OpenNET™ PCL2 for DOS Installation Guide

Order Number: 462308-002

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Rev.	Revision History	Date
-001	Original Issue	1/89
-002	Software upgrade and name change	9/90

Preface

This guide describes how to install the PCL2 Release 3.0 Software for DOS on an IBM PC XT AT (or 100-percent compatible) computer system; it also describes configuration and management of the network using a menu-driven utility included in the PCL2 Release 3.0 Software for DOS.

The instructions in this guide assume that the PCL2 Network Interface Adapter and the Ethernet network cable have been installed and the personal computer being connected to the network is currently using the DOS operating system, version 3.1 or later.

Audience

This installation guide is intended for two groups of users:

- Users who are installing the PCL2 Release 3.0 Software for DOS and the networking software. These users should refer to the first four chapters.
- Network administrators or users who are responsible for configuring and managing the network. These users should refer to all chapters but will find chapters 4 and 5 most helpful.

Manual Organization

Chapter 1. Introduction

This chapter describes the OpenNET™ network architecture, introduces Release 3.0 of the PCL2 Software for DOS, and describes concepts and terminology.

Chapter 2. Software Installation

Describes installation of the PCL2 Release 3.0 Software for DOS and the networking software.

Chapter 3. Starting the Software

Describes setting up and starting the PCL2 Release 3.0 Software for DOS and the networking software using the AUTOEXEC.BAT file. Describes setting up a Spokesman node.

Chapter 4. Configure and Start a Diskless Workstation

Describes setting up the diskless workstation; includes configuring the network and the personal computer, and creating image diskettes and images.

Chapter 5. System Administration

Provides information on managing the network using the Administrative utility included in the PCL2 Release 3.0 Software for DOS.

Appendix A. Error Messages

This appendix lists and describes the error messages the user could encounter while using the PCL2 Release 3.0 Software for DOS and suggests corrective action.

Appendix B. Hacker's Guide for PCL2

This appendix contains a table that shows graphically what is needed to install and configure PCL2 R3.0 software on diverse operating systems and different releases of PCL2 software.

Conventions Used in This Manual

The following conventions apply throughout this manual:

- The IBM PC XT AT (and 100 percent compatibles) are referred to as personal computers.
- PC-DOS or MS-DOS, version 3.1 or later, are referred to as DOS.
- PCL2 Release 3.0 Software for DOS is referred to as PCL2 R3.0.

- The Microsoft Network's networking software is referred to as MS-NET.
- The IBM PC Local Area Network networking software is referred to as IBM PC LAN.

Notational Conventions

The following notational conventions are used throughout this guide:

bold	Bold text is used to emphasize important points or to highlight command names.
italics	Italic text is used to emphasize the first occurrence of new terminology or refer to related manuals.
`computer`	The letter gothic font is used to represent text and command lines as they would appear on the monitor.
`computer`	The bold letter gothic font is used to represent text and command lines as entered by the user as they would appear on the monitor.
<key>	Command keys are symbolized between angled brackets.

Related Literature

While this installation guide is a document describing the software installation of the PCL2 Release 3.0 Software for DOS, several other Intel documents contain information helpful in setting up and using the network.

- *PCL2NIA Hardware Installation Guide*, order number 462305. This manual describes how to install the PCL2NIA into an IBM PC XT AT (or 100-percent compatible personal computer system).
- *iRMX®-NET Software Release 3.0 Installation and Configuration Guide*, order number 462040. Describes how to configure and install the iRMX R3.0 networking software.
- *iRMX®-NET Software Release 3.0 User's Guide*, order number 462041. This manual describes the user operation of iRMX-NET R3.0, which is particularly useful for users wishing to use an iRMX-based system as a boot server.

- *PCL2 Software Developer's Manual*, order number 462311. This is a Programmers Reference manual for users wishing to write applications to the NETBIOS RRB Interfaces. This manual is shipped with the Developers Kit.
- *iNA 960 Release 3.0 Programmer's Reference Manual*, order number 462250. Describes how to implement the iNA 960 R3.0 networking software.
- *iNA 960 Release 3.0 Configuration and Installation Guide*, order number 462252. Describes how to configure and install the iNA 960 R3.0 networking software.
- *PCL2NIA Hardware Reference Manual*, order number 450772. This manual describes the hardware design and programming interface for the PCL2NIA.

In addition, for some operations described in this guide users should refer to the literature specific to their hardware or software; these cases are noted in this installation guide.

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Introduction 1

Introduction

The PCL2 Release 3.0 Software for DOS is a software product from Intel for use with an IBM Personal Computer (or 100-percent compatible) and Intel's PCL2 Network Interface Adapter (NIA). The PCL2 R3.0 software allows a personal computer to become part of Intel's OpenNET™ Local Area Network (LAN) by using support networking software such as IBM's PC LAN Program or Microsoft's MS-NET.

OpenNET networks provide a high level of interoperability between diverse operating systems such as DOS, iRMX®, iNDX, XENIX, UNIX and VAX/VMS operating systems. The OpenNET network family incorporates a set of system and component level LAN products that implement the lower four layers (Physical, Data Link, Network and Transport Layers) of the ISO (International Standards Organization) OSI (Open Systems Interconnection) Model and the protocols on which they are based.

The major new features in release 3.0 of the PCL2 software are the support for an industry standard Session Layer Interface (NETBIOS), support for Diskless Workstations, performance improvements, and a set of user-friendly utilities for installation and administration.

The Developer's Kit Version of this software also includes user-friendly learning tools, network application debugger, a utility for rapid prototyping of NETBIOS-based applications, and sample programs.

PCL2 R3.0 Architecture

The PCL2 R3.0 software, in conjunction with the PCL2NIA, performs all the network communication functions for the first five layers of the ISO/OSI model shown in Figure 1-1. The remaining layers (six and seven) are implemented with either the MS-NET or the IBM PC LAN program executing on the personal computer.

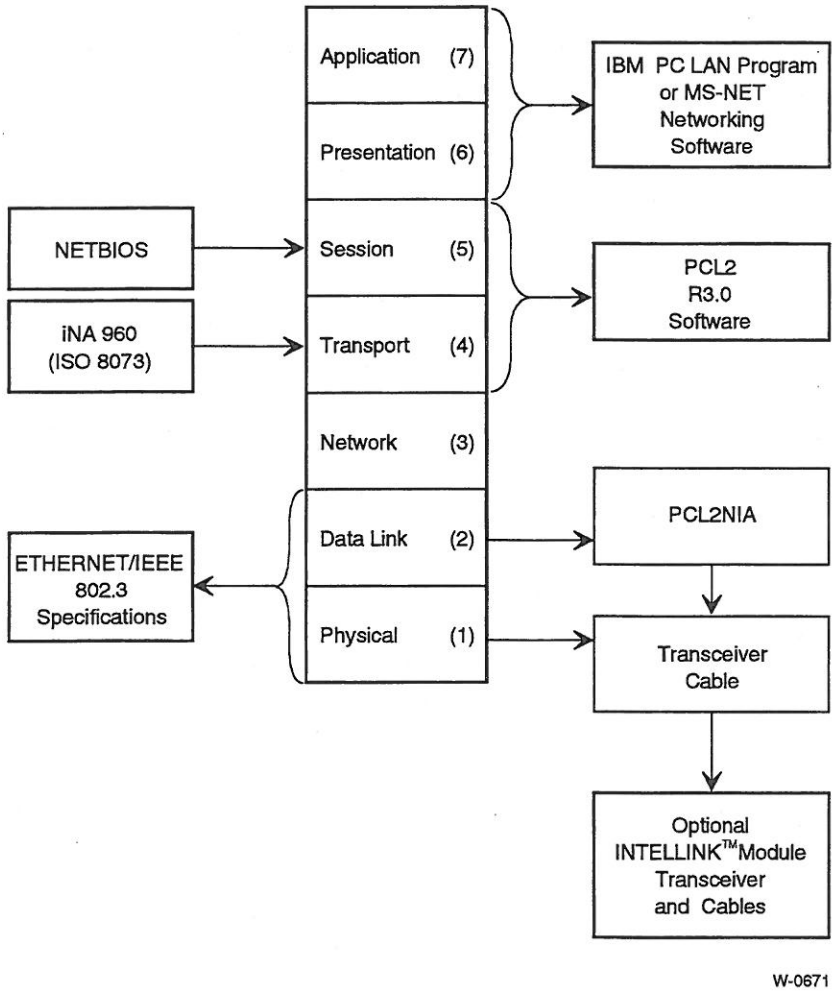

Figure 1-1. ISO/OSI Model

The Physical Layer (layer 1) describes the actual physical media over which the bit stream is transmitted. This layer is implemented using Ethernet cabling.

The Data Link Layer (layer 2) describes the rules of transmission and transfers units of information from one node to another. This layer is implemented with the PCL2NIA.

The Network Layer (layer 3) switches and routes information while the Transport Layer (layer 4) ensures end-to-end message integrity. These layers are implemented by iNA 960 and PCL2 R3.0 software.

The Session Layer (layer 5) is implemented in conformance with the NETBIOS Interface specified by IBM. The NETBIOS Interface also provides dynamic naming capabilities through the use of the ISO 8602 Datagram Services.

The Presentation Layer (layer 6) provides code conversion and data reformatting.

The Application Layer (layer 7) selects appropriate service for applications. These layers are implemented by the PCL2 R3.0 software using either the MS-NET or IBM PC LAN program.

Software Overview

The information in the following paragraphs will give a better understanding of the new features and usage of the PCL2 R3.0 Software.

PCL2 R3.0 in conjunction with MS-NET or the IBM PC LAN program provides a set of features that allows personal computers to interoperate with other systems on the OpenNET Local Area Network. The features of PCL2 R3.0 Software are:

- **Support for a complete NETBIOS interface as specified by IBM.**

  The NETBIOS interface is a recognized industry standard for networking personal computers.

- **Support for ISO/OSI Standard Transport and Network Layer implemented through iNA 960 R3.0.**

  In addition to supporting an industry standard interface at the Session layer (NETBIOS), PCL2 R3.0 software also provides ISO 8073 class 4 Transport Services and ISO ES/IS Network Layer support. The Session Services provided map all NETBIOS requests to equivalent ISO Transport requests. This guarantees that the network software can interoperate with other systems implementing the ISO/OSI protocol stack.

- **Support for dynamic name resolution on the network.**

  PCL2 R3.0 software provides a way for the user to find and communicate with other personal computers using network names. With this dynamic name resolution feature, the need for prior knowledge of network addresses is eliminated.

- **Support for popular network software such as IBM's PC LAN Program and Microsoft's MS-NET.**

  PCL2 R3.0 software implements a complete NETBIOS interface giving the flexibility to run industry standard networking software such as Microsoft's MS-NET and IBM's PC LAN Program. This interface also supports network applications written for the NETBIOS Interface.

- **Support for diskless workstations.**

  PCL2 R3.0 Software provides a complete set of software utilities to set up remote boot service for personal computers which have no physical fixed drive.

- **Menu-based installation and administrative utilities.**

  PCL2 R3.0 software includes both a menu-driven installation utility for installing the PCL2 R3.0 software and a menu-driven administrative utility to configure and manage the personal computers connected to the Local Area Network (LAN).

- **A complete set of development and debug utilities for purchasers of the PCL2 R3.0 Software Developer's Kit.**

  The Developer's Kit version of the PCL2 R3.0 software is primarily for original equipment manufacturers and value-added resalers who will be developing applications or systems-level software for the PCL2 R3.0.

  Included in the Developer's Kit are tools such as NETDEBUG, a pop-down Network Application Debugger; LEARN, a user-friendly program to help programmers learn the NETBIOS interface; and NETLANG, a prototyper allowing the developer rapid generation of NETBIOS test suites or application programs without writing any code.

Concepts and Terminology

This section explains some terminology and concepts which must be understood before using the PCL2 R3.0 software. This information will give a better understanding of all the new features and usage provided by the PCL2 R3.0 software. The terms introduced here are used throughout this installation guide and most are explained in greater detail in later chapters.

Concepts

The PCL2 R3.0 software provides an Ethernet/IEEE 802.3 connection between the personal computer and the OpenNET network. With PCL2 R3.0 software, a personal computer can be configured as either a server or a consumer and can share files between different systems on the OpenNET network such as iRMX, XENIX, UNIX, VAX/VMS, iNDX operating systems and R1.0 and R2.0 of PCL2.

Data and resource sharing is implemented by transparent remote file access, which allows the user to work with files residing on other systems attached to the network just as if the files were residing locally on the PC.

Terminology

The following terms are used throughout this guide and should be understood by the reader before attempting to configure a personal computer based networking system.

Server

A server is a computer that stores network resources such as directories and files. The server must have one or more fixed disk drives. This type of computer is called a "server" because it serves other computers on the network when they request file and/or printer services. A dedicated server (MS-NET) cannot perform other operations while acting as a server node. A non-dedicated (PC-LAN) server can serve remote nodes in the "background" while running a DOS application simultaneously in the "foreground". There can be a number of servers on the network, each servicing a group of computers as shown in Figure 1-2.

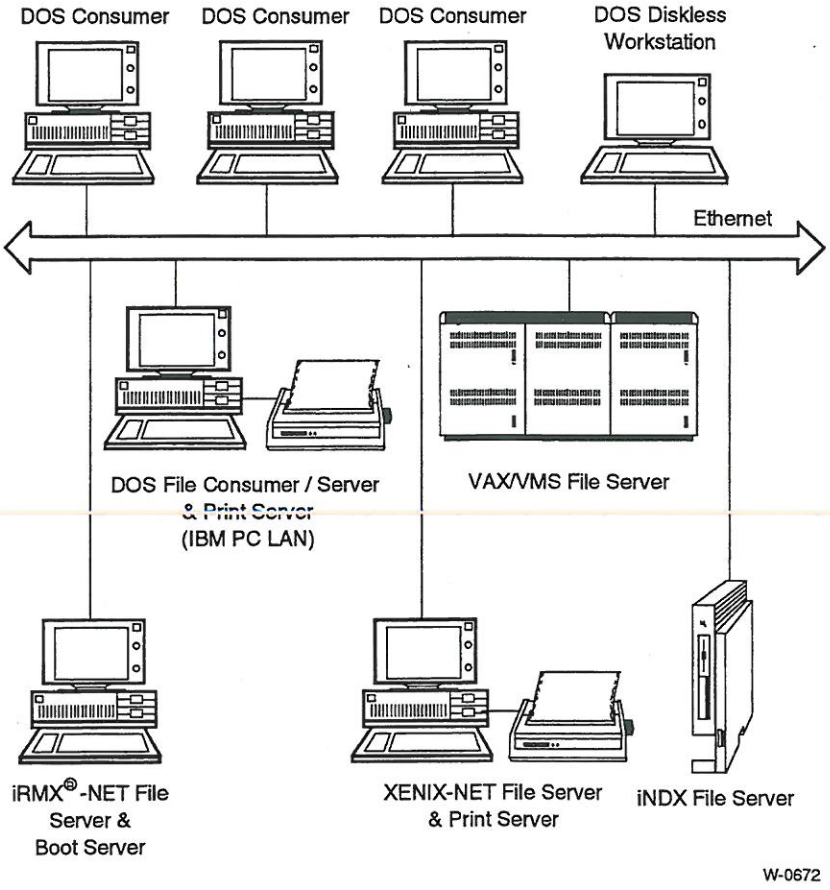

Figure 1-2. OpenNET™ Network With Servers and Consumers

Consumer

Computers connected to a server are called consumers. A consumer can access files and programs on the server's fixed disk and print files on a server's printer(s). This means that a number of consumers can share files and printers from a single server. Consumers also operate independent of the network.

Boot Server

A boot server is a computer storing communication software and files and serves other computers on the network when those computers request downloading of communication software. A boot server is different from a file server in that it does not share its files and directories with other systems on the network. The boot server is typically used for serving requests from diskless workstations. Only iRMX based systems can be configured as a boot server. Systems with iRMX-NET R3.0 or higher can be configured as both file servers and boot servers.

Diskless Workstation

A diskless workstation is a personal computer without a fixed disk drive. It may have one, two or no diskette drive(s). A typical diskless workstation has a PCL2NIA, which downloads its communication software from a boot server and its DOS image from a file server on the OpenNET network (refer to Figure 1-3). The PCL2NIA acts as the "disk controller" and makes the personal computer "think" that a fixed disk is attached to the system. A diskless workstation can only be a consumer on the network.

Images

Diskless workstations use the concept of images for loading the Disk Operating System. Images are exact duplicates of the DOS System Diskettes and are stored as files on the file servers. They act as the DOS System Diskettes for diskless workstations.

Image Diskettes

The diskettes from which images are created are called Image Diskettes. These are DOS System Diskettes. They may also have other applications stored on them.

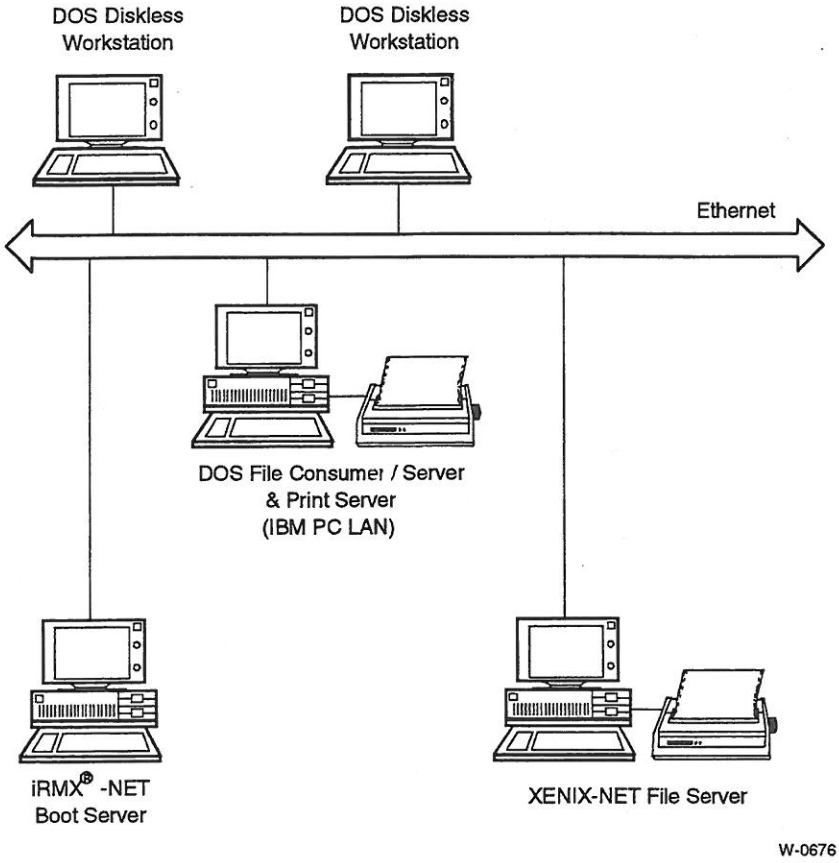

Figure 1-3. OpenNET™ Network Showing Diskless Workstation as a Consumer

Virtual Drive

The PCL2 R3.0 software, in conjunction with the MS-NET or IBM PC LAN program, uses the concept of virtual drives. When a network connection is made between a consumer and a server, the software creates a virtual drive which does not physically exist, but performs exactly like a personal computer's fixed disk drive. The user treats this as any other drive on the personal computer. A maximum number of twenty-six virtual drives (A: through Z:) can be assigned by the user and connected to different directories at the various file servers.

