflict, you may have to redo some of the WaveLAN installation steps.

A.5 NetWare Version 2.2 Installation

A.5.1 Workstation Shell Driver Generation

To generate a DOS workstation shell driver:

1. Run WSGEN.
2. When asked to select a LAN driver, press INSERT. Insert the WaveLAN software diskette in a floppy disk drive and press ENTER. Follow the screen prompts to select the WaveLAN driver.
3. When prompted, select the correct I/O Base Address from the list of available configurations (refer to Table A–1). The configuration you select should match the selection you made when you installed the WaveLAN card.
4. Complete the shell generation and workstation installation procedure as described in the Novell documentation.

A.5.2 Router Driver Generation

To generate a router driver:

1. Run ROUTEGEN.
2. When asked to select a LAN driver, press INSERT. Insert the WaveLAN software diskette in a floppy disk drive and press ENTER. Follow the screen prompts to select the WaveLAN driver. Select the LAN driver object file appropriate to the network (A, B, C, D).
3. When prompted, select the correct I/O Base Address from the list of available configurations (refer to Table A–1). The configuration you select should match the selections you made when you installed the WaveLAN card.

NOTE

An asterisk (*) indicates that the configuration option conflicts with other hardware configurations selected. If there is a conflict, you may have to redo some of the WaveLAN installation steps.

4. Complete the router generation and installation procedure as described in the Novell documentation.

A.5.3 File Server Installation

1. Run the INSTALL utility. Select Advanced Installation and follow the screen prompts until you see the Operating System Generation screen.
2. For the network in which the WaveLAN card will run (A, B, C, or D), highlight the network board Driver field, and press [INSERT]. Insert the WaveLAN software diskette in a floppy disk drive and press [ENTER]. Follow the screen prompts to select the WaveLAN driver from the list of available drivers.
3. When prompted, select the correct I/O Base Address from the list of available configurations (refer to Table A–1). The configuration you select should match the selections you made when you installed and configured the WaveLAN card.

NOTE

An asterisk (*) indicates that the configuration option conflicts with other hardware configurations selected. If there is a conflict, you may have to redo some of the WaveLAN installation steps.

4. Complete the file server generation and installation procedure as described in the Novell documentation.

A.6 NetWare Version 3.1x Server Installation

The WaveLAN driver for NetWare Version 3 is configured at run time. You can load and configure the driver when the server is running, or you can have the driver automatically loaded at server startup.

Install the server in the normal way, using the NetWare INSTALL utility.

A.6.1 Autoloading the NetWare Version 3 File Server Driver

If you want the driver loaded automatically each time the server comes up, you should edit the AUTOEXEC.NCF file, using the NetWare INSTALL utility:

1. Copy file WVLAN03.LAN from directory \NETWARE.NW3 on your working copy of the WaveLAN software diskette to a directory on the file server.
2. Load the INSTALL utility.
3. Select EDIT AUTOEXEC.NCF from the SYSTEM OPTIONS menu.

4. Add the following 2 lines to AUTOEXEC.NCF:

   load <PATH> wvlan03 port=<portnr>

   bind ipx to wvlan03 [port=<portnr>] net=<netnr>

where:

<path>	The server directory to which the WaveLAN driver was copied.
<portnr>	The I/O Base Address of the WaveLAN card to link the driver to. In the bind command line only specify the port parameter (including "[]") if more than one WaveLAN card has been installed.
<netnr>	Identifies a unique (Novell) network number for the network this card will be associated with.

Example of an AUTOEXEC.NCF file:

```
file server name NET3
ipx internal net 311C
load c:\wvlan03 port=390
bind wvlan03 net=1001
```

5. If more than one WaveLAN card is installed, repeat step 4 for the remaining cards.

6. Exit from the INSTALL utility and restart the server to load the WaveLAN driver(s).

A.6.2 Loading the WaveLAN NetWare Version 3 Driver Manually

If you have not included the WaveLAN driver in AUTOEXEC.NCF, you can load the driver manually while the server is running:

1. Place the working copy of the WaveLAN diskette in drive A.

2. At the prompt, type the following command line:

   load a:\wvlan03

   The system will prompt you to enter a port number.

3. Bind the driver to an installed card. Type the following command line:

   bind ipx to wvlan03

   The system will prompt you to enter a network number. If more than one WaveLAN card is installed or the driver has been loaded twice, the system will prompt you for the port number of the card to bind the driver to.

When the WaveLAN driver is successfully loaded, it displays the message:

Digital Equipment Corporation WaveLAN AT Vn.nn (yymmdd)

Vn.nn	the driver's version number
yymmdd	the driver's creation date in year, month, day format

A.7 NetWare Requester for OS/2

To install the WaveLAN driver for use with NetWare Requester for OS/2, proceed as follows:

1. Install the NetWare Requester for OS/2.

   Install the NetWare Requester on an OS/2 workstation in the standard manner. Note the directory to which the standard driver files are copied. This is usually C:\NETWARE\DRIVER. During the installation process, you must select a LAN driver. Select the driver NE2000. On exiting the INSTALL utility, do not select the REBOOT option.