Dynamic Name Resolution

The dynamic name resolution scheme allows users to log into the network from any machine on the network using any system name. When a user logs on, the node name is sent on the network to determine if any other node is already using the same name. If there is no one else using this name on the network, then this new name is added. If there is a node on the network using the same name, an error is indicated requesting the user to use another name. This feature allows systems on a network to be known by any name the user chooses. This eliminates the need for a network address (NETADDR) file for nodes supporting PCL2 R3.0. Figure 1-4 shows typical dynamic name resolution nodes interconnected.

File-Based Name Resolution

The File-Based Name Resolution scheme is the opposite of the Dynamic Name Resolution scheme in that users access systems on the network using predetermined system names, which are stored in a file (NETADDR in PCL2 releases 1.0 and 2.0; net/data in XENIX-NET). The file contains names and addresses of systems (file servers) the user wants to communicate with. This scheme makes it necessary to modify the file (NETADDR in PCL2 or net/data in XENIX-NET) every time a new file server is added to the network.

Spokesman

In the OpenNET environment there are some nodes which use file-based name resolution exclusively; XENIX, iNDX, VAX/VMS operating systems, and personal computers with R1.0 and R2.0 of PCL2, for example, cannot respond to queries sent by systems supporting dynamic name resolution. To allow the dynamic name resolution systems to access file-based systems, a spokesman node is created. A spokesman has all the names and addresses of the file-based nodes in its network address file. Once the names are added to the file, the spokesman will respond to the requests from dynamic name resolution systems.

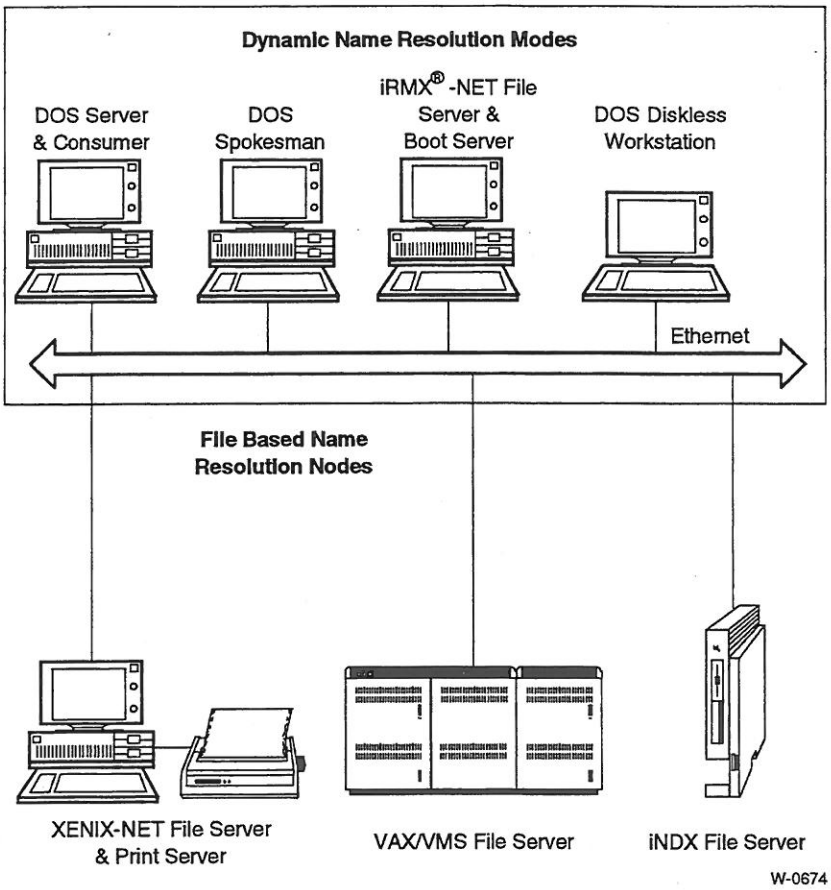

Figure 1-4. OpenNET™ Network Showing Dynamic Name Resolution Nodes

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Software Installation 2

Introduction

This chapter presents the information necessary to install PCL2 Release 3.0 Software for DOS. The installation is accomplished using a menu-driven install utility called INSTALL.EXE. This program automatically creates the necessary directories and installs the software.

The procedure for installation of the networking software is different for MS-NET or IBM PC LAN. In either case, the PCL2 R3.0 software MUST be installed first.

If an error is encountered, the install utility displays an appropriate error message on the screen. A list of error messages and corrective action information is provided in Appendix A.

Invoking the Install Utility

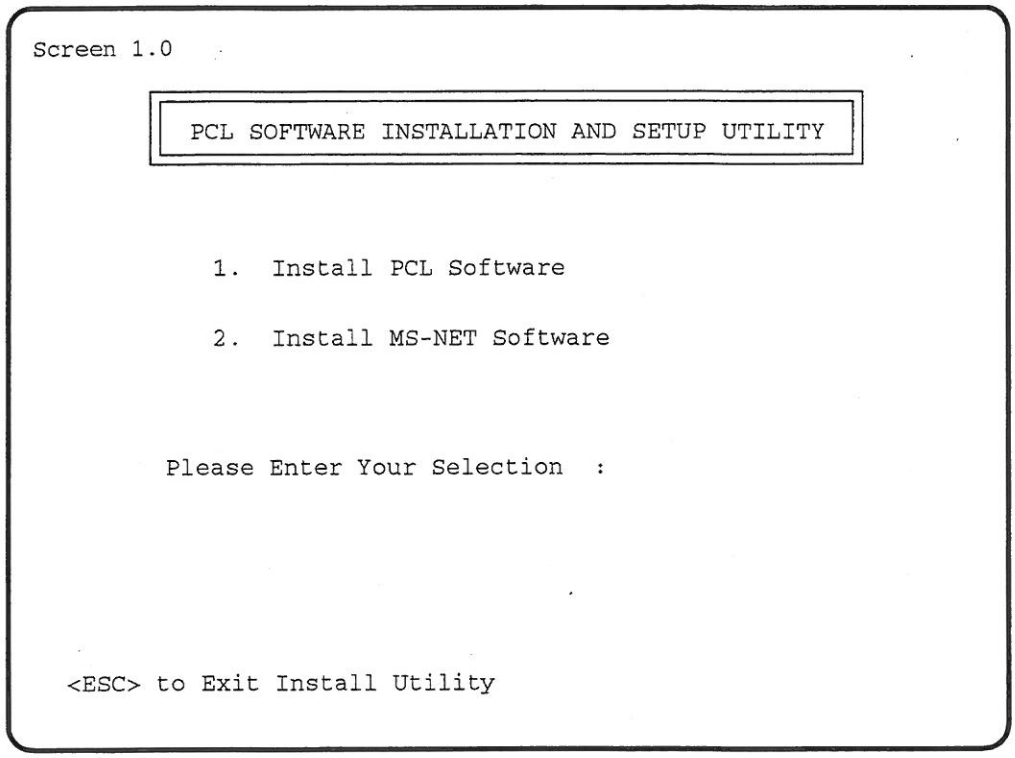
To invoke the install utility, insert the diskette labeled PCL2 R3.0 Installation Diskette (Disk 1) in drive A: and enter the following:-

```
A:INSTALL<Enter>
```

A screen similar to the one shown in Figure 2-1 appears.

During installation, use the arrow keys or the enter key to move between fields. If a mistake is made, use the arrow, backspace, or delete keys to correct the mistake.

The installation can be aborted at any time by pressing the <Esc> key.



W-2235

Figure 2-1. PCL2 R3.0 Software Install Utility, Initial Screen Display

Installing PCL2 R3.0

A screen similar to the one shown in Figure 2-1 displays two options. To install PCL2 R3.0 software, select option "1" and press the <Enter> key. A screen similar to the one shown in Figure 2-2 appears, prompting for more information.

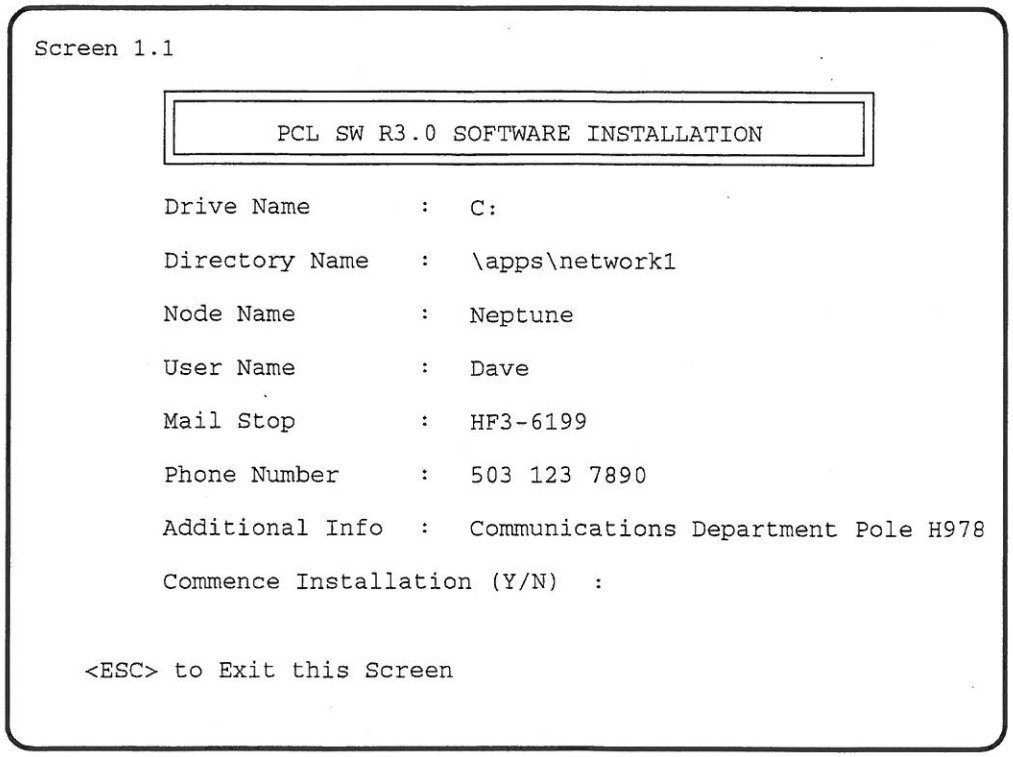


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Figure 2-2. PCL2 R3.0 Software Install Utility, Node and User Information Input Screen

In the first field, enter the letter designation for the drive on which the PCL2 R3.0 software is to be installed.

In the second field, enter the name of the directory under which the PCL2 R3.0 software is to be installed.

The remaining fields (name of the node, name of the user, mail stop, phone number, and additional information) physically locate a personal computer for network management and troubleshooting purposes.

In the third field, enter the name of the node where the PCL2 R3.0 software is being installed. It is recommended that the node name be consistent with the name used by the networking software (i.e., the name used in NET START RDR **<node name>** should be used in this field). The remaining fields are to be filled with user/node specific information.

As the PCL2 R3.0 software installation progresses, follow the screen prompts to insert the next diskette as identified on the screen.

When the installation of the PCL2 R3.0 software is complete, the initial screen (Figure 2-1) again appears to display the install options.

Install the networking software next. If MS-NET is being used, continue on to the next section. If IBM PC LAN is being used, then exit from the install utility by pressing the <Esc> key and refer to the IBM PC LAN Program User's Guide for installation instructions. After completing this installation, refer to Chapter 3 for instructions to configure the personal computer to automatically start the PCL2 R3.0 software when it is turned on.

Installing MS-NET Software

To install the MS-NET software, select option "2" and press the <Enter> key. A screen similar to the one shown in Figure 2-3 appears, prompting for additional information.

The first field is the drive name and the second field is the directory name. If installing the MS-NET software immediately after installing the PCL2 R3.0 software, the drive and directory names displayed on the screen are the same as entered during the PCL2 R3.0 software installation. Make sure that the MS-NET software is installed in the same directory as the PCL2 R3.0 software.

After installing both the PCL2 R3.0 and MS-NET software packages, the user could configure the system such that the software connecting the personal computer to the network is automatically started every time the personal computer is turned on. Continue on to Chapter 3 to accomplish this.

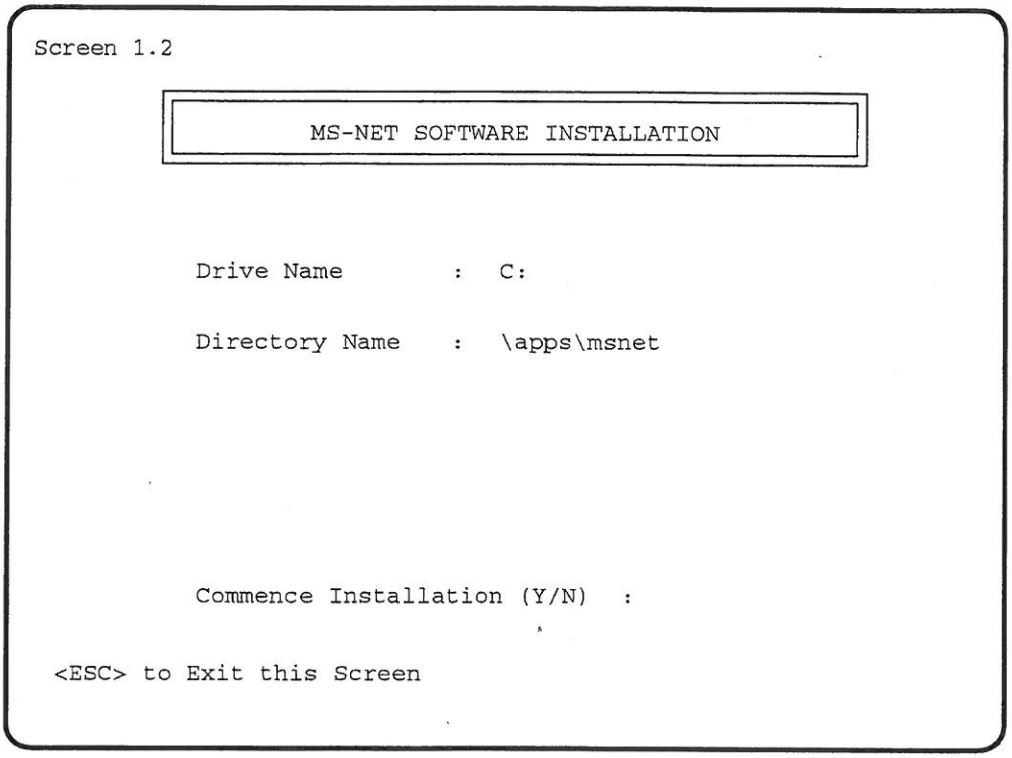

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Figure 2-3. Install Utility Screen for MS-NET Software

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Starting the Software 3

Introduction

This chapter contains instructions for starting the PCL2 R3.0 Software and using the NETBIOS command to establish the personal computer on the network.

Instructions are given to start either the MS-NET or the IBM PC LAN Program.

This chapter also contains information about network environments, which require a Spokesman and how to configure a personal computer as a Spokesman.

The NETBIOS Command

The NETBIOS command executes diagnostic tests on the PCL2 Network Interface Adapter (NIA) installed in the personal computer. These tests ensure the PCL2NIA is functioning correctly. The NETBIOS command then loads the communication software and the host driver. The various configuration parameters required for loading are obtained from the CONFIG.NIA file.

The CONFIG.NIA file, created during installation, contains default values for the PCL2NIA configuration parameters. For most user's, the default parameters are correct. Refer to Table 5-1 for a list of default values. If these parameters need to be modified, refer to Chapter 5 for information on the administrative utility (ADMIN.EXE).

If error codes are displayed during the execution of the NETBIOS command, refer to Appendix A for a description of the error codes and corrective action. The NETBIOS command error codes range from 000 through 099.

NETBIOS Command Example

The following example illustrates the use of the NETBIOS command. This procedure is performed by the user after the PCL2 R3.0 and MS-NET or IBM PC LAN networking software are installed.

The path to the CONFIG.NIA file must be specified as a parameter to the NETBIOS command only if this file does not exist in the present working directory. The format for the NETBIOS command is:

```
NETBIOS [Drive:\path\CONFIG.NIA]
```

Where:

`path` points to the directory where the CONFIG.NIA file is located.

Screen Display While NETBIOS Executes

A screen similar to the one shown in Figure 3-1 is displayed line-by-line while the NETBIOS command is executing and identifies the DOS version number, the NIA type, and the adapter Ethernet address.

```
C:\PCLR3> NETBIOS <CR>

DOS 3.3Ø PCL SW R3.Ø NETBIOS/ISO Transport Driver V1.2
(C) Copyright Intel Corporation 1986,87,88,89,9Ø

Primary Adapter Detected ..........................

Executing Primary Adapter Diagnostics ........ Successful

Adapter Ethernet Address ......................... ØØ ZZ ØØ Ø2 21 1Ø

Local Node Information Added.

C:\PCLR3>
```

Figure 3-1. NETBIOS Command Execution, Screen Result

Preparing for Automatic Program Start-Up

To automatically start the network software each time the personal computer is powered up, add the NETBIOS command and networking software commands to the AUTOEXEC.BAT file.

The procedures to follow assume some familiarity with the terms and files used. New users unfamiliar with these terms and files should refer to the *PCL2 LAN Controller User's Guide* for MS-NET commands or the *IBM PC LAN Program User's Guide* for IBM PC LAN commands.

The following procedure adds commands to the AUTOEXEC.BAT file so the personal computer is automatically established on the network each time the personal computer is turned on.

Because the AUTOEXEC.BAT file executes in exact sequence, place the NETBIOS command first so it will be executed **BEFORE** the specific networking programs.

1. If it doesn't already exist, create a file named AUTOEXEC.BAT in the DOS root directory.

2. Using a text editor, add the PATH command to the AUTOEXEC.BAT file so DOS can find the NETBIOS command. For example, the PATH command would be:

   ```
   PATH = c:\pclr3;\DOS
   ```

   If a PATH command already exists, insert the following at the BEGINNING of the PATH command:

   ```
   \pclr3;<Enter>
   ```

   For example, if the current PATH command is:

   ```
   PATH = c:\DOS;\SYSTEM;\WP
   ```

   then, the modified PATH command would be:

   ```
   PATH = c:\pclr3;\DOS;\SYSTEM;\WP
   ```

For users of IBM PC LAN, refer to the section titled Automatic Start-Up on IBM PC LAN to complete the file editing. Users of MS-NET will continue at the following paragraph.

Automatic Start-Up on MS-NET

3. Save the modified AUTOEXEC.BAT file.

4. Incorporate the following change to the MSNET.INI file so that the NETBIOS command automatically executes before the MS-NET software.

   Using the text editor, edit the MSNET.INI file to replace every occurrence of the XPORT command line with NETBIOS and every occurrence of the SESSION command line with MINSES.

   ```
   NETBIOS \pclr3\CONFIG.NIA
   MINSES
   ```

   The MSNET.INI file may contain more than one reference to each of the two commands (XPORT and SESSION). The first one invokes the Redirector (NET START RDR $1) and the second one invokes the Server (NET START SRV $1).

5. Save the changed MSNET.INI file.

Once these changes have been made, every invocation of the Redirector or Server installs the NETBIOS interface and drivers.

For example, to install the NETBIOS interface and invoke the Redirector or Server with the network name of "system" before loading the MS-NET software, enter the following commands:

```
NET START RDR <node name><Enter> or
NET START SRV <node name><Enter>
```

Refer to the *PCL2NIA Users' Guide* for more information on the various MS-NET commands (NET START, NET USE, etc.).

Automatic Start-Up on IBM PC LAN

3. Insert the NETBIOS command with the correct path to the CONFIG.NIA file:

   ```
   NETBIOS c:\pclr3\CONFIG.NIA
   ```

   This step guarantees the PCL2 R3.0 NETBIOS interface will be invoked each time the system is powered up.

4. Add the IBM PC LAN program invocation sequence to the AUTOEXEC.BAT file after the NETBIOS command line. For example, enter the following command:

   ```
   [NET START [SRV|RDR|MSG] NODE NAME] [cmd option]<Enter>
   ```

Refer to the IBM PC LAN Program User's Guide for the various configuration parameters.

5. Save the changed AUTOEXEC.BAT file.

The Spokesman System

PCL2 R3.0 software supports dynamic name resolution in which the users need not know the addresses of systems to communicate with them. The user specifies a node name and the software will find that name on the network.

However, file-based name resolution nodes such as XENIX, UNIX, iNDX, VAX/VMS operating systems and R1.0 and R2.0 of PCL2 do not support the dynamic name resolution feature and systems that do support dynamic name resolution like an iRMX-NET operating system do not support the PCL2 R3.0 software Dynamic Name Resolution protocol. To permit dynamic name resolution nodes to find the addresses of these nodes just as if they were dynamic nodes, a Spokesman is needed.

A Spokesman system is a PCL2 R3.0 node having the names and addresses of the file-based nodes added to the NETADDR file for that network. Once these names are added, the Spokesman responds to name queries for these nodes with their equivalent addresses. A maximum of 96 nodes can be added to a Spokesman system.

The Spokesman can continue being used as a network consumer or server node. The Spokesman function is transparent to the user and does not affect personal computer performance. For example, the network administrator's personal computer can act as a Spokesman without degrading system performance.

A number of Spokesmen can be on the network. The only restriction is that the same network names cannot be loaded onto more than one Spokesman. Once a Spokesman loads a set of file-based names, they become unique to the network and the dynamic name server prevents any other system from adding the same name (dynamic or file-based).

When adding file-based names, it is important to follow a particular naming convention. This helps in keeping the names unique and also helps in easily identifying systems. For example consider the following names:

APPS_XENIX_SRV
MKTG_XENIX_SRV
ENGG_VMS_SRV
ENGG_INDX_SRV

The node names in this NETADDR file indicate the department with the first four letters, followed by the system type, and ending with the node's function.

Setting Up a Spokesman Node

The following steps outline the configuration of a Spokesman node.

1. The network administrator lists all the file-based nodes on the network, along with their addresses. As an option, the administrator could take an existing PCL2 Release 1.0 NETADDR file or a XENIX net/data file and convert it to PCL2 R3.0 format using the ADMIN.EXE utility as described in Chapter 5.
2. The NETADDR file for the addresses must be placed in the directory where the PCL2 R3.0 Software is installed. **This is very important** because the NETBIOS command looks in that directory to find the file for loading the Spokesman.

The network administrator should be responsible for maintaining the NETADDR file on the Spokesman, updating it whenever a new file-based system is added to the network. The administrator should also provide all the users on the network with a list of the names contained in the Spokesman.

Nodes can be added to or deleted from the Spokesman System. Refer to Chapter 5 for more information on managing the Spokesman System.

The Spokesman Facility

Invoking PCL2 R3.0 V1.2 software does not invoke the Spokesman facility at a node when the node is brought up. To activate the spokesman, the user should use the LOADNAME.EXE utility to add nodes found in the NETADDR file.

The Backup Spokesman Capability

If a node gets added to the network by a PCL2 R3.0 V1.0 node, others cannot add the same name. Users can now backup their Spokesman by adding nodes using LOADNAME.EXE on both of them (using the /b switch). The Backup Spokesman will only load a name if the address matches the address associated with the already existing name.

Locating Spokesman Systems

The Locate utility can be used to find the Ethernet address and additional information of any node (Release 3.0) in the network. This can also be used to find the Name, Ethernet address and Additional information for the Spokesman Node of any Release 1.0 OpenNET Node.

In addition, the Name and Additional Information of a Release 3.0 node may be obtained if the Ethernet Address of the node is known by using the /a option.

Without any command line parameters, the Locate utility locates all nodes found in the NETADDR file. To locate node names listed in a file other than NETADDR, specify the name of the file on the command line using the /f option. A file containing a list of names or addresses (one name or address per line, each line ended with a semi-colon) can be used in place of the NETADDR file.

The Locate utility ignores any line in the NETADDR file that begins with a '#' character. The format for the Locate command is:

```
LOCATE [/f:\pathname\netaddr | node1 node2 .. |/a address1 address2..]
```

File Name (All Nodes present in this file will be Located)	OR Specific Node Names to be Located	OR Specific Node Address to be Located (R3.0 DOS and iRMX Nodes)

Examples

1. Program will prompt the user for a Node Name.

   ```
   LOCATE
   ```

2. User specifies Node Names.

   ```
   LOCATE <node_name1><node_name2>
   ```

3. User specifies a file.

   ```
   LOCATE /f:c:\pclinkr3\netaddr.old
   ```

4. Program will prompt the user for a Node Address.

   ```
   LOCATE /a
   ```

5. User specifies Node Address.

   ```
   LOCATE /a <node_address1><node_address2>
   ```

6. User specifies a file.

   ```
   LOCATE /a/f:c:\pclinkr3\netaddr.old
   ```

Loadname Utility

The Loadname utility can be used to add nodes to the spokesman. One or more nodes may be specified on the command line to be added to the spokesman.

Without any command line parameters the Loadname utility loads all names found in the NETADDR file. To load node names listed in a file other than NETADDR, specify the name of the file on the command line using the /f option.

The Loadname utility ignores any line in the NETADDR file that begins with a "#" character. The format for the Loadname command is:

```
LOADNAME [/f:\pathname\netaddr] [node1][node2] [/b]...
```

Option '/b' will bring this node up as a Backup Spokesman. That is, this node adds nodes even if they are already found in the network provided the existing address matches the one in the NETADDR file.

Delname Utility

The Delname utility can be used to delete nodes from the spokesman. One or more nodes may be specified on the command line to be deleted. Delname does not modify the NETADDR file.

Without any command line parameters the Delname utility deletes spokesman entries for all names found in the NETADDR file. To delete spokesman entries of node names listed in a file other than NETADDR, specify the name of the file on the command line using the /f option.

The Delname utility ignores any line in the NETADDR file that begins with a '#' character. The format is as follows:

```
DELNAME [/f:\path\netaddr] [node1][node2]...
```

***

Configure and Start a Diskless Workstation 4

Introduction

A Diskless Workstation is a personal computer without a fixed disk or a personal computer with its fixed disk disabled. A diskless workstation has no available local mass storage device and relies on other personal computers (boot and file servers) on the network to supply it with programs and files.

The diskless workstation feature is available only with PCL2 R3.0 Software running on firmware version 3.0 or higher on the PCL2 Network Interface Adapter (NIA). A diskless workstation may be configured with one, two, or no floppy drives.

Support for diskless workstations involves configuration of boot servers, file servers, and the workstation. This chapter contains instructions for configuring both servers that will support the diskless workstation and instructions for configuring the workstation personal computer and PCL2NIA.

Diskless Workstation and the Network

Typically, a personal computer with a fixed disk loads the DOS operating system automatically from the fixed disk on power up. On personal computers without a fixed disk, DOS is loaded on power up from a system diskette placed in drive A:.

When a diskless workstation is powered up, the firmware on the PCL2NIA completes the onboard diagnostics and then sends requests to the network boot server for downloading the control program that will run on the workstation's memory. The control program then requests the network boot server to download the communications software onto the PCL2NIA. This control program also sets up the workstation to boot from the network instead of a fixed disk or system diskette. It uses communications software on the PCL2NIA to download DOS from a network file server. The interaction between the diskless workstation and the network is not apparent to the user since the program operations remain unchanged.

If a diskless workstation has a floppy drive installed and a DOS system diskette is in the drive when powered up, then the operating system will load from the diskette instead of from the network.

The boot and file server may be two distinct OpenNET systems or they could be the same system, as in the case of a system with the iRMX-NET networking software shown in Figure 4-1.

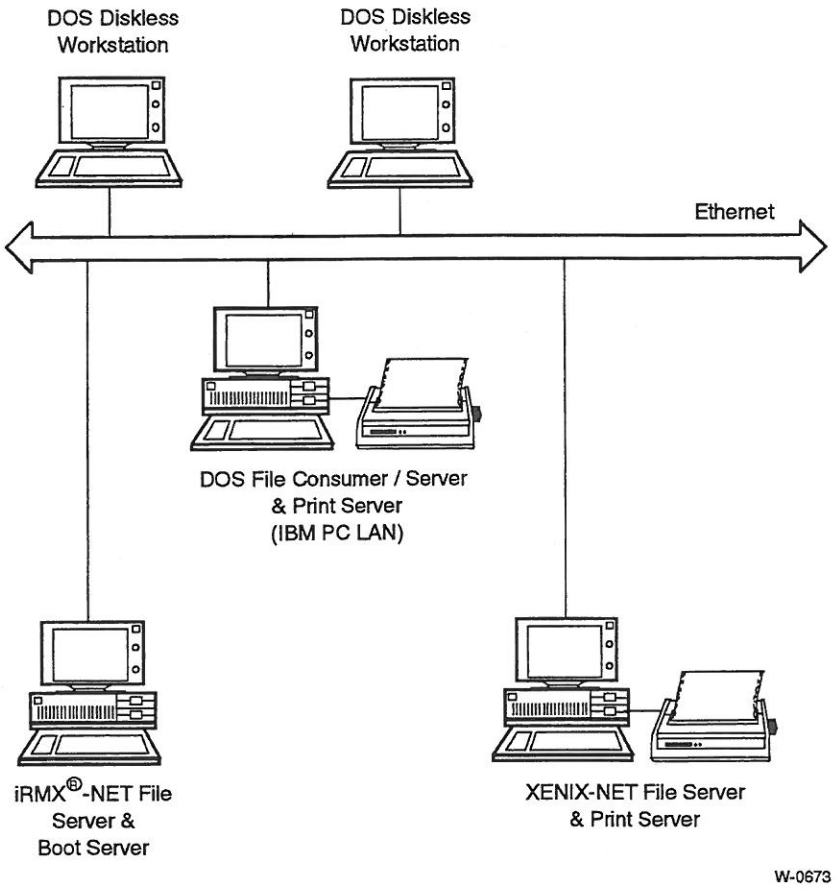


Figure 4-1. Diskless Workstations, Typical Network Configuration

The diskless workstation uses the concept of images for loading the DOS operating system. An image file, an exact duplicate of that workstation's system diskette, is stored on a file server. The image is created from the DOS system diskette and stored in a special format using the MKIMAGE.EXE utility. The image generated contains all the information and files present on the original diskette.

The diskless workstation control program downloaded from the boot server receives all drive A: requests and translates them into equivalent network requests to the image stored in the file server as if it were drive A:. In this way, the diskless workstation's computer is made to believe that a system diskette is physically present in drive A:.

Configuring the Boot Server

The boot server is a facility offered by iNA 960 (Release 3.0 or higher) for supporting diskless workstations in iRMX- or DOS-based operating systems. The boot server software runs on an iRMX System 120, 310, 320, or 520 and is normally shipped with the iRMX-NET R3.0 (or later) networking software. This guide assumes that the System 120, 320, or 520 is already configured as a functional boot server.

The network administrator should be familiar with the required setup of the iRMX boot server, therefore this guide will not discuss the iRMX boot server setup and configuration. For more information, refer to the *iNA 960 Release 3.0 Installation and Configuration Guide* or the *iRMX®-NET Installation and Configuration Guide.*

Because the boot service is the hub of all diskless workstation activity, its configuration and setup is the first step in preparing the network to support diskless workstations. There can be several boot servers on the network, each servicing a segment of the users.

Diskless Workstation Support Programs

The PCL2 Release 3.0 software includes an iRMX-formatted disk containing two files for supporting load requests from the diskless workstations. These two files, RB_DOS.MEM and INAR30.MEM, are the two programs downloaded by the boot server to the diskless workstation at power up. These files must be copied to the boot server to support the load requests from the diskless workstations.

RB_DOS.MEM is the diskless workstation control program and is downloaded first. This control program sets up the diskless workstation to receive its DOS operating system from the network instead of a fixed disk or system diskette. INAR30.MEM is the iNA 961 (the preconfigured derivative of the iNA 960) communications software for the NIA.

The boot server downloads files based on class codes it receives from the diskless workstations. The DOS diskless workstations based on PCL2NIA always use class code 2001 for the control program (RB_DOS.MEM) and class code 2000 for the iNA 961 communications software (INAR30.MEM).

It is important that these class codes be reserved for this diskless workstation application only. If the class codes are used for any other application, unpredictable results may be obtained, such as the wrong files being downloaded to the diskless workstation.

Boot Server Configuration Files

The boot server uses a file called CCINFO (Class Code Info) to determine the appropriate file to download when it receives a class code. The CCINFO file maps the class code to the file being downloaded. The CCINFO file is created by the BOCOL utility shipped with the boot server software. BOCOL uses a standard text file CCINFO.BDF (Boot Definition File) containing all the class codes and their respective files for input and generates the CCINFO file used by the boot server.

A sample CCINFO.BDF file is shown below:

```
3000 IS /RBOOT/MBIINA.33; File for   Class Code 3000

3001 IS /RBOOT/TESTOS.01; File for   Class Code 3001
6000 IS /RBOOT/INA961.33; File for   Class Code 6000
```

The network administrator needs to enter into the CCINFO.BDF file the two class codes for the diskless workstation and the corresponding load file.

For more information on boot server set up and BOCOL refer to *The iNA 960 R3.0 Installation and Configuration Guide* or the *iRMX®-NET R3.0 Installation and Configuration Guide.*

Boot Server Configuration and Setup

The following steps detail the procedure required to set up and configure the boot server for supporting PCL2-based diskless workstations:

1. Log onto the iRMX based boot server system as "SUPER".
2. Create a directory /rboot and make it the current directory with the following commands:

```
CREATEDIR  /RBOOT<Enter>
ATTACHFILE  /RBOOT<Enter>
```

3. Take the iRMX Remote Boot Load Files diskette supplied in the PC link2 R3.0 software package and insert it in the diskette drive. "Attach" to diskette drive using the logical device ":F:" with the following command:

```
ATTACHDEVICE WMFDXØ AS :F:<Enter>
```

   The device wmfdx0 may be different on some systems (such as wmfx0 or wmf0).

4. Copy the files from the /rboot directory on the diskette to the /rboot directory on the fixed disk using the following command:

```
COPY :F:/RBOOT/*  to /RBOOT<Enter>
```

5. Detach the diskette drive with the following command:

```
DETACHDEVICE :F:<Enter>
```

6. Change the current directory to the directory the boot server uses to find its CCINFO file. In release 3.0 of iRMX-NET and iNA 960 the default is set to /NET (it is a configuration option):

```
ATTACHFILE  /NET<Enter>
```

   Sometimes a network administrator may choose to use a name other than CCINFO.BDF. Check to see if any other file is used to generate the CCINFO file.

7. Edit the CCINFO.BDF file (or equivalent file) by adding the following two lines to the end of the file:

```
2ØØØ  IS /RBOOT/INAR3Ø.MEM<Enter>
2ØØ1  IS /RBOOT/RB_DOS.MEM<Enter>
```

8. Use the BOCOL utility on the system to update the CCINFO file. If any errors occur, refer to the documentation describing BOCOL in the *iNA 960 Release 3.0 Installation and Configuration Guide* or the *iRMX-NET R3.0 Installation Guide*.

9. When the update of the files is complete, shut down and reboot the boot server. The changes made to support the diskless workstation requests will be registered in the boot server.

10. Remove the iRMX Remote Boot Load Files diskette from drive A: and store it is a safe place.

This completes the configuration of the boot server. Repeat this procedure for each boot server on the network which must support diskless workstation requests.

Configuring the Hardware for the Diskless Workstation

The next step in the setup for diskless workstations is the configuration of the personal computer hardware by the user. This includes configuring the PCL2NIA and disabling the fixed drive(s), if desired. Support for the diskless workstation is only provided in Release 3.0 of the PCL2NIA firmware. To determine the firmware version, check the EPROMs at locations U2 and U10. The numbers on the EPROMs must be 458877-001 and 458877-002 or greater. Any number less than the one mentioned will not support the diskless workstation feature.

Configuring the PCL2NIA

Changing one jumper on the PCL2NIA configures it as a diskless workstation. The Initial Program Load Source (IPL SOURCE) jumper option must be set to the NETWORK position rather than the LOCAL position. The procedure for accomplishing this is provided below. Also refer to the instructions in the *PCL2NIA Hardware Installation Guide*, if needed.

1. If the personal computer does not already have an PCL2NIA installed, refer to the *PCL2NIA Hardware Installation Guide* to perform the configuration and installation.

2. Move the jumper so it connects E7 to E8; this selects the NETWORK as the IPL SOURCE. Make sure no jumper exists between E8 and E9. Also make sure that the Base Port Address is set to 360H and the Interrupt Level for the PCL2NIA is set to 2 (IRQ2).