2. Copy the WaveLAN driver to the driver directory.

   Insert the working copy of the WaveLAN diskette in drive A:. Copy the WaveLAN driver WVLAN04.SYS to the directory to which the standard driver files were copied in step 1. For example:

   copy a:\netware.os2\wvlan04.sys c:\netware\driver

3. Edit the CONFIG.SYS file.

   Use the OS/2 editor to edit the LAN driver definitions in CONFIG.SYS. Change the DEVICE definition line for the driver NE2000.SYS to indicate the WaveLAN driver. For example, if you have copied the WaveLAN driver to the same directory as the standard drivers, then change the LAN driver section of CONFIG.SYS.

   device=c:\netware\driver\ne2000.sys
   to
   device=c:\netware\driver\wvlan04.sys

4. Optionally, create a NET.CFG file.

   The default I/O Base Address (Port address) is **0300H**. If you have installed the WaveLAN card to use a different I/O Base Address, or if you have installed more than one WaveLAN card in the workstation, you will need to create or update a NET.CFG file. The NET.CFG file must contain LINK Driver statements and should be placed in the workstation's root directory.

The WaveLAN card is installed at address **03E0H.** The NET.CFG file should contain the following lines:

```
Link Driver WVLAN04
Port 3e0
```

Two WaveLAN cards are installed, at addresses **0300H** and **0390H**. The NET.CFG file should contain the following lines:

```
Link Driver WVLAN04 (first card)
Link Driver WVLAN04  (second card)
Port 390
```

5. Reboot the OS/2 workstation.

   When the WaveLAN driver is successfully loaded, it displays the message:
   Digital Equipment Corporation WaveLAN AT Vn.nn (yymmdd)
   where:

Vn.nn	the driver's version number
yymmdd	the driver's creation date in year, month, day format

A.8 Installing the DOS ODI Driver

To install the WaveLAN driver for use in a NetWare DOS ODI workstation, proceed as follows:

1. Copy the WaveLAN driver to the root directory.

   Insert the working copy of the WaveLAN diskette in drive A:. Copy the WaveLAN driver WVLAN05.COM to the workstation's root directory. Example command:

   copy a:\netware.dos\wvlan05.com c:

2. Copy the NetWare DOS ODI support files to the root directory. Insert the NetWare WSGEN diskette in drive A:. Copy a NetWare shell file to the workstation's root directory. Suitable files are:

NET3.COM	for MS-DOS Version 3.x
NET4.COM	for MS-DOS Version 4.x
NET5.COM	for MS-DOS Version 5.0
NETX.COM	for all the above MS–DOS versions

   From the \DOSODI subdirectory of the WSGEN diskette, copy the following files:

LSL.COM	(Link Support Layer)
IPXODI.COM	(IPX Protocol Stack file)

   NOTE

   For some NetWare versions, these files are provided on a separate DOS ODI WORKSTATION SERVICES diskette.

3. Edit the AUTOEXEC.BAT file.

   Edit the workstation's AUTOEXEC.BAT file to include the following lines in the order shown here:

   LSL
   WVLAN05
   IPXODI
   NET**5** (example)

4. Optionally, create a NET.CFG file.

   The default I/O Base Address (Port address) is **0300H**. If you have installed the WaveLAN card to use a different I/O Base Address, or if you have installed more than one WaveLAN card in the workstation, you will need to create or update a NET.CFG file. The NET.CFG file must contain LINK Driver statements and should be placed in the workstation's root directory.

The WaveLAN card is installed at address **03E0H** and uses the Ethernet_II (DIX) frame format. The NET.CFG file should contain the following lines:

```
Link Driver WVLAN05
Port 3e0
Frame Ethernet_II
```

Two WaveLAN cards are installed, at addresses **0300H** and **0390H**. The NET.CFG file should contain the following lines:

```
Link Driver WVLAN05 (first card)
Link Driver WVLAN05 (second card)
Port 390
```

In addition, the AUTOEXEC.BAT file must contain two occurrences of the driver filename:

```
LSL
WVLAN05
WVLAN05
IPXODI
```

A.9 NetWare Lite Installation

To install NetWare Lite with the WaveLAN DOS ODI driver, do the following:

1. Use the DOS DISKCOPY command to make a backup copy of your NetWare Lite installation diskette.
2. Copy the WaveLAN files:

   DRIVER.LST
   WVLANO5.COM

   from directory \NETWARE.DOS on the WaveLAN software diskette to the backup NetWare Lite Installation diskette. (Note: DRIVER.LST replaces an existing file of the same name on the NetWare Lite disk.)
3. Install NetWare Lite using the backup installation diskette.

A.10 Checking Your NetWare Installation

Run the NetWare COMCHECK utility to verify that your newly installed WaveLAN network stations can communicate with each other.

Use the WaveLAN Diagnostic utilities, described in this manual, to optimize antenna positioning, and to troubleshoot environmental or operational problems.

B

NDIS Driver Installation

B.1 Introduction

The Network Driver Interface Specification (NDIS) was issued by 3Com® and Microsoft Corporation as a standard for the development of network drivers and communication protocols. Many network operating environments provide NDIS support.

This chapter describes the steps typically required to install the WaveLAN NDIS driver in NDIS-compatible network environments, and provides examples for the following environments:

- PATHWORKS™ for DOS (DECnet™) (Digital Equipment Corporation)
- PATHWORKS for DOS (TCP/IP) (Digital Equipment Corporation)
- PC/TCP™, LAN Watch (FTP Software, Inc.)
- Sta LAN (NCR®)
- OS/2 LAN Server (IBM Corporation)
- 3+Open (3Com)
- LAN Manager (Microsoft and NCR)

B.2 NDIS Driver Installation General Information

In the LAN Manager environment, the NDIS driver installation is done by using the LAN Manager Setup program. The installation default values are modified manually.

In non-LAN Manager environments, the installation of the NDIS driver depends on the way the software that uses the NDIS driver is installed. In general, you must complete the following four steps:

1. Install the driver software.
2. Edit the CONFIG.SYS file.
3. Edit the PROTOCOL.INI file.
4. Edit AUTOEXEC.BAT.

As a result, the following lines will be added or changed in the various system files.

B.2.1 The CONFIG.SYS File

The CONFIG.SYS file should contain at least the following lines:

DEVICE=<ppath><protocol_manager> (/I:<ppath>)
DEVICE=<dpath><wavelan_driver>
DEVICE=<ppath><protocol_stack_file>

where:
<ppath> is the drive and directory containing the protocol files.

<dpath> is the drive and directory containing the WaveLAN driver.

<protocol_manager> is the protocol manager filename.

<protocol_stack_file> is the protocol stack filename.

<wavelan_driver> is the name of the WaveLAN driver file (OWVLAN02.OS2 for OS/2 or DWVLAN02.DOS for DOS).

B.2.2 The PROTOCOL.INI File

During the WaveLAN driver installation, three parameters are added to the file PROTOCOL.INI:

```
DriverName      = WVLAN$
IOBase          = 0x300
ACR             = 6
```

In PC-AT systems, change the value of IOBase to the I/O Base Address used when configuring the card.

The PROTOCOL.INI file should contain at least the following lines:

```
[PROTOCOL MANAGER]
  DriverName = PROTMAN$
[<protocol_stack>]
  DriverName = <protocol_stack_name>
  /Bindings = "WAVELAN"
[WAVELAN]
; Protocol.ini entry for the WaveLAN Communications Adapter.
        DriverName      = WVLAN$
        IOBase          = 0x300
        ACR             = 6
```

NOTE

- Lines starting with a semicolon are comment lines. These lines are ignored by the Protocol Manager.
- The term WAVELAN may be replaced by another name, as long as the name between the quotes is exactly the same as the name between square brackets in the line immediately following.

B.2.3 The AUTOEXEC.BAT File

The AUTOEXEC.BAT file (DOS systems only) should contain at least the following statement:

<bpath>NETBIND

where:
<bpath> is the drive and directory where NETBIND.EXE resides, for example, C:\LANMAN.DOS\DRIVERS\PROTMAN for LAN Manager.

B.2.4 Driver Initialization

After a successful installation, the driver displays the following message at startup:

Digital Equipment Corporation WaveLAN AT NDIS driver Vn.nn

B.3 PATHWORKS FOR DOS (DECnet)

Before installing PATHWORKS for DOS (DECnet), you need the following information:

- Node name of the PC (Format: xxxxxx)
- Node address of the PC (Format: nn.nnn)
- Node name of the File Server (Format: xxxxxx)
- Node address of the File Server (Format: nn.nnn)
- Select other NDIS driver when prompted by the PATHWORKS installation procedure
- Driver Location:
  (A: \MSLANMAN.DOS\DRIVERS\WAVELAN\DWVLAN02.DOS)
- PROTOCOL.INI STUB File (A: \MSLANMAN.DOS\DRIVERS\WAVELAN\ )
- WaveLAN card IO Base Address

Refer to the *PATHWORKS for DOS Client Installation and Configuration Guide with Diskettes* for information on installing PATHWORKS for DOS (DECnet). The PATHWORKS installation will modify the following files:

- CONFIG.SYS
- PROTOCOL.INI
- AUTOEXEC.BAT

NOTE

If your WaveLAN IO address is other than the default of 300H you will need to edit the PROTOCOL.INI file when prompted by the PATHWORKS installation procedure.