3. Connect the transceiver cable between the PCL2NIA and the network. (The network administrator can help with this connection.)

4. It is very important that the fixed disk drive(s) on the personal computer be disabled. The diskless workstation software will not function if the personal computer has an operable hard disk.

If the personal computer does not have a fixed disk, skip to paragraph 4.5. If the personal computer has a fixed disk and is either an IBM PC/XT, a PS/2 Model 25, PS/2 Model 30, an Intel 301, or 302 then refer to the appropriate technical manual for instructions about how to disable the drive.

Disabling the Fixed Disk on a PC AT

To disable the fixed disk on an IBM PC AT, perform the following procedure:

1. Place the diskette labeled "IBM PC AT Advanced Diagnostics Diskette" in drive A: and turn on the personal computer. The IBM Personal Computer Hardware Reference Library *Guide to Operations* contains this diskette and describes its usage.
2. Choose SETUP (option 4) from the screen menu displayed.
3. A screen displaying Time and Date settings appears. Skip by pressing the <Enter> key.
4. A menu showing options appears. Indicate the options are not correct by entering "N".
5. A screen of diskette drive option settings appears. Skip by pressing the <Enter> key in response to the prompts.
6. A screen then displays the types of fixed disks. Write down the types of fixed disks listed and keep for reference if ever the workstation needs reconversion to a fixed disk system. Enter "N" to change the fixed disk options. When the system requests the number of fixed disks, enter "0".
7. The screen display shows no fixed disk drives installed.

   ```
   Fixed Disk Drive C -- Not Installed
   Fixed Disk Drive D -- Not Installed
   ```

   To confirm, enter "Y".
8. Confirm each of the remaining options by entering "Y". The personal computer system then restarts.
9. Remove the diskette from drive A:. The personal computer is now a diskless workstation.

When there is no longer any need to load from the network, the fixed disk must be re-enabled. For PC AT systems, follow the procedure above until step 6. In step 6, enter the appropriate number of fixed disks and their types as referenced from the written list set aside. To re-enable the fixed disk on personal computers other than PC AT and compatibles, refer to the appropriate technical manual for instructions.

Defining the Software for the Diskless Workstation

All the needed changes to the hardware have now been made. Next, the user must define the software for the diskless workstation. This is very important as this definition will determine the environment and support software the diskless workstation will have when applications are loaded.

A Diskless Workstation User Worksheet (an example is provided in Figure 4-2), is used to identify the software requirements of the workstation. The network administrator uses the information entered on this worksheet to create an image file for the workstation on the file server. All the software specified in the worksheet is included in the image file.

Typical software requirements are the DOS operating system, networking software, utilities and application programs (accounting, mail, spreadsheet, etc.). Because the image is an exact duplicate of a diskette, only two storage densities are supported, 360 and 1.2 Mbytes. If the user requires several application programs, it is best to create a 1.2 Mbyte image. A user may have more than one image file, but only one image file may be specified each time the workstation is started. If there is not enough room on the image file to contain all the files needed by the user, the network administrator can place those files on the file server.

Some of the information in the worksheet will need to be discussed with the network administrator. Generally, the worksheet is completed as follows:

1. Name: Name of user.
2. Mail Stop: Internal company address of user, if any.
3. Phone: Phone number of user.
4. Username: Login ID of user.
5. Password: Password of user (optional).
6. File server name: The name of the file server holding image file.
7. Image name: The name of the image file.
8. DOS ver: The version of DOS required for the image.
9. Image size: The size required for the image file. For example, if the software is on a 1.2-Mbyte diskette, enter 1.2Mbytes for the image size.

DISKLESS WORKSTATION USER WORKSHEET

NAME: _____

MAIL STOP: _____

PHONE NUMBER: _____

USER NAME: _____

PASSWORD (OPTIONAL): _____

FILE SERVER NAME: _____

IMAGE NAME: _____

DOS VER: ___ 3.1 ___ 3.2 ___ 3.3 ___ 4.0

IMAGE SIZE: ___ 360 KB ___ 1.2 MB

Write Protected: ___ Y ___ N

Networking SW: ___ IBM PC LAN ___ MS-NET

Other Applications:

_____

_____

_____

_____

_____

_____

Figure 4-2. Diskless Workstation User Worksheet

10. Write Protected: Indicate whether or not the image file should be write protected. Write protection prevents other users from changing the file.
11. Networking Software: The networking software, either MS-NET or IBM PC LAN, needed to run the workstation on the network.
12. Other applications: Enter the names of application programs needed.

The network administrator can now use the information on the worksheet to configure the diskless workstation.

Setting Up the File Server and Making Images

The final step in setting up the network support for diskless workstations is the creation of the image files and setting up the file servers to store the boot image files. The network administrator uses the completed Diskless Workstation User Worksheet to create customized images for each user and for setting up user accounts on the file servers.

Creating User Accounts on the File Server

The first step in the setup of the file server supporting diskless workstations is the creation of accounts for the diskless workstation users on the file server. This step is not required for any user who already has an account established on the file server. For more information on creating user accounts refer to the user's manual for the appropriate file server.

A default diskless workstation account is recommended. The default user name in the control program is DWUSER with a null password.

```
Default Diskless Workstation User Name: DWUSER<Enter>
Default Diskless Workstation Password: <null><Enter>
```

Creating Image Diskettes

Because images are exact duplicates of the DOS system diskette, they serve as the "system diskette" for diskless workstations. These images are created from system diskettes containing all the software the user requires in the image. As the first step

in creating the image, the network administrator must create a diskette with all the necessary software requested on the user worksheet. This diskette is called the Image Diskette.

DOS system diskettes are usually low-density (360) in storage capacity. If the diskless workstation supports high-density diskette drives, a high-density (1.2 Mbyte) diskette can be used as an image diskette.

In making each image diskette, use the information provided by the user on the worksheet to determine the necessary diskette density, write protection status, software and utilities.

Create the image diskette following these steps:

1. Format the low- or high-density diskette as a system diskette using the FORMAT command.

   For low-density diskettes being formatted on a personal computer with a low-density drive, use the following command:

   ```
   C:>FORMAT B:/S [/V]<Enter>
   ```

   Low-density diskettes can also be formatted on the high-density diskette drive using the following command:

   ```
   C:>FORMAT A:/S/4 [/V]<Enter>
   ```

   The volume label [/V] option is recommended to help the user identify the image when booted. With this option, a requestor will ask for the volume name at the completion of formatting.

   The image diskette, after being formatted, contains the DOS operating system.

2. The next step is the installation of all the software requested on the user worksheet. First, the image needs to have directories made to organize the software, utilities, and tools specified by the user. The following directory structure is an example:

   ```
   \
   \DOS3_20        ;DOS 3.2 Utilities
   \MSNET1.01      ;MS_NET Software
   \TOOLS          ;Misc tools required
   \ETC            ;User directories
   ```

   When copying the software to the image diskette, always use the procedures provided with the software. The software should be copied into the appropriate directories on the image diskette in the same way it would be installed if the diskette itself was used rather than a remote server.

3. Create an AUTOEXEC.BAT file on the image diskette. The AUTOEXEC.BAT file should contain at least the path to the various directories. Automatic startup of MS-NET or PC LAN program can also be included (refer to Chapter 3).

   If the diskless workstation will be using MS-NET for network access, copy a file called MSNET.DWS (Diskless Workstation Startup) to the MSNET.INI in the directory where the PCL2 R3.0 software has been installed. The MSNET.DWS file is provided on the PCL2 R3.0 Utilities Diskette.

   This is an AUTOEXEC.BAT file based on the example above:

```
PATH=A:\;A:\DOS3_20;A:\MSNET1.01;A:\TOOLS;
REM **** START THE NETWORK SOFTWARE ****
NET START RDR DWS
```

4. To install any drivers for devices or the screen, create a CONFIG.SYS file on the image diskette; for example; CONFIG.SYS may contain the following lines:

```
DEVICE = ANSI.SYS      ;ANSI TERMINAL DRIVER
LASTDRIVE = Z          ; # OF DRIVES IS 26
FILES = 51
BUFFERS = 48
BREAK ON
FCBS = 16,8
```

5. The creation of the image diskette is now complete. Check the user worksheet to make sure that the requested software is on the image diskette.

6. The image diskette should be tested. Because the image created from the diskette will be used to boot the operating system of the diskless workstation, the image diskette should be tested as the system diskette on a personal computer using the following verification process:

   - Insert the image diskette into diskette drive A: on a personal computer.
   - Turn on the power to the personal computer, or reset by pressing the <Ctrl> + <Alt> + <Del> keys at the same time.
   - The personal computer should load the DOS operating system from the image diskette.
   - When the operating system has loaded, verify the software by invoking each. If all the software can be verified, the image diskette is error free.

The image diskette is complete. From this image, the image file on the file server is created. A diskless workstation environment example is shown in Figure 4-3.

Creating Images from Image Diskettes

Images are created from the image diskette using the MKIMAGE utility provided with the PCL2 R3.0 software and stored in the file server. Each diskless workstation user should have at least one image.

In addition, the network administrator should provide a default image for users. This default image is the image associated with the default user name, DWUSER.

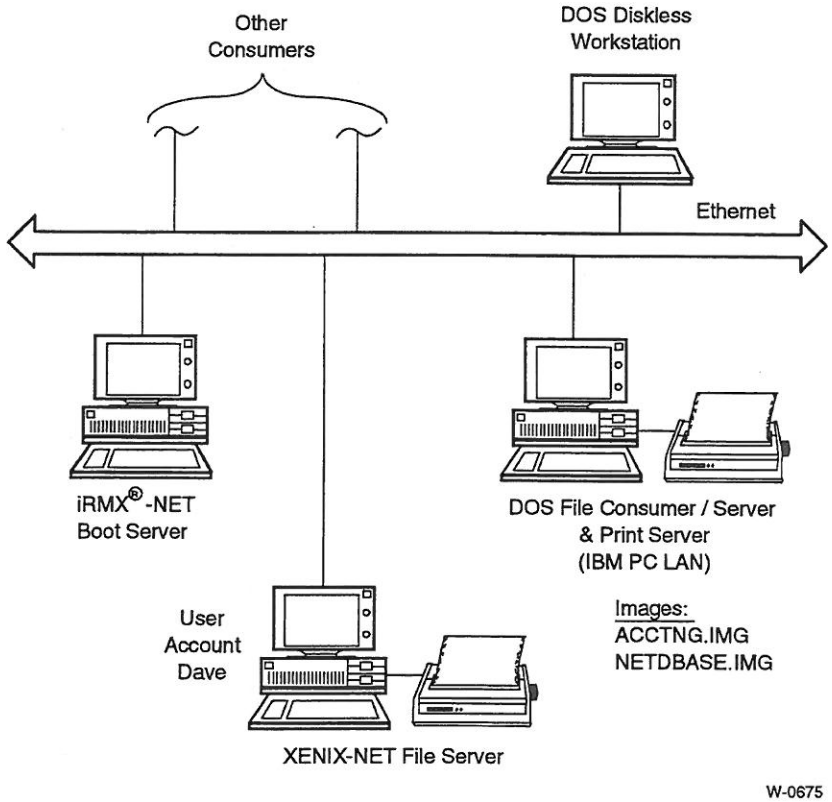


Figure 4-3. Diskless Workstation Example Environment

The Remote Boot Control Program uses a default image name called DOS.IMG and must be created by the network administrator. This image file should reside on the file server with the default diskless workstation user name account.

The size of the image corresponds to the storage capacity of the image diskette from which it is created. If the image diskette is high-density, the image created from it acts like a 1.2 Mbyte diskette. Likewise, a low-density image diskette results in an image which acts like a 360 kbyte diskette.

If the image diskette is write protected (i.e., it has a write protect tab on it), the image created from it is also write protected. Note that if the diskless workstation is started from a write protected image, the user is not able to write to the image. It is advisable to write protect any image diskette which multiple diskless workstations will be sharing.

Using the MKIMAGE Utility

The MKIMAGE utility creates image files from image diskettes and stores these files on the fixed disk drive of the file server. To create an image file with the MKIMAGE utility, follow the procedures below:

1. Choose a personal computer with a floppy drive and place the prepared image diskette in drive A:.
2. Connect to the file server which will serve the diskless workstation using the following command:

   ```
   NET USE device: \\file_server\username<Enter>
   [password]<Enter>
   ```

3. Execute the MKIMAGE utility with the following command:

   ```
   MKIMAGE device:Image1<Enter>
   ```

   Where:

   device is the destination for the image and it is most logically the drive name that is connected to the file server.

   The following message appears:

   ```
   Floppy Image Making Utility Version 1.00
   Copyright  1988, 89 Intel Corporation.

   Place the diskette in Drive A and press any key
   ```

Place the image diskette in drive A and press any key. The image file created is IMAGE1 with the default suffix of .IMG. If such a file already exists, the following message appears:

```
Overwrite existing File (Y/N)
```

Enter "Y" to overwrite the file. Enter "N" to keep the existing file. The user is requested to enter a different file name for the new file. The user is also prompted for a file name if no file name is specified in the command line.

If the image diskette is write protected and is of high-density, the following message then appears:

```
Verifying floppy type:  Read Only and High Density
Making the Image  ....  Complete
```

The message displays diskette type, write protection status, and diskette capacity. Then, the MKIMAGE utility reads the image diskette track by track to create the image file.

This procedure is repeated for making other image files.

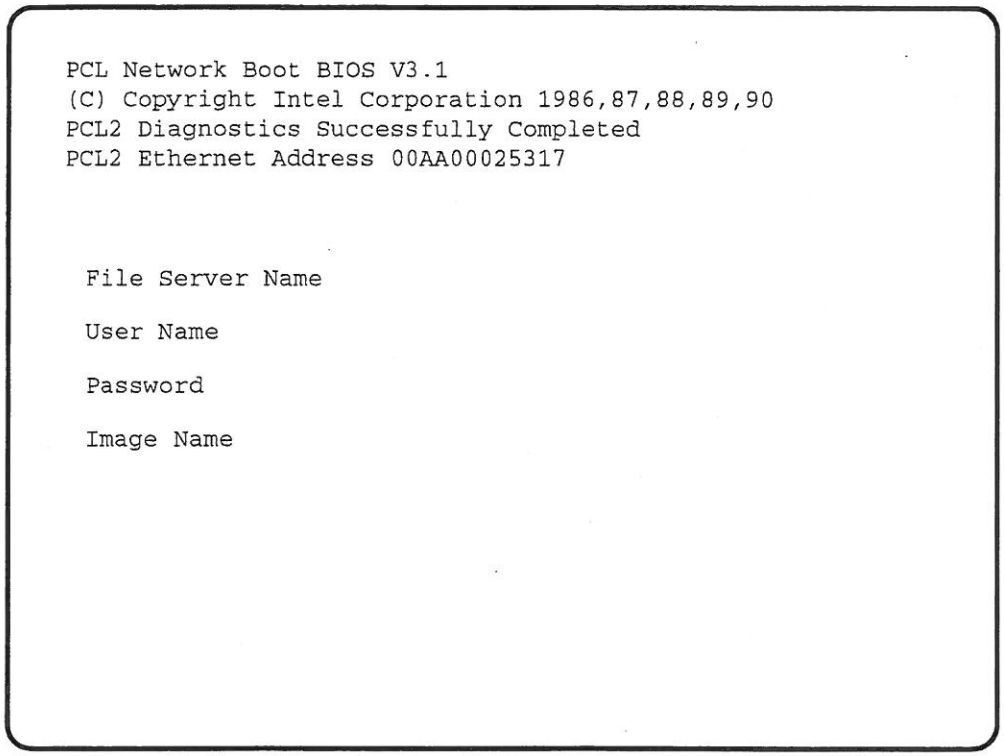
Starting the Diskless Workstation

Make sure the Drive A door is open and turn on the diskless workstation. The menu shown in Figure 4-4 appears on the screen.

Four fields are displayed on the screen: file server, user name, password, and image name. Each field is filled with a default value; these may not be correct for the user. Any key must be pressed within 20 seconds or the default values are used. Once any key is pressed, the system waits until the <Esc> key is pressed before attempting to load.

The default values for the various fields are:

```
File Server Name:  Intelboot<Enter>
User Name:  DWUser<Enter>
PASSWORD:  <NULL><Enter>
IMAGE NAME:   DOS.IMG<Enter>
```



W-2238

Figure 4-4. User Remote Boot Screen

To change a field, use the backspace key to erase, then type the new value. Move to the next field by pressing the <Enter> key. If the <Enter> key is pressed in the last field, the cursor moves to the first field. The password field displays "X's" to avoid showing the password on the screen.

Press the <Esc> key to start loading the system from the network.

During the loading process, if messages appear indicating the file server is down or any field information is invalid, edit the incorrect field(s) and try loading again. If messages indicate problems with the PCL2NIA, try resetting by pressing the <Alt> + <Ctrl> + <Del> keys at the same time or turning the power off, waiting at least 30 seconds, and then back on again.

After the workstation is started, it functions as if a DOS system diskette were in drive A:. If it is switched off and on again, or reset by pressing the <Alt> + <Ctrl> + <Del> keys, the screen shown in Figure 4-4 is redisplayed and the loading process must start again.

Example Setting of a Diskless Workstation Network Environment

The following example illustrates a typical network supporting diskless workstations. The network in Figure 4-5 includes a boot server, a variety of file servers performing particular network functions, and two diskless workstations.

On power up, the two diskless workstations receive the control and communications software from the iRMX-NET Boot Server (BOOTSRV1). When the initial download is complete, the users, Dave and Jane, are presented with the Remote Boot Screen requesting the username, password, file server and image names. Dave and Jane enter the necessary information into the fields, requesting their respective images.

In this example, both Dave and Jane have user accounts on the same file server (FILE_SERVER), their individual images DAVE_DOS.IMG and JANE_DOS.IMG residing there. The diskless workstations use these images to load their DOS operating systems and networking software.

When their diskless workstations are started, Dave and Jane might need to access other file servers and print servers on the network. They can do this using either MS-NET or IBM PC LAN.

Another variation of the network might be the consolidation of the boot server and file server on one system. A System 120, 320 or 520 using iRMX-NET R3.0 can be configured as both boot server and file server. This makes for simpler network administration of diskless workstations.