B.3.1 The CONFIG.SYS File

The CONFIG.SYS file should contain at least the following lines:

```
device=\decnet\himem.sys
shell=\command.com /P /e:526
DEVICE=\DECNET\PROTMAN.SYS /I:C:\DECNET
DEVICE=\DECNET\DWVLAN02.DOS
lastdrive=z
```

B.3.2 The PROTOCOL.INI File

The PROTOCOL.INI file should contain at least the following lines:

```
[protocol manager]
DRIVERNAME = PROTMAN$

[IPX4MAC]
DRIVER = IPX$MAC
BINDINGS    = DWVLAN02.DOS
```

```
DATALINK]
DRIVERNAME  = DLL$MAC
LG_BUFFERS  = 16
SM_BUFFERS  = 6
OUTSTANDING = 32
HEURISTICS  = 0
BINDINGS    = DWVLAN02.DOS
;Specify IRQ level used by workstations network adapter
;NI_IRQ     = 5

[DWVLAN02.DOS]
; Protocol.ini entry for the WaveLAN Communications Adapter.
            DriverName    = WVLAN$
            IOBase        = 0x3e0
            ACR           = 6
```

B.3.3 The AUTOEXEC.BAT File

The AUTOEXEC.BAT file should contain the following statement to start the network:

```
call \DECNET\STARTNET
```

B.4 PATHWORKS FOR DOS (TCP/IP)

Before installing PATHWORKS for DOS (TCP/IP), you need the following information:

- Node name of the PC (TEST1 is used in this example.)
- Node IP address of the PC (192.20.1.2 is used in this example.)
- Node name of the File Server (FILES1 is used in this example.)
- Node IP address of the File Server (192.20.1.1 is used in this example.)
- Domain name of the IP network (XYZ.ABC.COM is used in this example.)
- Subnet mask of the network (255.255.255.0 is used in this example.)
- Name server address (192.20.1.3 is used in this example)

- Default gateway address (192.20.1.4 is used in this example.)
- Select other NDIS driver when prompted by the PATHWORKS installation procedure.
- Driver Location:
  (A: \MSLANMAN.DOS\DRIVERS\WAVELAN\DWVLAN02.DOS)
- PROTOCOL.INI STUB File (A: \MSLANMAN.DOS\DRIVERS\WAVELAN\)
- WaveLAN card IO Base Address

Refer to the *PATHWORKS for DOS Client Installation and Configuration Guide with Diskettes* for information on installing PATHWORKS for DOS (TCP/IP). The PATHWORKS installation will modify the following files:

- CONFIG.SYS
- PROTOCOL.INI
- AUTOEXEC.BAT

NOTE

If your WaveLAN IO address is other than the default of 300, you will need to edit the PROTOCOL.INI file when prompted by the PATHWORKS installation procedure.

B.4.1 The CONFIG.SYS File

The CONFIG.SYS file should contain at least the following lines:

```
shell=\command.com /P /e:526
DEVICE=\tcpip\nemm.dos
DEVICE=\tcpip\PROTMAN.SYS /I:C:\TCPIP
DEVICE=\tcpip\DWVLAN02.DOS
DEVICE=\tcpip\tcpdrv.dos /I:C:\tcpip
lastdrive=z
device=\tcpip\himem.sys
```

B.4.2 The PROTOCOL.INI File

The PROTOCOL.INI file should contain at least the following lines:

```
; PROTOCOL.INI file created by TCPIPOMO.V41 V1.1.026
;                  via TCPIPWIK.V41 V2.0.012
;
;*************************************************************
;*                                                           *
;*    Protocol Manager Initialization File Template          *
;*                                                           *
;*************************************************************

[PROTOCOL MANAGER]
DRIVERNAME = PROTMAN$

;*****************************
;*                           *
;*      PROTOCOLS            *
;*                           *
;*****************************

; DLC Protocol
[DLC]
DRIVERNAME = MDLC$
BINDINGS =

; TCP Protocol Drivers
[TCPLITE]
DRIVERNAME = TCPLITE$
BINDINGS = DWVLAN02.DOS
SNAP = NO
IP.ADDRESS = 192 20 1 2
IP.SUBNET.MASK = 255 255 255 0
IP.GATEWAY0 = 192 20 1 4
DEFAULTS = LIGHT-USER
```

```
TCP.WINDOW = 2
UDP.BCAST.ZERO = NO

[TCPGLOBAL]
HOSTNAME = "test1"
NETFILES = "c:\tcpip"

[DNR]
DRIVERNAME = DNR$
BINDINGS = TCPLITE
NAMESERVER0 = 192 20 1.3
DOMAIN = "xyz.abc.com"

[NMDRV]
DRIVERNAME = NMDRV$
BINDINGS = TCPLITE
SYSTEMDESC = "PATHWORKS for DOS (TCP/IP) V2.0"

[SOCKETS]
DRIVERNAME = SOCKETS$
BINDINGS = TCPLITE
MAXSENDSIZE = 102
POOLSIZE = 10000
NUMSOCKETS = 32
NUMTHREADS = 32

[IPX4MAC]
DRIVER = IPX$MAC
BINDINGS = DWVLAN02.DOS

[TELNET]
DRIVERNAME = TELNET$
BINDINGS = TCPLITE
NSESSIONS = 4
MAX_OUT_SENDS = 3
MAX_SEND_SIZE = 128
DRIVER_EOL = 1
APP_EOL = 1
```

```
REDIREC_COM = 1
ECH_CHAR = "^^"
BRK_ACTION = 3
MUI_PROMPT = "MUI> "

[TINYRFC]
DRIVERNAME = TINYRFC$
BINDINGS = TCPLITE
NUMNAMES = 6
NUMSESSIONS = 8
; BCASTADDR =
INTERNETNAMES = 4

;*************************************
;*                    *
;*      ADAPTERS          *
;*                    *
;*************************************

[DWVLAN02.DOS]
; Protocol.ini entry for the WaveLAN Communications Adapter.
;
            DriverName    = WVLAN$
            IOBase        = 0x300
            ACR           = 6
```

B.4.3 The AUTOEXEC.BAT File

The AUTOEXEC.BAT file should contain the following statement to start the network:

```
call \TCPIP\STARTNET
```

B.5 TCP/IP and LAN Watch Installation

B.5.1 Install the Driver Software

Install the TCP/IP generic Ethernet software.

Copy the NDIS driver from the \MSLANMAN.DOS\DRIVERS\WAVELAN directory on the WaveLAN disk to the \LANMAN directory.

B.5.2 The CONFIG.SYS File

The CONFIG.SYS file should contain at least the following lines:

```
DEVICE=C:\LANMAN\PROTMAN.SYS
DEVICE=C:\LANMAN\DWVLAN02.DOS
DEVICE=C:\LANWATCH\DIS_PKT.GUP
DEVICE=C:\LANWATCH\IFCUST.SYS
DEVICE=C:\LANWATCH\IPCUST.SYS
```

B.5.3 The PROTOCOL.INI File

The PROTOCOL.INI file should contain at least the following lines:

```
[PROTOCOL MANAGER]
  DRIVERNAME = PROTMAN$
[PKTDRV]
  DRIVERNAME = PKTDRV$
  BINDINGS ="DWVLAN02_NIF"
  INTVEC = 0X65
  CHAINVEC = 0X66
[DWVLAN02_NIF]
; Protocol.ini entry for the WaveLAN Communications Adapter.
            DriverName      = WVLAN$
            IOBase          = 0x300
            ACR             = 6
```

B.5.4 The AUTOEXEC.BAT File

The AUTOEXEC.BAT file should contain at least the following lines:

```
SET PATH=C:\LANWATCH;C:\LANMAN
NETBIND
```

B.6 StarLAN Installation

B.6.1 Install the Driver Software

Install StarLAN.

Copy the NDIS driver from the \MSLANMAN.DOS\DRIVERS\WAVELAN directory on the WaveLAN disk to the \STARLAN directory.

B.6.2 The CONFIG.SYS File

The CONFIG.SYS file should contain at least the following lines:

```
DEVICE=C:\STARLAN\PROTMAN.DOS/i:C:\STARLAN
REM  DEVICE=C:\STARLAN\SLAN.DOS
DEVICE=C:\STARLAN\DWVLAN02.DOS
DEVICE=C:\STARLAN\NETBEUI.DOS
REM  DEVICE=C:\STARLAN\SLIM.DOS
```

B.6.3 The PROTOCOL.INI File

The PROTOCOL.INI file should contain at least the following lines:

```
; PROTOCOL.INI file for NETBEUI and the
; NCR AT StarLAN adapter
 [protocol manager]
  drivername = PROTMAN$
 [netbeui_xif]
  drivername = NETBEUI$
  bindings = wavelan
(. . . Non WaveLAN specific lines . . .)
 [wavelan]
;Protocol.ini entry for the WaveLAN Communications Adapter.
              DriverName      = WVLAN$
              IOBase          = 0x300
              ACR             = 6
```

B.6.4 The AUTOEXEC.BAT File

The AUTOEXEC.BAT file should contain at least the following line:

C:\STARLAN\NETBIND

B.7 IBM OS/2 LAN Server

To install the WaveLAN driver in LAN Server, you should first install a driver for an IBM-supported ETHERAND network adapter, and then replace that driver software and PROTOCOL.INI file by the respective WaveLAN files. The network card used for this purpose is the Western Digital card because its characteristics, from an installation viewpoint, are closest to the WaveLAN card.

NOTE

If you are installing WaveLAN in an existing configuration where the selected adapter is not the Western Digital card (but, for instance, a Token Ring card), then you must remove LAN Requester from your system and do a complete reinstallation. This is necessary to ensure that CONFIG.SYS and PROTOCOL.INI are correctly set up.

B.7.1 Installing OS/2 1.3 EE (Including Requester)

In the Basic Configuration Services Main menu, choose the LAN Services, and select the Western Digital adapter, Universal Address.