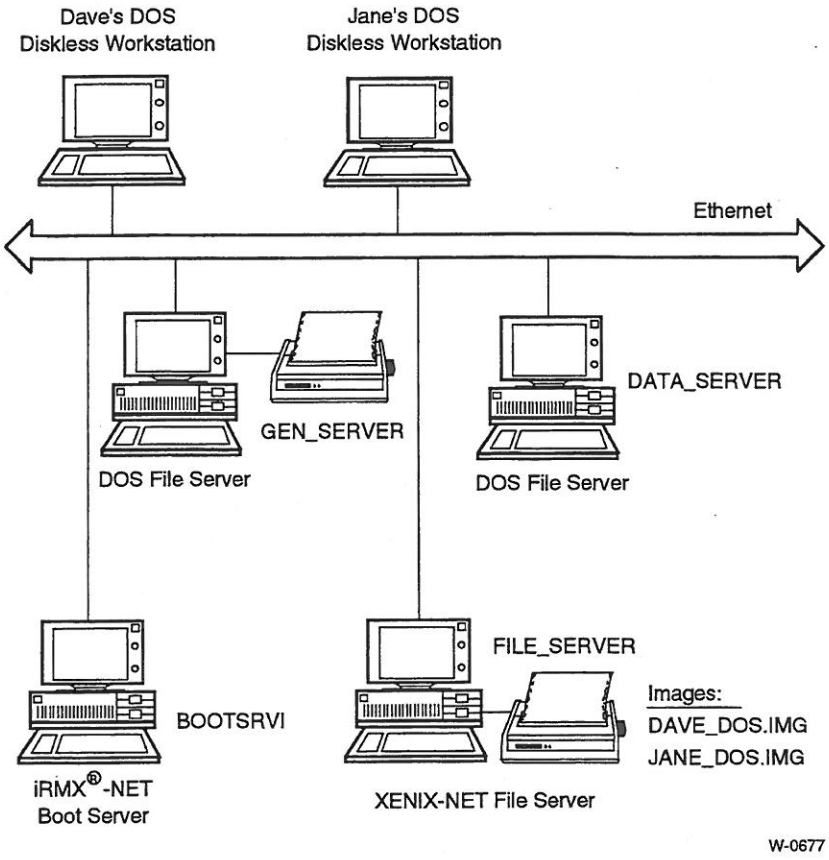


Figure 4-5. Example Configuration of Diskless Workstation Environment

***

System Administration 5

Introduction

This version of the PCL2 R3.0 Software includes an administrative utility that allows system administrators and users to manage and configure networked PCL2 based systems. The administrative utility can be used for reconfiguring the PCL2 parameters, for managing NETADDR files for spokesman systems, and for obtaining information on nodes on the network.

Administrative Utility (ADMIN.EXE)

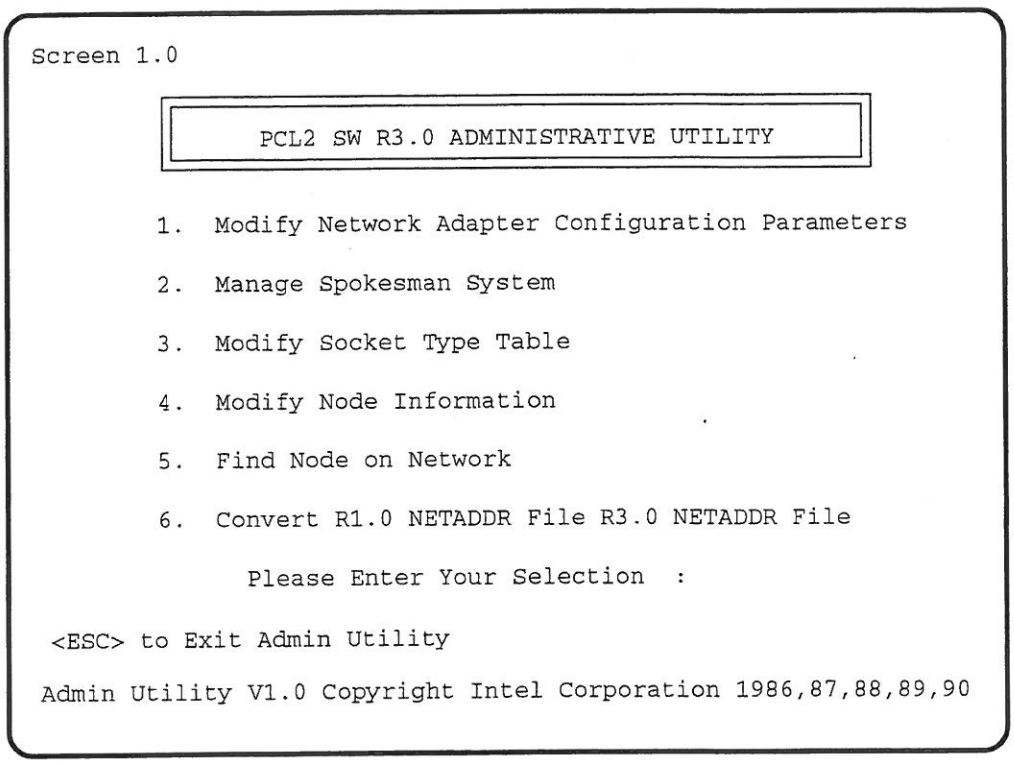
The administrative utility included with this release is called ADMIN.EXE and is used to:

- Modify the NIA configuration parameters stored in the configuration file CONFIG.NIA.
- Manage the NETADDR file for spokesman systems by allowing users to dynamically add, delete, and modify nodes and list all the nodes in the Spokesman System.
- Manage and modify the socket-type table. This is a feature that supports various NETBIOS based applications requiring communications with iRMX-NET based nodes.
- Modify the local node administrative information.
- Obtain administrative information about PCL2 R3.0 based personal computers connected to the network.
- Convert R1.0 based NETADDR files to R3.0 formats for spokesman systems. This feature supports users migrating from R1.0 to R3.0 of PCL2 R3.0 software.

To invoke the administrative utility, enter the following:

```
C:>ADMIN<Enter>
```

A screen similar to the one shown in Figure 5-1 appears displaying the various options available.



W-2239

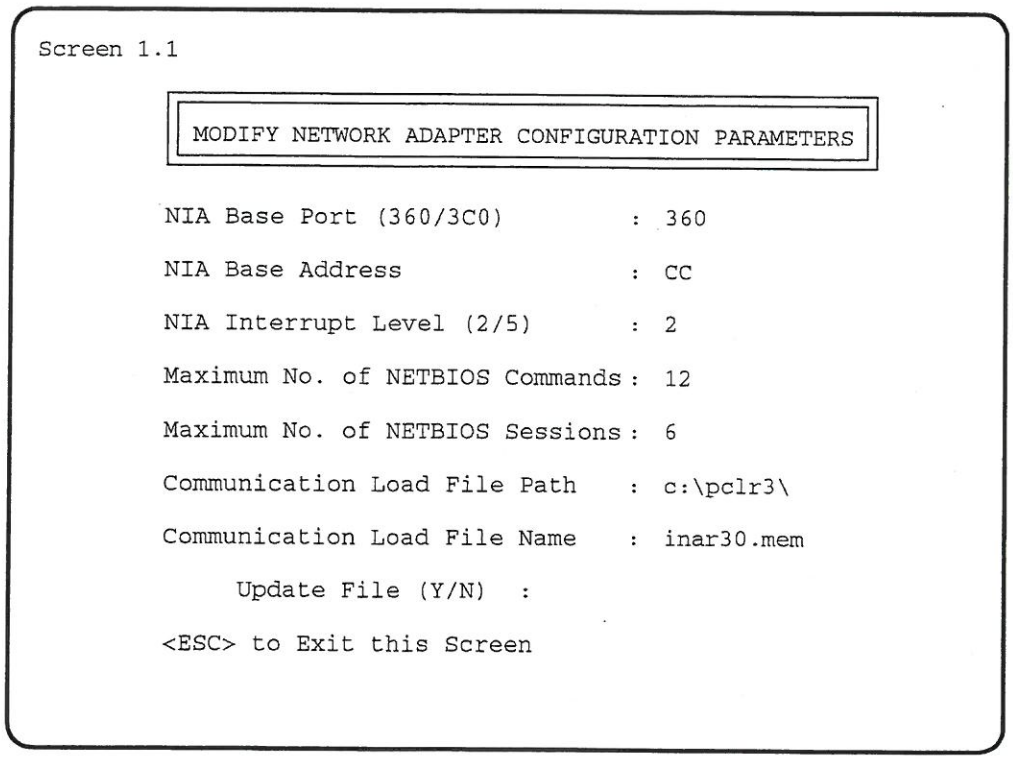
Figure 5-1. Administrative Utility, Main Screen

To move between fields, use the arrow keys, <Enter> key, <Tab> key, or the <Shift> key. To edit fields, use the <Backspace> key to delete the entries and then insert the new values.

The <Esc> key can be used to abort from the ADMIN utility.

Modify Network Adapter Parameters

To edit the hardware specific details of the NIA, select option "1" from the main screen shown in Figure 5-1. This option "1" displays the Modify Network Adapter Parameters screen similar to the one shown in Figure 5-2. The ADMIN utility, upon selection of this option, reads and displays all the parameters settings from the CONFIG.NIA file.



W-2240

Figure 5-2. Modify Network Interface Adapter Configuration

As mentioned earlier, the CONFIG.NIA is a configuration file used by the NETBIOS command for obtaining the various hardware and software parameters required for successful execution.

The default parameters shipped with the product works without any modifications in most personal computer systems.

Table 5-1 lists the default parameter values contained in the CONFIG.NIA file as shipped with the product.

Table 5-1. CONFIG.NIA File Parameter Default Values

Parameter List	Default	Alternate/ Maximum	Comment
Base Port Address	360H	3C0H	I/O Port used by the PCL2NIA.
Base Address	CC000H	Table 5-2	Start of Memory used by PCL2NIA.
Interrupt Level	2(IRQ2)	5(IRQ5)	Interrupt level used by the PCL2NIA
No. of NETBIOS Commands	12	32*	Maximum number of pending NETBIOS commands supported by the PCL2NIA
No. of NETBIOS Sessions	6	32*	Maximum number of NETBIOS sessions supported by the PCL2NIA
Communications Load File Pathname	\PCLR3\	N/A	Default Pathname for the communications load file
Communications Load File	INAPCL2.MEM	N/A	Default name for the communications load file. Use with PCL2 card.
	INAPCL2A.MEM	N/A	Use with PCL2A card.

* Indicates the maximum settings of the PCL2NIA.

The following paragraphs describe the various parameters in detail and also indicates the acceptable values.

NOTE

After making changes to any of the network adapter configuration parameters, re-initialize the PCL2NIA. Refer to Chapter 3 for NETBIOS command information used to re-configure the network adapter configuration parameters.

NIA Base Port: (Default: 360H Alternate: 3C0H)

The base port indicates the I/O port used by the PCL2NIA for communication with the personal computer. The default port is 360H and is the standard default port for many network adapters. If there is conflict with another controller board in the personal computer, use Port 3C0H as an alternate port for communication.

If a change to the I/O port setting is made, change the jumper setting on the PCL2NIA to reflect this change. Refer to the PCL2NIA Hardware Installation Guide on jumper locations.

NOTE

Port 3C0H cannot be used as an alternate port on personal computers that have an EGA (Enhanced Graphics Adapter) card installed in the system.

NIA Base Address (Default: CC000H ALTERNATE: See Table 5-2.)

The base address indicates the area in personal computer memory that the PCL2NIA uses for sending data between the NIA and the personal computer. This memory area is 8K bytes in size and is set by default to start at CC000H. CC000H is the default address used in all networking adapters and does not conflict with memory used by any other type of controller.

However, this default value can be changed to any one of the 31 different locations specified in Table 5-2. If a value other than CC000H is selected, ensure that the address selected does not conflict with memory used by any other controller in the personal computer. This information is available in the Hardware Installation Manuals (or equivalent) for that particular controller.

Enter only the first two letters corresponding to the appropriate base address location. For example, enter the following:

```
A2 for selecting A2000H<Enter>
D8 for selecting D8000H<Enter>
```

Table 5-2. Valid Base Addresses

XX	Base Addresses
A0	A0000H
A2	A2000H
A4	A4000H
A6	A6000H
A8	A8000H
AA	AA000H
AC	AC000H
AE	AE000H
B0	B0000H
B2	B2000H
B4	B4000H
B6	B6000H
B8	B8000H
BA	BA000H
BC	BC000H
BE	BE000H
C0	C0000H
C2	C2000H
C4	C4000H
C6	C6000H
CA	CA000H
CC	CC000H
CE	CE000H
D0	D0000H
D2	D2000H
D4	D4000H
D6	D6000H
D8	D8000H
DA	DA000H
DC	DC000H
DE	DE000H

NIA Interrupt Level: (Default: 2 Alternate 5)

PCL2NIA uses the NIA interrupt level to indicate communication with the personal computer. The default value is 2 (IRQ2); while the alternate setting is 5 (IRQ5). Network adapters use IRQ2 as the standard interrupt ensuring that no interrupt conflict with any other controllers in the personal computer will exist.

If a change to the interrupt level is required, make sure that the equivalent jumper change on the PCL2NIA occurs. Refer to the *PCL2NIA Hardware Installation Guide* on jumper locations for setting the Interrupt level.

To change this parameter, enter either 2 or 5.

Maximum number of NETBIOS Commands (Default: 12 Maximum: 32)

This parameter determines the maximum number of pending NETBIOS commands that the PCL2NIA supports. The default is 12 with a maximum set at 32.

The default setting of 12 is sufficient for most consumer/server workstations and may be increased for servers servicing a large number of users (>16). Setting the number of NETBIOS commands to 32 for a server with high usage is advisable.

Maximum Number of NETBIOS Sessions: (Default: 6 Maximum: 32)

This parameter determines the number of sessions that the PCL2NIA supports. Each session translates to a user of the server. For example, 16 sessions means that 16 users can use the server at any one time.

Communication Load File Pathname: (Default: \PCLR3\)

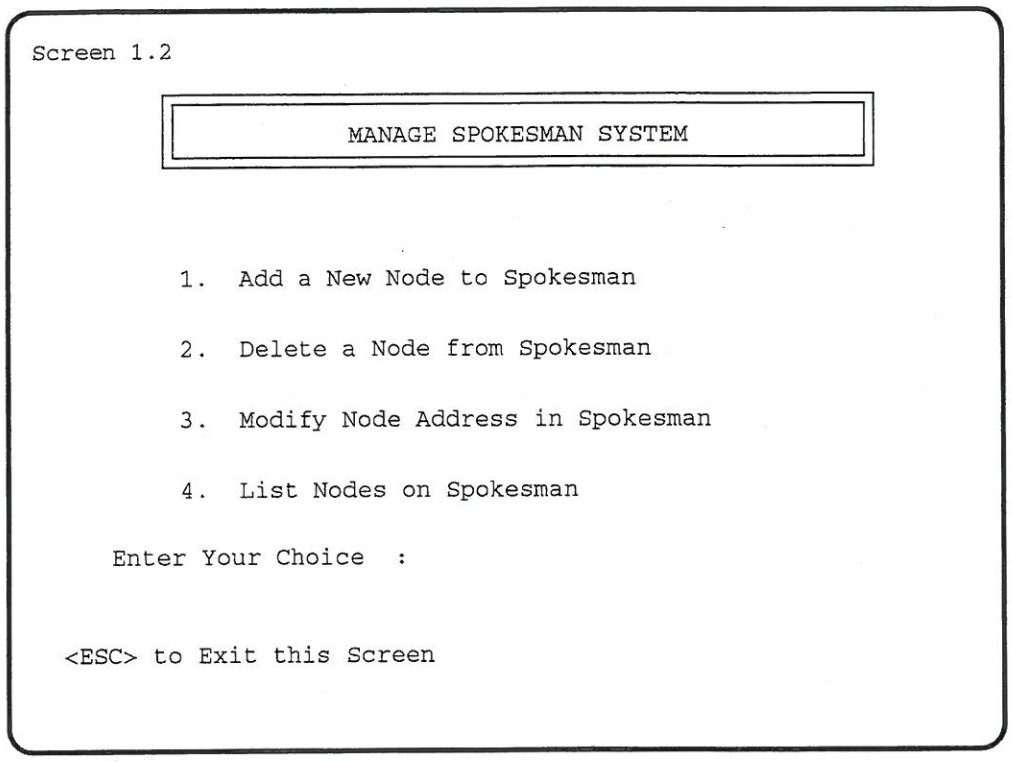
This parameter determines the pathname to the directory where the PCL2 R3.0 load files and utilities are located. This parameter is set at installation time when the user specifies the pathname for installing the software.

Communications Load File Name (INAPCL2.MEM / INAPCL2A.MEM)

This is the name of the communications load file (pre-configured iNA 961.) Use INAPCL2.MEM for PCL2NIA. Use INAPCL2A.MEM for PCL2ANIA.

Spokesman System Management

To allow the network or system administrator to manage the PCL2 R3.0 Spokesman, select option "2" from the main screen as shown in Figure 5-1; a screen similar to the one shown in Figure 5-3 appears. The Spokesman system contains all the names and addresses of the nodes that do not implement the dynamic name resolution scheme, such as XENIX, iNDX, VAX/VMS, UNIX operating systems, and R1.0 and R2.0 of PCL2.



W-2241

Figure 5-3. Modify Spokesman File

This option allows the administrator to dynamically add new nodes to the Spokesman, delete nodes from the Spokesman, modify information for a specific

node, and list all the nodes configured into the Spokesman. Changes to the Spokesman are automatically incorporated into the NETADDR file.

The number of nodes that a Spokesman can support is limited to 96 names. Any PCL2 R3.0 node can be a Spokesman and the Spokesman does not cause any overhead in performance.