In the Communication Manager, Advanced Configuration function, LAN Features selection, Western Digital selection, and IEEE 802.2 selection, make sure that the 802.3 protocol and Universal Address are installed.

Copy the NDIS Driver from the WaveLAN disk to C:\CMLIB. The driver is OWVLAN02.OS2 in directory: \MSLANMAN.OS2\DRIVERS\WAVELAN.

B.7.2 The CONFIG.SYS File

In the following example, note the REM statement which shows the Western Digital drive used during the initial installation. Also, note the **CFG=C:\CMLIB\ETHERNET.CFG** parameter in some of the statements. **ETHERNET.CFG** is the user-defined name of the configuration file generated during the Communication Manager/LAN Features installation process.

CONFIG.SYS should contain at least the following lines:

```
DEVICE=C:\CMLIB\LANDD.SYS
DEVICE=C:\CMLIB\PROTMAN.OS2/I:C:\CMLIB
REM DEVICE=C:\CMLIB\MACWD.OS2
DEVICE=C:\CMLIB\OWVLAN02.OS2
DEVICE=C:\CMLIB\ETHERDD.SYS . .
                . . CFG=C:\CMLIB\ETHERNET.CFG
RUN=C:\CMLIB\ACSEPSYS.EXE
RUN=C:\CMLIB\NETBIND.EXE
DEVICE=C:\CMLIB\NETBDD.SYS . .
                ..CFG=C:\CMLIB\ETHERNET.CFG
DEVICE=C:\IBMLAN\NETPROG\RDRHELP.SYS
IFS=C:\IBMLAN\NETPROG\NETWKSTA.SYS . .
/I:C:\IBMLAN
```

B.7.3 The PROTOCOL.INI File

In the following example, the lines before END OF FILE have been copied from the the original PROTOCOL.INI file generated by the LAN Requester installation. Nonapplicable lines have been removed.

The lines after END OF FILE have been copied from the PROTOCOL.INI file in directory \MSLANMAN.DOS\DRIVERS\WAVELAN on the WaveLAN software diskette.

Use an editor to change the BINDINGS statement and to add the "[WAVELAN]" line.

Edit PROTOCOL.INI to contain the following lines:

```
; ——— Protocol Manager Definition ———
[PROTOCOL_MANAGER]
   DriverName = PROTMAN$
; ——— IBM ETHERAND Protocol Definition ———
[ETHERAND]
   DriverName =OS2EE$
   Bindings = WAVELAN
;**** END OF FILE ****
[WAVELAN] ;
;Protocol.ini entry for the WaveLAN Communications Adapter.
            DriverName    = WVLAN$
            IOBase        = 0x300
            ACR           = 6
```

B.8 IBM DOS LAN Requester Version 1.2

The installation of the DOS Requester consists of two parts:

- Installation of the PC LAN Support program, which creates the basic LAN software environment to access the WaveLAN adapter. This is a prerequisite for installing the actual DOS Requester. Follow the instructions as described in the *LAN Support Program User's Guide* to generate the environment for the Western Digital adapter.
- Installation of the DOS Requester.

B.8.1 PC LAN Support Program Installation

To install the PC LAN Support program, do the following:

1. Install the driver software.
2. Edit the CONFIG.SYS file.
3. Edit the PROTOCOL.INI file.
4. Edit AUTOEXEC.BAT.

B.8.1.1 The CONFIG.SYS File

Replace the **DEVICE=\MACWD.DOS** line by **DEVICE=\DWVLAN02.DOS**. In the following example, note the REM statement which shows the Western Digital driver that was used during the initial installation. Note that the parameters behind the device drivers in the other lines may not be mentioned in the User's Guide but must be there to make the system run.

Detailed information on the parameters can be found in the DXMINFO.DOC file on the PC LAN support diskette.

The CONFIG.SYS file should contain at least the following lines:

```
DEVICE=\LANMAN\PROTMAN.EXE
DEVICE=\DWVLAN02.DOS
REM   DEVICE=\MACWD.DOS
DEVICE=\DXMA0MOD.SYS 001
DEVICE=\DXME0MOD.SYS
DEVICE=\DXMT0MOD.SYS E O=N
```

B.8.1.2 The PROTOCOL.INI File

In the following example, the lines before END OF FILE have been copied from the the original PROTOCOL.INI file generated by the LAN Requester installation. Nonapplicable lines have been removed.

The lines after END OF FILE have been copied from the PROTOCOL.INI file in directory \MSLANMAN.DOS\DRIVERS\WAVELAN on the WaveLAN software diskette.

Use an editor to change the BINDINGS = statement and to add the [WAVELAN] line.