Add A New Node To Spokesman

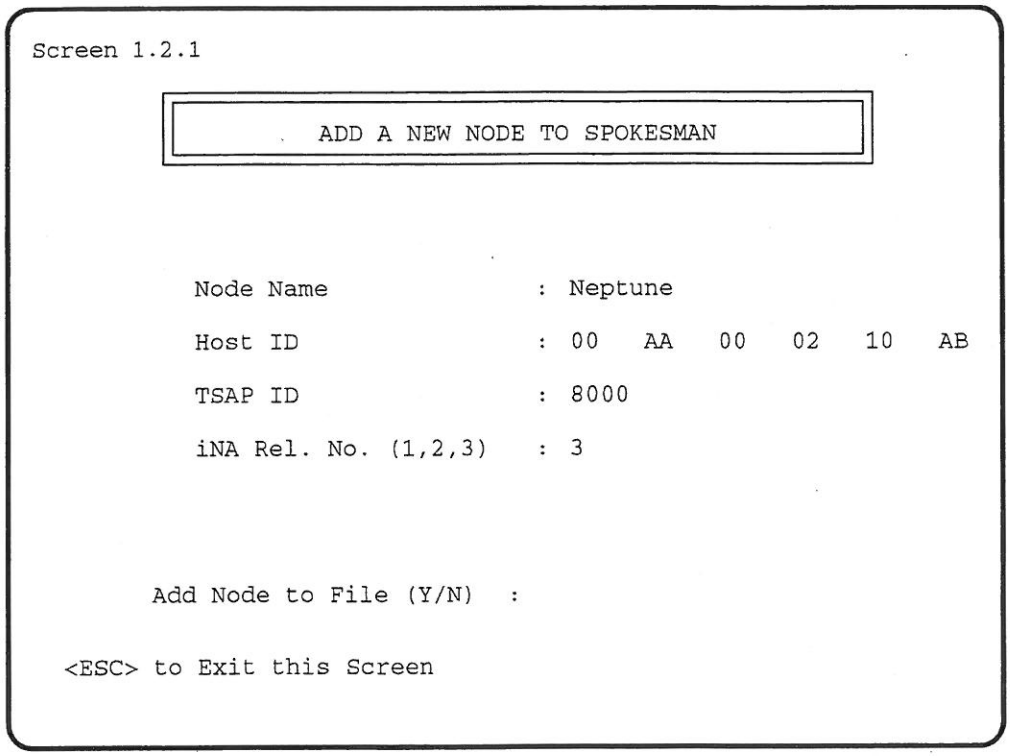
This option allows the administrator to add a new node to the Spokesman and also to the NETADDR file. To add a node to the Spokesman system, select option "1" from the Manage Spokesman screen. A screen similar to the one shown in Figure 5-4 appears. The screen requests the user to enter the name of the node to be added, its Ethernet address, and TSAP ID. The screen also requests the user to determine the type of node being added R1 (iNA 960 R1.0), R2 (iNA 960 R2.0), or R3 (iNA 960 R3.0).

Names should not be more than 15 bytes long and can be either upper case or lower case (all lower case letters are converted to upper case). Nodes for virtual terminal support must have the .VT extension.

TSAP ID (Transport Service Access Point) is an identifier at which a particular application waits. For example, the UNIXNET Virtual Terminal software will wait at TSAP ID 4000H. Table 5-3 lists the various TSAPs used by the different OpenNET products. Use this table to determine the TSAP ID for that particular node.

Table 5-3. OpenNET™ Products TSAP Addresses

Products	Address
XENIXNET	8000
UNIXNET	8000
iRMX®-NET	8000
iNDX	8000
VAX/VMS	8000
Virtual Terminal	4000
PCL2 R1.0 & R2.0	0001



W-2242

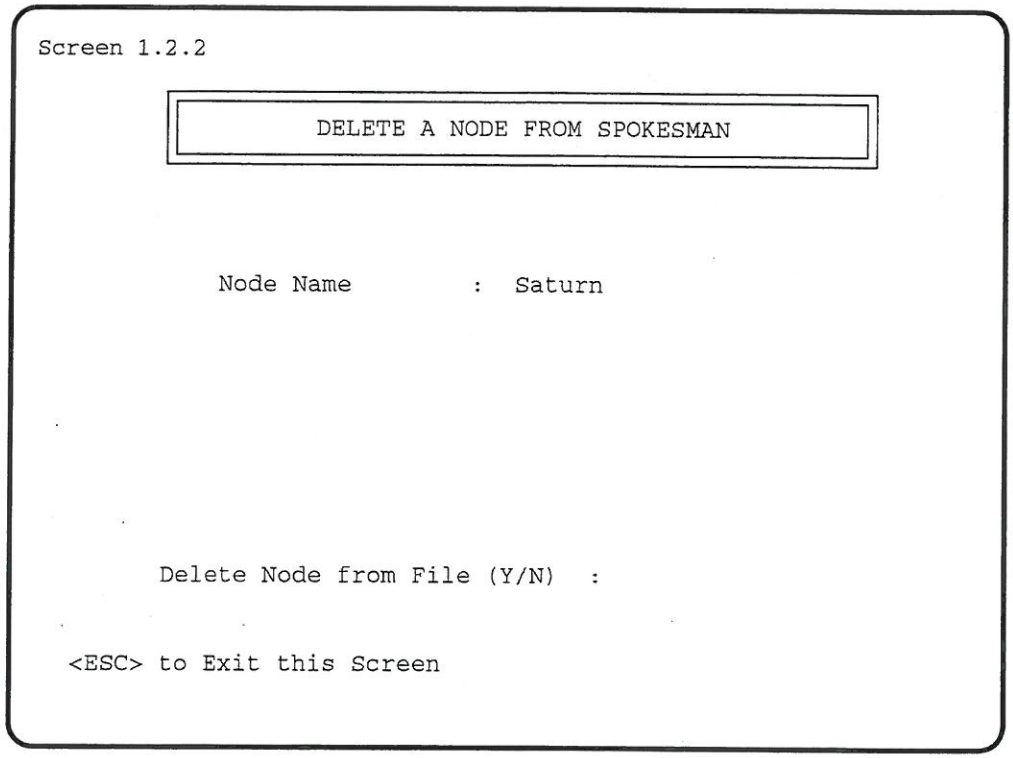
Figure 5-4. Add a New Spokesman Node, Initial Screen

Information on the release version of iNA 960 of the node being added is also required. The user should respond with 1, 2, or 3 depending on the version of iNA 960 for the node being added.

Once all the information is entered, move to the field update (Y/N) and respond with a "Y". This node gets added to the NETADDR file. The user is then prompted as to whether the new node is to be made accessible to the network through the Spokesman.

Delete a Node From A Spokesman

To delete a node from the Spokesman node, select option "2" from the Spokesman screen. A screen similar to the one shown in Figure 5-5 appears. This screen requests the name of the node to be deleted.



W-2243

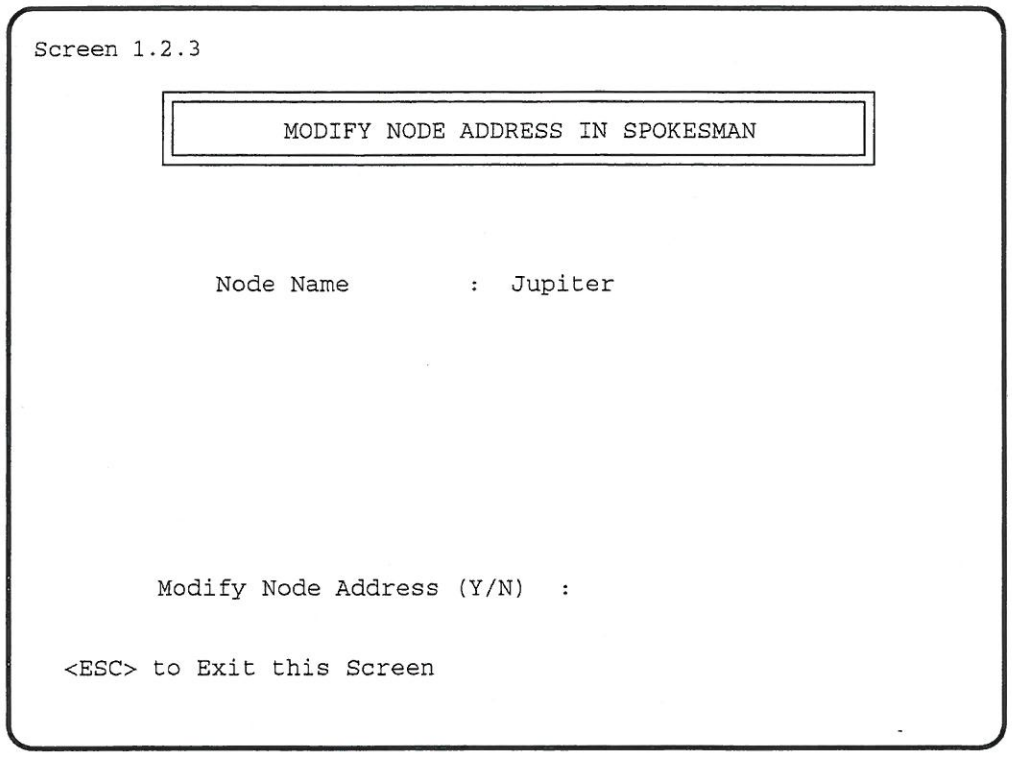
Figure 5-5. Delete a Spokesman Node

The node name entered is deleted from the NETADDR file by entering "Y" to "Update File (Y/N)". Responding with a "N" will not update the file and the same screen remains. The user is then prompted as to whether the node should be deleted from the Spokesman System immediately.

Press the <Esc> key to return to the previous screen.

Modify Node Address In Spokesman

To modify a node address select option "3" from the Spokesman screen similar to the one shown in Figure 5-3. A screen similar to the one shown in Figure 5-6 appears.



W-2244

Figure 5-6. Modify Spokesman Node Address

Enter the name of the node to be modified and enter any modifications to the old address.

To modify the node address in the NETADDR file, enter "Y" in response to "Update File (Y/N)". Responding with a "N" will not update the file and the same screen remains.

The user is then prompted as to whether this new node address is to be added to the Spokesman System immediately.

List Nodes On Spokesman

To see a list of all Spokesman nodes, select option "4" from the Modify Spokesman Screen similar to the one shown in Figure 5-3. A screen similar to the one shown in Figure 5-7 appears, listing all Spokesman nodes with their current addresses.

Modify Socket Table

This option is for systems or application programmers writing applications on the NETBIOS interface to communicate with other NETBIOS and iRMX-NET nodes.

Naming Conventions

The NETBIOS interface supports names with a length of 16 bytes. The applications have an option of either using all 16 bytes for the name, or using only 15 bytes for the name with the last byte used as an Application Identifier or socket. The advantages and disadvantages of both options are discussed in the following paragraphs.

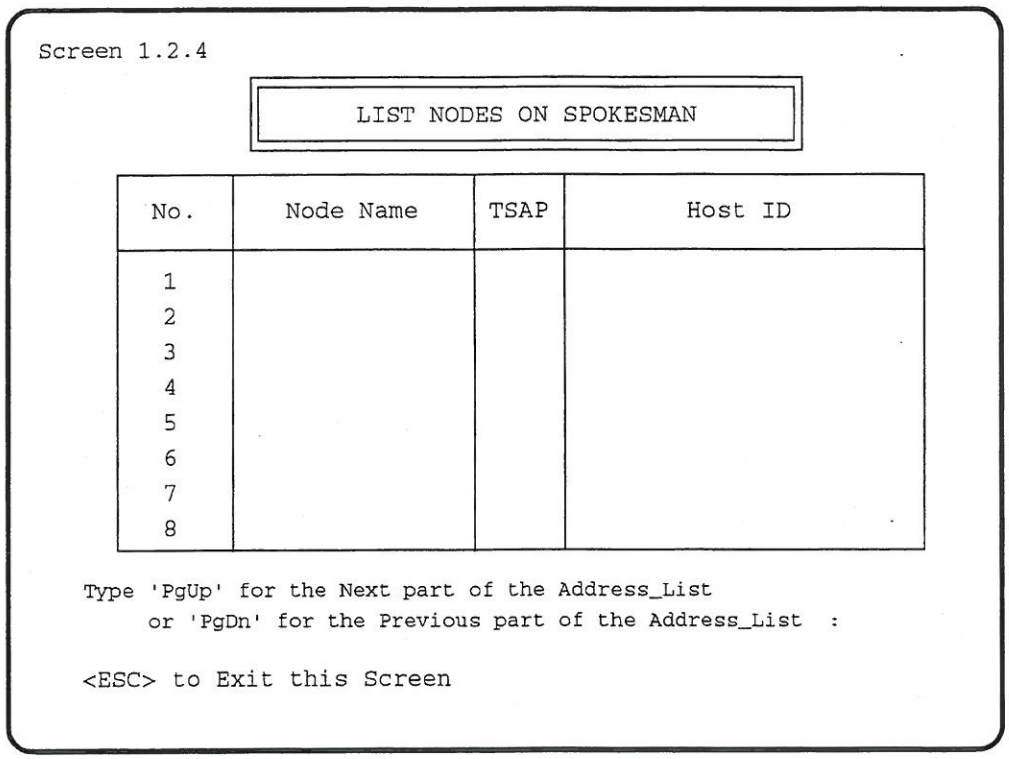


Figure 5-7. List Spokesman Nodes

Using All 16 Bytes For a Name

In this option, the application uses all 16 bytes to determine a name. Names less than 16 bytes are space filled.

This approach is useful when there is only one application using the NETBIOS services (i.e., there is no need to determine the identity of the application requesting the NETBIOS service).

The disadvantage in using all 16 bytes of a name or space filling the remaining bytes of a name with less than 16 bytes is that multiple applications executing on the system have to use the same name for NETBIOS services. This requires a large

amount of processing to determine which application requested the NETBIOS services. This approach seriously restricts the number of applications that can execute on the system, which can also cause performance and reliability problems.

Another way would be to have each application use a unique name. This results in the restriction that the node name will not be the name at which the application can receive information.

For example:

A system is added on the network with a name "PC_FILE_SERVER". The name is 14 bytes long and the other two bytes are space-filled. The system also has three applications using the same name. A mail application, a consumer application, and an application that is monitoring some network activity all using the same name "PC_FILE_SERVER". When information is sent to the system, there is no simple method for the system named "PC_FILE_SERVER" to determine the application to which the information should go. Also, the remote end that is sending the data has no idea if the equivalent application is or is not executing on the system because there is no unique way of identifying the application requesting or receiving the NETBIOS services.

The other approach of having each application use a different name means that the mail application could use a name "PC_FILE_MAILER", the consumer application could use the same name as the system "PC_FILE_SERVER", and the network monitoring application could use the name "PC_FILE_MONITR". This results in a requirement that the applications trying to communicate with a particular system needs to know all the various names used by the applications. It will not suffice just to know the node name, in this case, "PC_FILE_SERVER".

Using Sockets

In this option, the length of the name is restricted to 15 bytes, with the last byte reserved for the applications identifier or socket.

For example:

PC_FILE_SERVER	PC_FILE_SERVER 0	File Consumer
PC_FILE_SERVER	PC_FILE_SERVER 1	File Server
PC_FILE_SERVER	PC_FILE_SERVER 3	Redirected Name
PC_FILE_SERVER	PC_FILE_SERVER 8	Mail Handler Name
PC_FILE_SERVER	PC_FILE_SERVER 9	Network Monitor

In this approach, the applications use the same 15-byte name, but the last byte, called the Socket, uniquely differentiates each name based on the application using it. In this approach, the remote application calling the system "PC_FILE_SERVER" needs to know only the name of the node and is guaranteed that the same name with an appropriate socket will connect it to the correct application.

In the example, the network monitor system sends data to the system called "PC_FILE_SERVER" with socket 9, and could also send periodic mail to the network administrator by sending messages to the same node "PC_FILE_SERVER" with socket 8.

IBM's PC LAN Program uses the concepts of sockets and the sockets shown in Table 5-4 are reserved:

Table 5-4. Reserved Sockets

Socket Number	Application Type
00H	File Redirector
01H	Reserved
02H	Reserved
03H	Additional User Name
04H	Reserved
05H	Forwarded Name
06H	Reserved
07H	Reserved
08H	Reserved
09H	Reserved
20H	File Server
76H	Virtual Terminal

Naming Conventions for NETBIOS to iRMX®-NET (OpenNET™) Communications

The concepts of sockets previously described work well between systems that implement the NETBIOS interface (currently only PCL2 R3.0 software). However, in systems that use iRMX-NET a completely different application identifying scheme is used. The iRMX-NET system uses the concept of "Types" to differentiate applications. Each name is composed of three parts: name, type, and value. Where name is the name of the node, Type is the equivalent of a NETBIOS socket (not necessarily the same) and value is the address associated with that name. Even though the NETBIOS and iRMX-NET application identifying schemes are similar in features, they are very different and are not compatible.

In order to maintain compatibility with both the NETBIOS socket scheme and the iRMX-NET Type scheme, a mapping scheme has been implemented for NETBIOS nodes to communicate with iRMX-NET nodes and vice-versa.

This mapping scheme, maps every NETBIOS socket to an equivalent iRMX-NET Type. This mapping table is the Socket Table. The Socket table has up to 256 entries and every NETBIOS socket is mapped to an equivalent iRMX-NET Type. This table is automatically loaded every time the NETBIOS command is invoked. Table 5-5 shows the default socket to iRMX-NET Type mapping and its function.

Table 5-5. NETBIOS to iRMX®-NET Type Mapping Scheme

NETBIOS Socket (Byte)	iRMX-NET Type (Word)	Application
0	0003	Server
1	0003	Consumer
2	0003	

With this mapping, iRMX-NET applications can uniquely identify their NETBIOS counter-parts using iRMX-NET Types. The NETBIOS application maps these Types to equivalent Sockets before sending it to the appropriate NETBIOS application.

Developers writing applications across dissimilar interfaces (iRMX-NET to NETBIOS and vice-versa) must follow this convention.

Administration of the Socket Table

The administration of the Socket Table can be done by both the applications developer and the user.

The applications developer should indicate in the documentation the Socket and Type that the application uses for communicating with its iRMX-NET counterpart executing on a iRMX-NET system.

NOTE

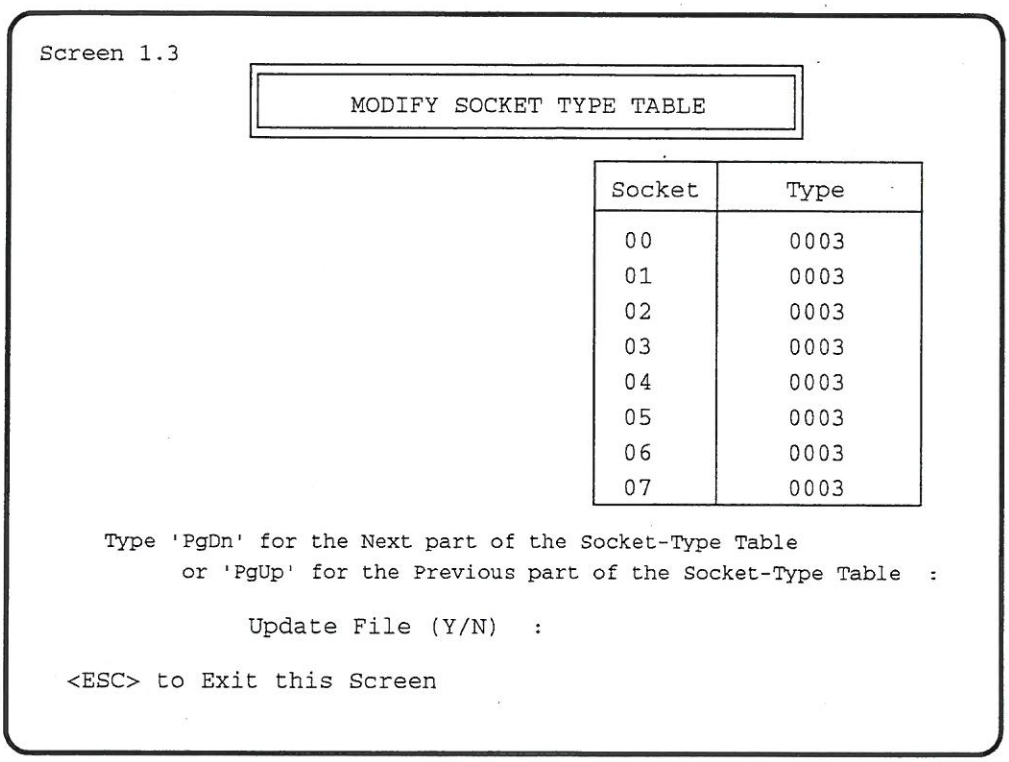
This should be clearly documented and should be the first step in the installation.

The user chooses this option in the Administrative utility to add the new Socket and Type to the table. Selecting this option will cause a screen similar to the one shown in Figure 5-8 to appear. The user can use the <PgUp>, <PgDn>, and arrow keys to move to the appropriate socket. Once the correct socket is located, the user may enter the new Type in the Type column. Use the arrow keys to move to the field "Update File (Y/N)" and respond with "Y". This updates the Socket-Type mapping table. Restart the system for the new Type table to take effect.

NOTE

The entire system needs to be re-initialized using the NETBIOS command described in Chapter 3.

It is recommended that applications and system level developers using the NETBIOS interface provided in PCL2 R3.0 software use the Socket concept in all their applications.



W-2246

Figure 5-8. Modify Socket Type Table Screen

Modify Node Information

To modify node information, select option "4" from the main screen shown in Figure 5-1. A screen similar to the one shown in Figure 5-9 appears.

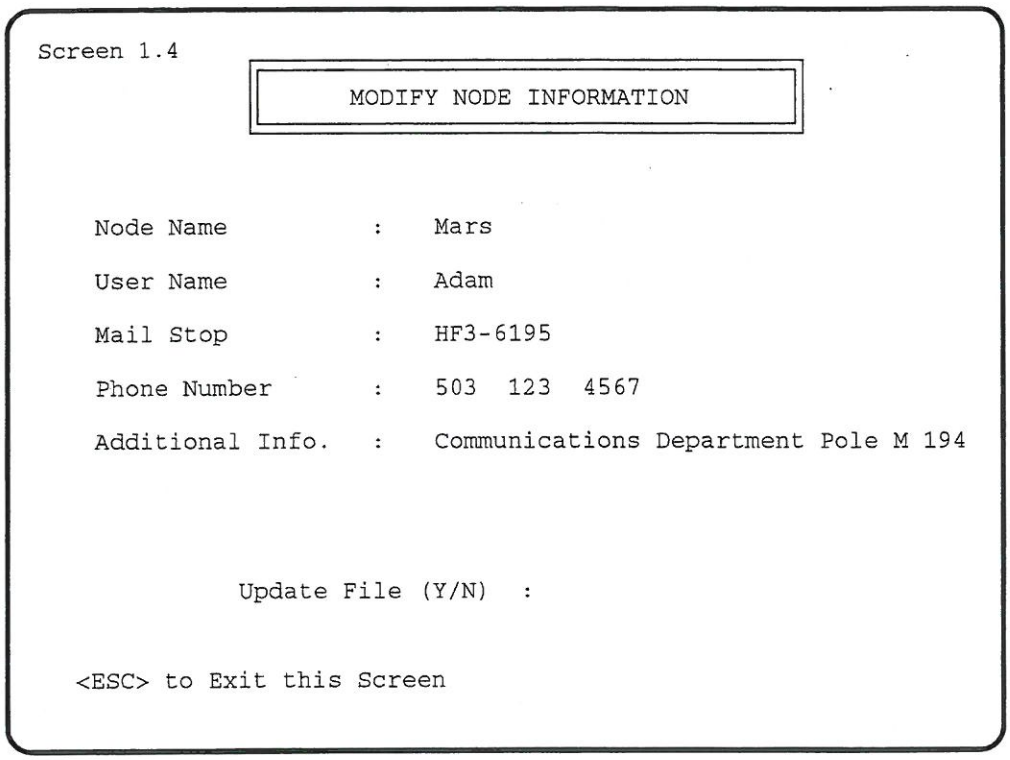


Figure 5-9. Modify Node Information Screen

The fields present in the screen are:

- Node name — The name of the node
- User name — The name of the user
- Mail stop — The user's mail stop
- Phone number — The user's phone number
- Additional information — whatever the user wants to place there.

Modify the information in the fields using the arrow and backspace keys.

The node information is modified by responding "Y" to "Update File (Y/N)". Responding with "N" will not update the file and the same screen remains.

Use the <Esc> key to return to the previous screen.

Finding a Node on the Network

Every personal computer with PCL2 R3.0 software installed is associated with a user, a mail stop, phone number, and 100 bytes of extra information. This information is stored in the CONFIG.NIA file of each personal computer and passed to the NIA when the network is started. A user of any personal computer on the network can find all the node information concerning another personal computer on the network by selecting option "5" from the main screen similar to the one shown in Figure 5-1.

If option "5" is selected, a screen similar to the one shown in Figure 5-10 appears. The only input requested in this screen is the node name.

Enter the name of the node and enter "Y" in response to "Find Node (Y/N)". A screen similar to the one shown in Figure 5-11 appears. If the node exists on the network, the information associated with it is displayed. If no such node exists, the user is advised of this and prompted to enter another node name.

NETADDR Conversion

Network administrators setting up a Spokesman for the file-based nodes on the network can use this utility to convert a PCL2 Release 1.0 NETADDR file to a Release 3.0 NETADDR file. Select option "6" from the main screen shown in Figure 5-1. A screen similar to the one shown in Figure 5-12 appears. The input parameters expected are the path of the R1.0 NETADDR file and the path of the R3.0 NETADDR file.

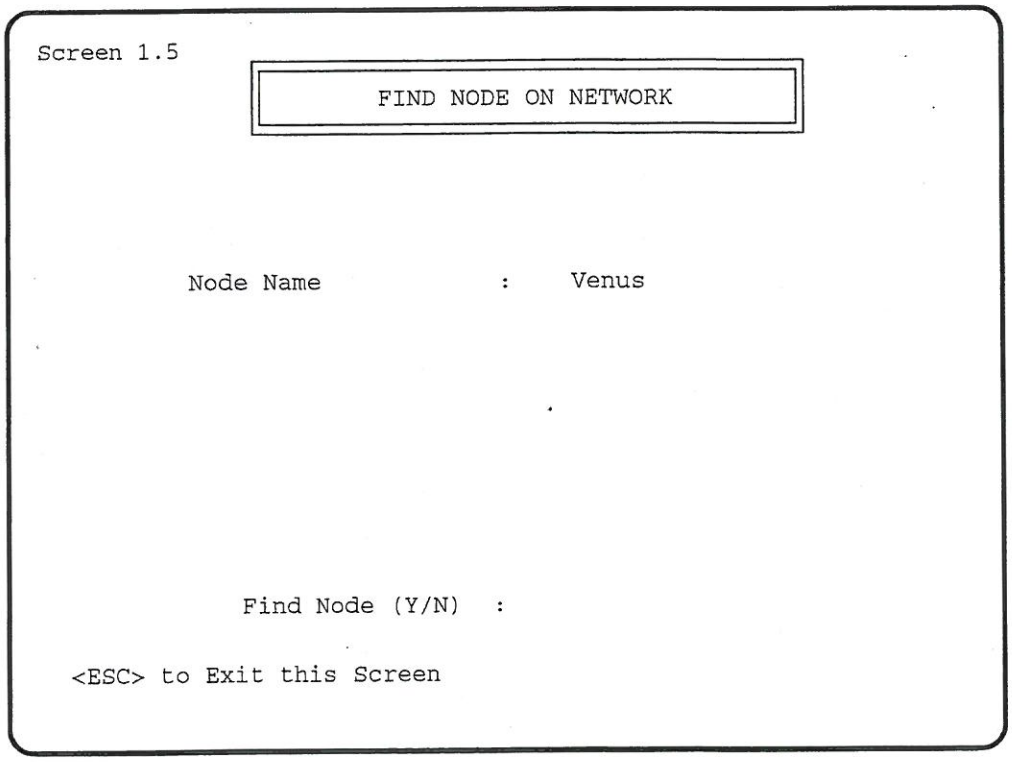
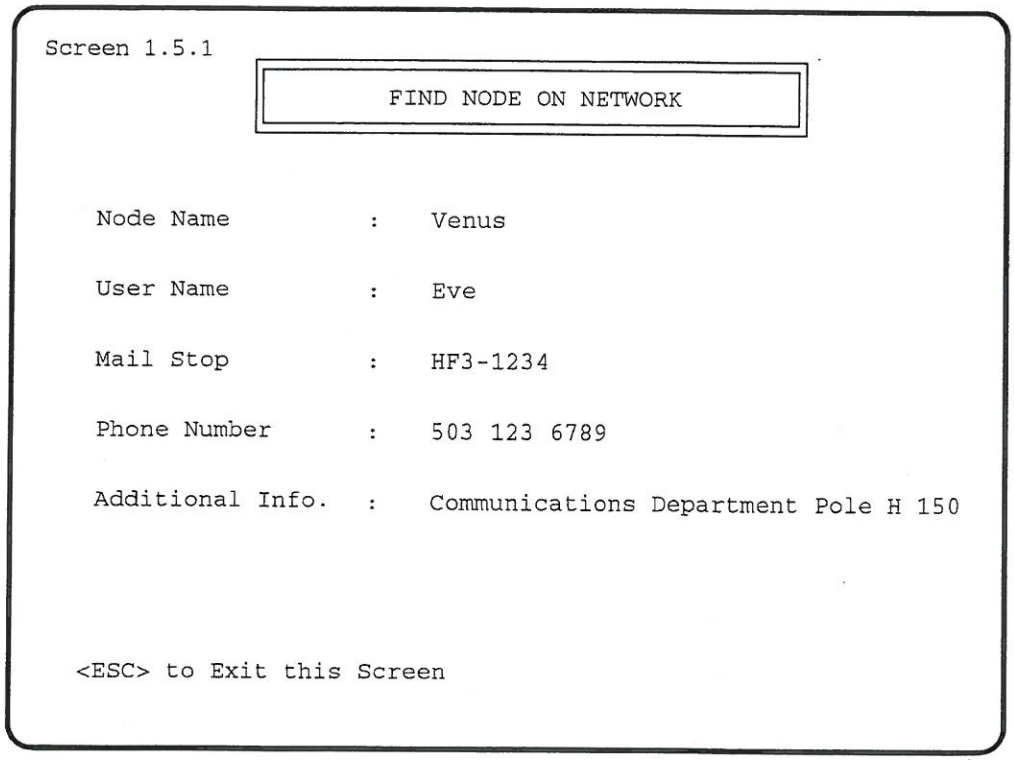
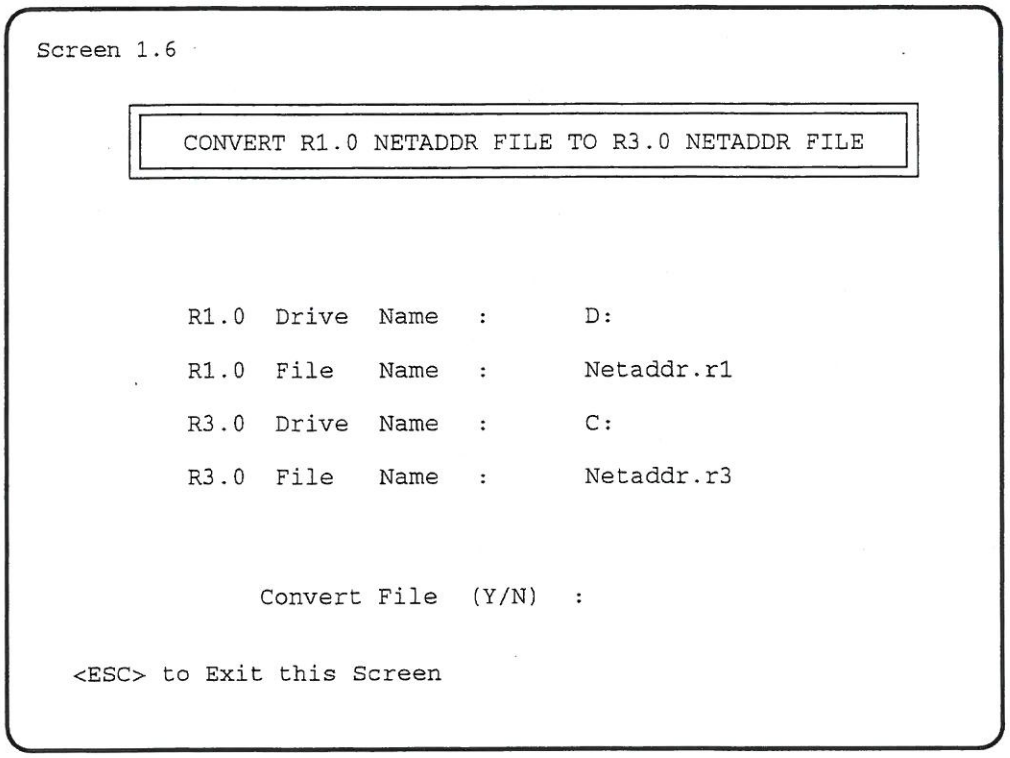


Figure 5-10. Find Node on Network, Initial Screen



W-2249

Figure 5-11. Find Node on Network



W-2250

Figure 5-12. NETADDR File Conversion Screen

***

Error Messages A

Introduction

This appendix contains the error messages that may occur when using the PCL2 R3.0 software. All error messages printed by PCL2 R3.0 have the format:

```
==> Error ###_____ Description_____
```

Where:

###	can have any value from 000 to 999 depending on the nature of the error.

In the case of a non-fatal error, a warning is issued. This warning has the following format:

```
==> Warning ###_____ Description_____
```

The range of error codes defined in PCL2 R3.0 are listed by classification in Table A-1.

Table A-1. Error Code Classification

Error Codes	Error Classification
000 through 099	Error codes in this range indicate a failure in the PCL2NIA or its on-board diagnostics. These error codes also indicate a failure during the PCL2 R3.0 start-up sequence. These occur when the NETBIOS command is executed.
100 through 199	Error codes in this range indicate a failure in the INSTALL utility.
200 through 299	Error codes in this range indicate a failure in the ADMIN utility.
300 through 399	Error codes in this range result from incorrect responses to Y/N questions, available memory space restrictions, and disk I/O operations. These occur when the ADMIN/INSTALL utilities are executed.
400 through 499	Error codes in this range result from errors during usage of the MKImage Utility.
500 through 599	Error codes in this range indicate failure in the diskless workstation start-up and initialization.

Diagnostic and Start-Up Errors

The following errors could occur during the initialization and start-up of the PCL2 software.

```
Error Ø11: 8Ø186 Register Addressing Test  FAILED.
Error Ø12: 8Ø186 Register Data Test  FAILED.
Error Ø13: 8Ø186 Boolean Function Test  FAILED.
Error Ø14: 8Ø186 Stack Command Test  FAILED.
Error Ø21: 8Ø186 Register Map Test  FAILED.
Error Ø22: PIC Test  FAILED.
Error Ø23: Timer Test  FAILED.
Error Ø31: EPROM Checksum Test  FAILED.
Error Ø32: Ethernet ID PROM CRC Check  FAILED.
Error Ø41: DRAM Data Pattern Test  FAILED.
Error Ø42: DRAM Parity Test  FAILED.
```

Cause: These error codes indicate a problem with the 80186 microprocessor, the memory control logic, or problems with the various PROMs on the PCL2NIA. This usually indicates the controller board is defective.

Action: Call Intel World Wide support at 1-800-INTEL-4-U for assistance in repairing or replacing the PCL2NIA. Please jot down or keep the error message display visible while calling the World Wide support Center.

```
Error Ø51: 82586 Initialization Test  FAILED.
Error Ø52: 82586 Internal Diagnostic Test  FAILED.
Error Ø53: 82586 Dump Command Test  FAILED.
Error Ø54: 82586 Internal Loopback Test  FAILED.
Error Ø55: 82586 External Loopback Test  FAILED.
```

Cause: These error codes indicate a problem with the 82586 Ethernet controller or the 82501 serial controller. Error codes 51 through 55 may also result from the cable not being properly connected to either the PCL2NIA or the Ethernet network.

Action: Check the connections and run the software again (refer to Chapter 3). If error codes 51 through 55 are still reported, the 82586 or 82501 has failed. Call Intel World Wide support at 1-800-INTEL-4-U for assistance in repairing or replacing the PCL2NIA. Please jot down or keep the error message display visible while calling the World Wide support Center.

Warning Ø56: 82586 Connector Loopback Test FAILED.

Cause: This warning is issued if the software fails to detect a connection between the PCL2NIA and the network.

Action: This is a non-fatal warning and the software start-up and initialization will complete. However, check the cable connections and transceivers. If this warning is still reported, there is a problem with the cable or the transceivers. Refer the problem to the network administrator.

Error Ø8Ø: Invalid DOS Version.

Cause: This error indicates that the DOS version necessary for the software to run successfully is not installed.

Action: Install DOS version 3.1 or greater.

Error Ø81: PCL2NIA Not Responding.

Cause: This error indicates that the PCL2 R3.0 software did not find the PCL2NIA on the personal computer bus. This could be caused by using a port address or interrupt level already being used by another board in the system. This error is also generated when the PCL2 R3.0 software is run without the PCL2NIA being installed in the personal computer.

Action: Check the optional boards in the system. Assign another port address or interrupt level that does not conflict with any other optional boards in the system. Illegal configuration specifications could also cause this error.

Error Ø82: Communication File Not Found.

Cause: This error indicates that PCL2 R3.0 could not find the communication software file.

Action: Be sure the communication software file exists in the directory path specified. Run the ADMIN utility to give the correct path to the file name. Re-run the NETBIOS command after the change has been made.

Error Ø83: Communication File Read Error.

Cause: This error indicates that the communications software file has been corrupted.

Action: It is recommended that the PCL2 software be re-installed.

Error Ø84: CONFIG.NIA File Not Found.

Cause: This error occurs when the CONFIG.NIA file is not found in the path specified.

Action: Verify the path to the CONFIG.NIA file and re-enter. In most cases, the CONFIG.NIA file is located in the same directory as the PCL2 R3.0 software. Otherwise, re-install the PCL2 R3.0 software and run the ADMIN utility.

Error Ø85: NETBIOS Driver Already Installed.

Cause: This error indicates that the user tried to invoke the PCL2 R3.0 software more than once.

Action: The user cannot invoke the PCL2 R3.0 software more than once. Re-boot the personal computer and invoke the NETBIOS command.