The PROTOCOL.INI file should contain at least the following lines:

```
; ——— Protocol Manager Definition ———
[PROTOCOL_MANAGER]
   DriverName = PROTMAN$
; ——— IBM ETHERAND Protocol Definition ———
[ETHERAND]
   DriverName =DXMEO$
  ——— Bindings = STATEMENT ———
   BINDINGS=WAVELAN
;**** END OF FILE ****
[WAVELAN] ;
;Protocol.ini entry for the WaveLAN Communications Adapter.
            DriverName    = WVLAN$
            IOBase        = 0x300
            ACR           = 6
```

B.8.1.3 The AUTOEXEC.BAT File

If needed, edit AUTOEXEC.BAT to contain the following lines:

```
SET COMSPEC=C:\DOS\COMMAND.COM
PROMPT $p$g
NETBIND
```

B.8.2 DOS Requester Installation

Follow the instructions as described in the *Operating System/2 Local Area Network Server Version 1.3 DOS Requester User's Guide*. Make backup copies of the CONFIG.SYS, AUTOEXEC.BAT, and any existing PROTOCOL.INI file.

B.8.2.1 The CONFIG.SYS File

In this example, note that **DOSLAN** is the default name used by the DOS Requester. **SYSTEM** and **LANMAN** were user-selected during installation. Also, note the parameters behind **DXMT0MOD.SYS**, which are placed by the DOS Requester installation process. The **O=N** parameter has to be entered manually when the DOS Requester installation process asks if you agree with the changes to the DXMT0MOD.SYS driver line.

The CONFIG.SYS file should contain at least the following lines:

```
SHELL=C:\COMMAND.COM/E:2000/P
BUFFERS=20
FILES=20
DEVICE=C:\DOSLAN\LANMAN\PROTMAN.EXE . .
        . . /I:C:\DOSLAN\LANMAN
DEVICE=C:\DOSLAN\SYSTEM\DWVLAN02.DOS
REM    DEVICE=C:\DOSLAN\SYSTEM\MACWD.DOS
DEVICE=C:\DOSLAN\SYSTEM\DXMA0MOD.SYS001
DEVICE=C:\DOSLAN\SYSTEM\DXME0MOD.SYS
DEVICE=C:\DOSLAN\SYSTEM\DXMT0MOD.SYS. .
        . . S=12  C=14 ST=12  O=N
LASTDRIVE=Z
FCBS=16,8
```

B.8.2.2 The PROTOCOL.INI File

The PROTOCOL.INI file is the same as the one for the PC LAN Support Program (Section B.8.1.2).

B.8.2.3 The DOSLAN.INI or AUTOEXEC.BAT Files

The DOSLAN.INI file contains default parameters used by the **NET START** command.

You should change the value of the **/WRK**: parameter to set the Oplock flag off (=0):

Old value: **/WRK:1111211012**
New value: **/WRK:1111211002**

Alternatively, you can override the default parameter value by editing the **NET START** command in AUTOEXEC.BAT.

Edit AUTOEXEC.BAT to contain the following lines:

```
NET START RCV MCRQSTR WAVEDOM . .
            . . /WRK:1111211002
```

B.8.2.4 Notes for Users of MS–DOS Version 5.0:

MS–DOS 5.0 uses the **SETVER** command to return a DOS version number other than 5.0 to a program. This mechanism is enabled when DOS 5.0 is installed by putting the line **DEVICE=<dospath>SETVER.EXE** in the CONFIG.SYS file. This line should be removed or "REM"ed to avoid problems when running the DOS LAN Requester software.

The driver software can be loaded into Upper Memory as shown in the following example of the CONFIG.SYS file.

The CONFIG.SYS file should contain at least the following lines:

```
REM   DEVICE=C:\DOS50\SETVER.EXE
DEVICE=C:\DOS50\HIMEM.SYS
DEVICE=C:\DOS50\EMM386.EXE NOEMS
DOS=HIGH,UMB
FILES=20
STACKS=0,0
SHELL=C:\COMMAND.COM /E:2000/P
BUFFERS=20
DEVICEHIGH=C:\DOSLAN\LANMAN\PROTMAN.EXE . .
        . . /I:c:\DOSLAN\LANMAN
DEVICEHIGH=C:\DOSLAN\SYSTEM\DWVLAN02.DOS
REM  DEVICE=C:\DOSLAN\SYSTEM\MACWD.DOS
DEVICEHIGH=C:\DOSLAN\SYSTEM\DXMA0MOD.SYS
. .
                    . . 001
DEVICEHIGH=C:\DOSLAN\SYSTEM\DXME0MOD.SYS
DEVICEHIGH=C:\DOSLAN\SYSTEM\DXMT0MOD.SYS
. .
                  . . S=12 C=14 ST=12 O=N
LASTDRIVE=Z
FCBS=16,8
```

B.9 3Com 3+Open Installation

To install the WaveLAN driver in a 3Com 3+Open network, you should first install a driver for 3Com-supported ETHERNET network adapter, and then replace that driver software and PROTOCOL.INI file by the respective WaveLAN files. The network card used for this purpose is the Western Digital card because its characteristics, from an installation viewpoint, are closest to the WaveLAN card.