Warning Ø86: Unable to Add Local Node Information. Node already exists on the Network.

Cause: This warning occurs when the system detected another node using the same node name.

Action: This is a warning and the user can proceed with normal operation. However, the administrator cannot obtain local node information for this node. It is recommended that the local node name used be changed. This is explained in Chapter 5, the section titled Modify Node Information.

```
Warning Ø87: NETADDR File Not Found.
```

Cause: This warning indicates that the NETADDR file could not be found. This is normal on systems that are not configured as a Spokesman node.

Action: Check if the NETADDR file exists in the directory from which the NETBIOS command was invoked.

```
Error Ø88: NETADDR File Corrupted.
```

Cause: This error occurs when illegal characters are found in the NETADDR file.

Action: Re-create the NETADDR file.

Install Utility Errors

One or more of the following errors could occur while installing the PCL2 R3.0 software using the INSTALL utility.

```
Error 1ØØ: Drive Name Not Specified.
```

Cause: This error occurs when the Drive Name field is left blank.

Action: Enter the appropriate drive letter (C:, D:, etc.) in the Drive Name field and continue.

```
Error 1Ø1: Invalid Drive Name.
```

Cause: This error occurs when the drive name entered is other than A-Z or the colon is absent.

Action: Enter a valid drive name and continue.

```
Error 1Ø2: Directory Name Not Specified.
```

Cause: This error occurs when the directory field is left blank.

Action: Enter the correct path and directory name in the directory field and continue.

Error 103: Invalid Directory Name. Existing File or Device.

Cause: This error occurs when the user specified a directory name that is an existing file or device.

Action: Enter a valid directory name.

Error 104: Node Name Not Specified.

Cause: This error occurs when the node name field is left blank.

Action: Enter a valid node name and continue.

Error 105: Incorrect Disk Mounted.

Cause: This error occurs when the install program prompted a particular disk and the user did not insert the requested disk in Drive A:.

Action: Insert the requested disk in Drive A:.

Warning 106: Specified Target Directory Exist Overwrite (Y/N).

Cause: This error occurs when the specified directory already exists. The user is given the option of either stopping at this point or allowing the existing files to be overwritten.

Action: If the files in the specified directory can be overwritten, then specify "Y"; otherwise specify "N".

Error 107: Invalid Install Disk.

Cause: This error occurs when the inserted Installation diskette did not contain all the required files.

Action: Use the original diskette (or copies of the original diskette) to install the software.

```
Error 108: Invalid Driver Disk.
```

Cause: This error occurs when the inserted Driver diskette did not contain all the required files.

Action: Use the original diskette (or copies of the original diskette) to install the software.

Admin Utility Errors

The following errors could occur while the network administrator is setting up or modifying the networking system using the ADMIN utility.

```
Error 200: CONFIG.NIA File Not Found.
```

Cause: This error occurs when the CONFIG.NIA file is not found in the current directory.

Action: Verify the path to the CONFIG.NIA file and re-enter. In most cases, the CONFIG.NIA file is located in the same directory as the PCL2 R3.0 software.

```
Error 201: CONFIG.NIA File Read Data Error.
```

Cause: This error occurs when the CONFIG.NIA file is found corrupted.

Action: Copy the CONFIG.NIA file from the original NETBIOS Driver diskette and re-run the ADMIN utility. Be sure to incorporate changes made to the various default parameters into the new file.

```
Error 202: Adapter Port Address Not Specified.
```

Cause: This error occurs when the adapter port address field is left blank.

Action: Enter a valid adapter port address and continue.

Error 203: Invalid Adapter Port Address Specified.

Cause: This error occurs when the hexadecimal adapter port address entered contained one or more illegal digits. The legal range is 0-9, and A-F.

Action: Enter legal hexadecimal digits and continue.

Error 204: Illegal Adapter Port Address Specified.

Cause: This error occurs when the hexadecimal adapter port address entered was other than "360" or "3C0."

Action: The two legal values for port addresses are 360 and 3C0. Use only one of these values. Be sure the PCL2NIA port jumpers are strapped for the same value. Note that port 3C0 cannot be used in a system with an Enhanced Graphics Adapter.

Error 205: Adapter Base Address Not Specified.

Cause: This error occurs when the adapter base address field is left blank.

Action: Enter a valid adapter base address and continue.

Error 206: Invalid Adapter Base Address Specified.

Cause: This error occurs when the hexadecimal adapter base address entered contained one or more illegal digits. The legal range is 0-9, and A-F.

Action: Enter legal hexadecimal digits and continue.

Error 207: Illegal Adapter Base Address Specified.

Cause: This error occurs when the hexadecimal adapter base address entered was not one of the valid 31 locations. Check Table 5-2.

Action: Select one of the 31 legal base addresses that will not conflict with another system board. The default setting is CC and in most cases users can use this default.

Error 208: Interrupt Level Not Specified.

Cause: The error occurs when the interrupt level field is left blank.

Action: Enter a valid interrupt level and continue.

Error 209: Invalid Interrupt Level Specified.

Cause: This error occurs when the hexadecimal interrupt level entered contained one or more illegal digits. The legal range is 0-9, and A-F.

Action: Enter legal hexadecimal digits and continue.

Error 210: Illegal Adapter Interrupt Level Specified.

Cause: This error occurs when the hexadecimal adapter interrupt level entered was not legal.

Action: The PCL2NIA supports two interrupt levels: IRQ2 (2) and IRQ5 (5). Use only one of these values.

Error 211: Maximum No. of NETBIOS Commands Not Specified.

Cause: The error occurs when the maximum number of NETBIOS Command field is left blank.

Action: Enter a valid number of maximum NETBIOS commands and continue.

Error 212: Invalid Maximum No. of NETBIOS Commands Specified.

Cause: This error occurs when the hexadecimal value entered contained one or more illegal digits. The legal range is 0-9 and A-F.

Action: Enter legal hexadecimal digits and continue.

Error 213: Maximum No. of NETBIOS Sessions Not Specified.

Cause: This error occurs when the number of NETBIOS Sessions field is left blank.

Action: Enter a valid number of maximum NETBIOS Sessions and continue.

Error 214: Invalid Maximum No. of NETBIOS Sessions Specified.

Cause: This error occurs when the hexadecimal value entered contains one or more illegal digits. The legal range is 0-9 and A-F.

Action: Enter legal hexadecimal digits and continue.

Error 215: Path Name Not Specified.

Cause: This error occurs when the communication file path name field is left blank.

Action: Enter a valid communication file path name and continue.

Error 216: File Name Not Specified.

Cause: This error occurs when the communication file name field is left blank.

Action: Enter the correct communication file name and continue. Be sure the file name is spelled correctly.

Error 217: Specified Communications File Not Found.

Cause: This error occurs when the communications file specified does not exist in the directory specified.

Action: Check for the existence of the communications file in the path specified.

Error 220: Node Name Not Specified.

Cause: This error occurs when the node name field is left blank.

Action: Enter a valid node name and continue.

Error 221: Host ID Not Specified.

Cause: This error occurs when the Host ID field is left blank.

Action: Enter a valid Host ID and continue.

Error 222: Invalid Host ID Specified.

Cause: This error occurs when one or more illegal hexadecimal digits are entered in the Host ID field. The legal range is 0-9, and A-F.

Action: Enter a legal Host ID and continue.

Error 223: TSAP ID Not Specified.

Cause: This error occurs when the TSAP ID field is left blank.

Action: Enter a valid TSAP ID and continue.

Error 224: Invalid TSAP ID Specified.

Cause: This error occurs when one or more illegal hexadecimal digits are entered in the TSAP ID field. The legal range is 0-9, and A-F.

Action: Enter a legal TSAP ID and continue.

Error 225: iNA Rel. No. Not Specified.

Cause: This error occurs when the iNA release number field is left blank.

Action: Enter a valid iNA release number and continue.

Error 226: Illegal iNA Release No.

Cause: This error occurs when the number entered for the iNA release number was not 1, 2, or 3.

Action: Enter the correct iNA release number and continue.

```
Error 245: Specified Name Already Exists in the Spokesman.
```

Cause: This error occurs when a name is added to the Spokesman system.

Action: Select and enter another node name.

```
Error 246: Specified Name Not found in the Spokesman
```

Cause: This error occurs when the name entered was not found in the Spokesman system.

Action: Check spelling and re-enter node name.

```
Error 247: Invalid NETADDR File Format.
```

Cause: This error occurs when the NETADDR file is corrupt.

Action: Pass this information to the network administrator. The NETADDR file should be re-created.

```
Error 248: NETADDR File Full.
```

Cause: This error occurs when the number of nodes in one Spokesman System exceeds the allowed maximum of 96.

Action: Remove unwanted nodes or configure another system as a Spokesman node.

```
Error 250: Node Name Not Specified.
```

Cause: This error occurs when the node name field is left blank.

Action: Enter a valid node name and continue.

```
Error 260: Network Software Not Started.
```

Cause: This error occurs when the ADMIN utility is invoked without first starting the network software.

Action: Start the network software and then run the ADMIN utility.

Error 261: Specified Node Does Not Exist.

Cause: This error occurs when the node specified is not found in the network.

Action: None.

Error 262: Unable to Get Node Information.

Cause: This error occurs when the ADMIN utility cannot obtain information about a specified node.

Action: Notify the node user and network administrator.

Error 263: Unable to Add Node Information.

Cause: This error occurs when the user tries to add local node information to the network and the ADMIN utility is unable to update this information.

Action: Notify network administrator.

Error 270: R1.0 Drive Name Not Specified.

Cause: This error occurs when the R1.0 drive name field is left blank.

Action: Enter a valid drive name and continue.

Error 271: Invalid R1.0 Drive Name.

Cause: This error occurs when the drive name entered is other than A-Z or the colon is absent.

Action: Enter a valid drive name and continue.

Error 272: R1.0 File Name Not Specified.

Cause: This error occurs when the R1.0 file name field is left blank.

Action: Enter a valid R1.0 file name and continue.

Error 273: R3.Ø Drive Name Not Specified.

Cause: This error occurs when the R3.0 drive name field is left blank.

Action: Enter a valid R3.0 drive name and continue.

Error 274: Invalid R3.Ø Drive Name.

Cause: This error occurs when the drive name entered is other than A-Z or the colon is absent.

Action: Enter a valid drive name and continue.

Error 275: R3.Ø File name Not Specified.

Cause: This error occurs when the R3.0 file name field is left blank.

Action: Enter a valid R3.0 file name and continue.

Error 28Ø: Specified R1.Ø File Does Not Exist.

Cause: This error occurs when the file name entered cannot be found in the path specified.

Action: Verify file name and path and re-enter.

Warning 281: Specified R3.Ø File Exists. Overwrite? (Y/N).

Cause: This error occurs when a file name matching the file name entered already exists.

Action: Enter "Y" to overwrite existing file or "N" to choose and enter another file name.

Common Error Messages

The following error messages are possible while the personal computer is performing disk accesses, improper character entry for user response to Y/N questions, or if available memory resources are insufficient for the application.

`Error 300: Invalid Choice.`

Cause: This error occurs when the user enters any other character but "Y" or "N" when responding to Y/N choices.

Action: Enter the appropriate character and continue.

`Error 301: Insufficient Memory.`

Cause: This error occurs when there is not enough memory to perform the specified operation.

Action: Delete one or more memory resident programs to free-up memory space, or install more memory.

`Error 320: Insufficient Disk Space.`

Cause: This error occurs when the Target Disk is full.

Action: Specify a Target Disk with sufficient space.

`Error 328: Attempt to Write on a Write Protected Disk.`

Cause: This error occurs when a write operation is attempted on a write protected diskette.

Action: Remove the write protect tab from the diskette and continue.

```
Error 329: Unknown Drive Unit Specified.
```

Cause: This error occurs when an illegal drive unit was entered.

Action: Enter the correct drive designator and continue.

```
Error 330: Drive Not Ready <Drive Name>.
```

Cause: This error normally indicates a failed fixed disk or open door on a floppy drive.

Action: Check the appropriate disk or diskette. For the floppy drive, check to see that the door is completely closed; otherwise check that the drive is functional by inserting another diskette and attempting to do some operation. In the case of a fixed disk, have the service person check the disk for errors.

```
Error 332: Data Error Read/Write (CRC).
```

Cause: This error occurs when the read/write operation was incorrect. This could be due to a bad diskette or drive or fixed disk drive, as applicable.

Action: Check the fixed disk for correct operation. If the fixed disk is defective, replace it. If the error occurred on a diskette, check the diskette and replace it if the problem persists. If the error happened while reading from a diskette supplied with this product, contact Intel Worldwide Support at 1-800-INTEL-4-U for replacement.

```
Error 335: Unknown Disk Media Type.
```

Cause: This error occurs when a unformatted or non-DOS formatted diskette was inserted into the floppy drive.

Action: Insert the appropriate diskette in the drive and continue.

Error 338: Write Failure Disk I/O.

Cause: This error occurs when a problem exists in writing to the hard or floppy disk.

Action: If writing to a diskette, check to be sure that the diskette is properly formatted. If writing to the fixed disk, call the system's local service representative and have the fixed disk repaired.

Error 339: Read Failure Disk I/O.

Cause: This error occurs when there is a problem in reading from the source diskette.

Action: This normally indicates a defective source diskette. If available, try another set of PCL2 R3.0 source diskettes or call Intel Worldwide support at 1-800-INTEL-4-U for replacement.

Error 340: General Failure Disk I/O.

Cause: This indicates a failure with either the hard or floppy drive that does not fall under the various categories mentioned previously.

Action: Have both the hard and floppy drive systems checked. If the problem is with the PCL2 R3.0 source diskettes, call Intel Worldwide support at 1-800-INTEL-4-U for replacement.

MKIMAGE Utility Errors

Error 400: Unable to create <filename>.

Cause: This error occurs when an attempt to create Image file fails.

Action: Check to see if the filename contains illegal characters or exceeds the maximum length. Also check the permissions for creating files in that drive/directory.

Error 401: Unable to read the diskette.

Cause: This error occurs when an attempt to read the diskette in drive A fails.

Action: Determine if the correct diskette is in drive A and the drive door is closed.

Error 402: Unexpected error reading drive A.

Cause: This error occurs when an attempt to read any track of the diskette fails.

Action: Determine if the floppy is properly formatted.

Error 403: Error writing to <filename>.

Cause: This error occurs when an attempt to write to the Image file fails.

Action: The image is write protected and no write operation to this Image is possible.

Diskless Workstation Error Messages

Error 510: PCL2NIA is not responding.

Cause: This error indicates that the PCL2NIA failed to respond to load the control file from the Boot Server.

Action: Check to see if the PCL2NIA jumper configuration is correct and if the Ethernet connector is connected properly. Try rebooting or switching the system off and then on again.

Error 530: No response from the Boot Server.

Cause: This error indicates that there is no response to the boot request for loading the control or Communication Files.

Action: Check to see if the Boot Server is set up properly according to the Installation guidelines given in Chapter 4. Also check to see if the Boot Server is active and its cables are connected to the network.

Error 531: Premature end of file from the Boot Server.

Cause: This error indicates that the either the control or communication file could not be completely down loaded from the Boot Server.

Action: Check to see if the Boot Server is functioning correctly. Also check if the control or communication files are identical to the ones supplied.

Error 532: Bad header from the Boot Server.

Cause: This error indicates that either the control or communication file is corrupted.

Action: Re-install the Boot Server with the control and communication files provided with this product.

Error 539: Requested Server not found on the Network.

Cause: The specified server was not found on the network.

Action: Find out whether the specified server really exists on the network. If the server does not exist, specify an alternate server name and proceed.

Error 540: Cannot connect to File Server.

Cause: This error indicates that it was unable to connect to the File Server specified on the menu for booting the Diskless workstation.

Action: Check to see if the File Server is active. Try again or try with a different File Server.

Error 541: Invalid user name or password.

Cause: This error indicates that it was unable to connect to the File Server with the user name and password specified on the menu for booting the Diskless workstation.

Action: Check to see if the user name and password are valid on the File Server. Also check for case sensitivity.

Error 542: Unable to open the image file.

Cause: This error indicates that the diskless workstation was unable to open the Image file specified.

Action: Check to see if the Image file exists on the File Server. Check if it exists in the root directory. Or else specify the full pathname. Check to see if the user name specified on the Diskless PC menu has read/write access for the Image file. Also, check to see if the file is already opened by someone else, precluding others opening it.

Error Remote Booting Error 55Ø: O.S. Image File Read/Write Error.

Cause: This error indicates that a read or write operation to the Image file has failed.

Action: Reboot the system and check if the File Server on which the Image files are present is functioning correctly.

***

Hacker's Guide for PCL2 B

Introduction

This appendix contains Table B-1, which is a quick reference chart showing what is needed to install and configure PCL2 R3.0 software for communicating with the other OpenNET based nodes. The last column of Table B-1 is provided for any user defined node.

Table B-1. Quick Reference Chart

TO FROM	PCL2 Rel 3.0 MS-NET	PCL2 Rel 3.0 IBM PC LAN	PCL2 Rel 2.0 MS-NET	PCL2 Rel 1.0 MS-NET	IRMX®-NET Rel 2.0	IRMX®-NET Rel 3.0
PCL2 Rel 3.0 MS-NET	Y	Y	Y,SP,R2	Y,SP,R1	Y,SP,R1	Y,SP,R3
PCL2 Rel 3.0 IBM PC LAN	Y,NM	Y	Y,SP,R2,NM	Y,SP,R1,NM	Y,SP,R1,NM	Y,SP,R1,NM
PCL2 Rel 2.0 MS-NET	Y,R2,NN	Y,R2,NN	Y	N	N	Y,R2
PCL2 Rel 1.0 MS-NET	Y,R1,NN	Y,R1,NN	N	Y	Y	Y,R1,NN

Table B-1. Quick Reference Chart (continued)

TO FROM	VMS-NET Rel 1.X	VMS-NET Rel 2.X	SV OpenNET™ Rel 3.0	INDX Rel 3.3	XENIX-NET Rel 2.1	
PCL2 Rel 3.0 MS-NET	Y,SP,R1	Y,SP,R1	Y,SP,R3	Y,SP,R1	Y,SP,R1	
PCL2 Rel 3.0 IBM PC LAN	Y,SP,R2,NM	Y,SP,R1,NM	Y,SP,R3,NM	Y,SP,R1,NM	Y,SP,R2,NM	
PCL2 Rel 2.0 MS-NET	N	N	Y,R2	N	N	
PCL2 Rel 1.0 MS-NET	Y	Y	N	Y,R1	Y	

***

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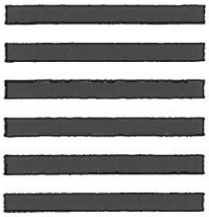

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