The driver to use for DOS is DWVLAN02.DOS, which can be found on the WaveLAN disk in the directory: \MSLANMAN.DOS\DRIVERS\WAVELAN.

The driver to use for OS/2 is OWVLAN02.OS2, which can be found on the WaveLAN disk in the directory: \MSLANMAN.OS2\DRIVERS\WAVELAN.

Edit the system files in accordance with the general guidelines described in Section B.2 in this appendix. A sample PROTOCOL.INI file can be found in both of the above directories.

B.10 LAN Manager Installation

Use the LAN Manager SETUP utility to install the WaveLAN NDIS driver in a LAN Manager environment. The general installation procedure is described in the *Microsoft LAN Manager Installation Guide*. This appendix provides additional information specific to WaveLAN driver installation.

NOTE

The installation procedures for LAN Manager Versions 2.0 and 2.1 are different. If you are installing LAN Manager Version 2.1, refer to Section B.10.2.

B.10.1 LAN Manager Version 2.0 Installation

1. Start the LAN Manager SETUP program, and select the Actions menu.
2. Insert your working copy of the WaveLAN diskette in a disk drive.

3. Choose Import from the Actions menu, and specify the WaveLAN diskette's drive letter when asked. The Import Network Drivers dialog box is displayed.

4. Select the WaveLAN driver (use the Space key) and exit. The driver is copied to directory \LANMAN\DRIVERS\WAVELAN (or \LANMAN.DOS\DRIVERS\WAVELAN on an MS-DOS workstation).

5. Choose View/Modify from the Actions menu, and use the Network Drivers dialog box to install the driver.

6. Choose Save from the Actions menu, to save the new driver installation.

NOTE

The WaveLAN driver uses standard protocols (for example: **Netbeui**).

B.10.2 LAN Manager Version 2.1 Installation

Microsoft LAN Manager Version 2.1 is supplied with an earlier version of the WaveLAN driver.

1. Using the LAN Manager SETUP program, install LAN Manager and select other driver.

2. Insert your working copy of the WaveLAN diskette in the disk drive when prompted. The SETUP program finds the following drivers:

   MSLANMAN.DOS\DRIVERS\WAVELAN\DWVLAN02.DOS
   MSLANMAN.OS2\DRIVERS\WAVELAN\DWVLAN02.OS2

3. Continue with the installation as documented in your LAN Manager Installation manual.

C

Microsoft Windows for Workgroups

C.1 Microsoft Windows for Workgroups Driver Installation

We have included an OEMSETUP.INF file on our distribution diskette. Follow the instructions given in the "Installing and Configuring Network-Adapter Drivers" in the "Configuring Hardware" chapter of the *Microsoft Windows for Workgroups User's Guide*.

D

Installation Worksheet

D.1 Installation Worksheet

The Installation Worksheet on the following page is designed to help you carry the information you need through the various installation steps. It also serves as a hard-copy record of your installation, which will help you maintain your WaveLAN network or adapt it to meet changing requirements.

WaveLAN 915 PC-AT Installation and Configuration

Station _____ Installer _____

Date _____

Hardware Installation:

I/O Base Address Switch settings (Switches 1 and 2):

☐	SW 1: off	SW 2:	off	Address: 0300H
☐	off		on	Address: 0390H
☐	on		off	Address: 03C0H
☐	on		on	Address: 03E0H

Switches 3 and 4 are not used.

Security Feature installed: ☐ Yes ☐ No

Configuration Installation:

Description: _____

_____

Network ID: _____

MAC Address Type: ☐ Universal ☐ Local

Local Address _____

Datalink Security: ☐ Enabled ☐ Disabled

Key _____

Configuration Install utility filename:

☐ INSTCONF.EXE ☐ _____

Interrupt Request Line (IRQ): 10 11 12 15 3 4 5 7

WaveLAN 2400 PC-AT Installation and Configuration

Station _____ _____ Installer _____ _____

Date _____

Hardware Installation:

I/O Base Address Switch settings (Switches 1 and 2):

☐	SW 1: off	SW 2:	off	Address: 0300H
☐	off		on	Address: 0390H
☐	on		off	Address: 03C0H
☐	on		on	Address: 03E0H

Remote Boot Address Switch Settings (switches 3 and 4):

☐	SW 3: off	SW 4:	off	Address: Disabled
☐	off		on	Address: C8000H
☐	on		off	Address: D0000H
☐	on		on	Address: D8000H

Security Feature installed: ☐ Yes ☐ No

Configuration Installation:

Description: _____

_____

Network ID: _____

MAC Address Type: ☐ Universal ☐ Local

Local Address _____

Datalink Security: ☐ Enabled ☐ Disabled

Key _____

Configuration Install utility filename:

☐ INSTCONF.EXE ☐ _____

Interrupt Request Line (IRQ): 10 11 12 15 3 4 5 7

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