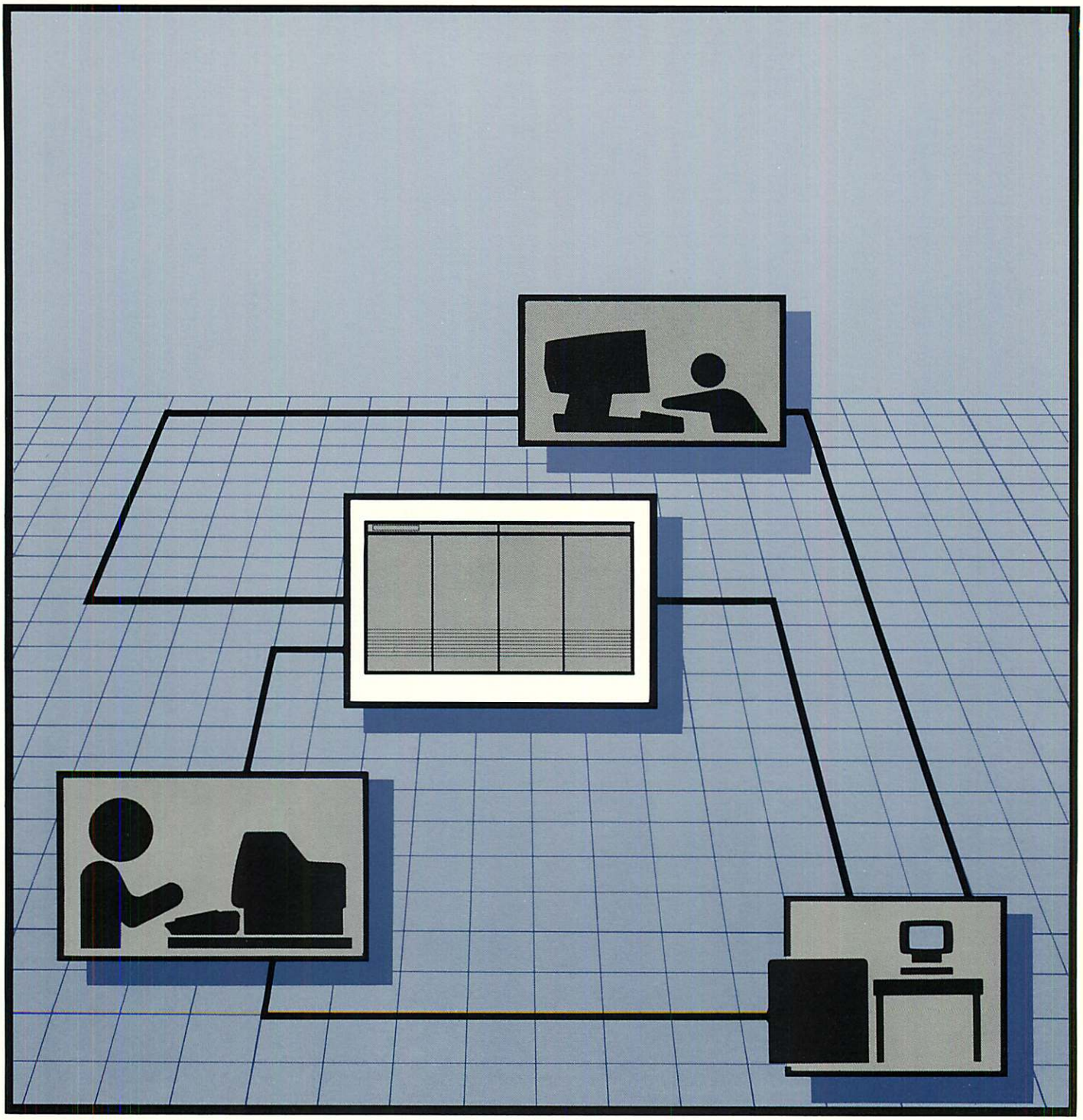
HP AdvanceNet

HEWLETT PACKARD

NS X.25 3000/V LINK

Guide



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NS X.25 3000/V LINK

Guide

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PREFACE

The subject of this manual is the **NS X.25 3000/V Network Link** (product number 24405A), hereafter referred to as NS X.25. This hardware and software product implements the Consultative Committee for International Telephony and Telegraphy (CCITT) X.25 Recommendation on Packet Switching Network access for use on HP 3000s running the MPE-V/E operating system. NS X.25 is an **HP AdvanceNet** product designed for use in an **NS3000/V** distributed networking environment.

This manual is designed to serve as a guide for the node manager (NM) when configuring and starting the NS X.25 product. It is organized as follows:

Section 1, *NS X.25 Product Overview*, introduces the NS3000 X.25 link product. It specifies the product's capabilities and lists the product's hardware and software components.

Section 2, *NS X.25 Installation and System Configuration*, lists the installation tasks that must be completed before you can use the NS X.25 link.

Section 3, *NS X.25 Node Configuration*, contains a step-wise procedure for configuring both the network configuration file (NSCONF.NET.SYS) and the network directory file (NSDIR.NET.SYS).

Section 4, *NS X.25 Principles of Operation*, lists and explains the commands used to:

- Start your NS X.25 network.
- Establish a connection with a remote node.
- Use an existing connection to a remote node.
- Close an existing connection to a remote node.
- Shut-down your NS X.25 network.

Section 5, *X.25 PAD Support*, provides information geared toward the user or programmer, including discussions of the session and programmatic PAD interfaces and information on application development and terminal configuration.

Section 6, *NS X.25 Troubleshooting*, discusses troubleshooting techniques for problems encountered while starting the network or establishing a connection.

Appendix A, *A Comparison of NS X.25 to CCITT X.25*, lists HP's implementation of the CCITT 1980 X.25 recommendation for the NS X.25 link product.

Appendix B, *X.28 and X.3*, describes the standards that govern the interface between PAD and asynchronous devices.

Appendix C, *Configuration Worksheets*, contains the worksheets that you must use to design your network.

RELATED MANUALS

These listed manuals contain information for the maintenance and use of NS X.25:

- The *NS3000/V Network Manager Manual, Volume I* (32344-90002).
- The *NS3000/V Network Manager Manual, Volume II* (32344-90012).
- The *NetIPC3000/V Programmer's Reference Manual* (5958-8581).
- The *NS3000/V User/Programmer Reference Manual* (32344-90001).
- The *NS3000/V Error Message and Recovery Manual* (32344-90005).
- *X.25: The PSN Connection* (5958-3402).

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CONVENTIONS USED IN THIS MANUAL

NOTATION	DESCRIPTION
nonitalics	Words in syntax statements which are not in italics must be entered exactly as shown. Punctuation characters other than brackets, braces and ellipses must also be entered exactly as shown. For example: `EXIT;`
italics	Words in syntax statements which are in italics denote a parameter which must be replaced by a user-supplied variable. For example: `CLOSE` *filename*
[ ]	An element inside brackets in a syntax statement is optional. Several elements stacked inside brackets means the user may select any one or none of these elements. For example:  User *may* select A or B or neither.
{ }	When several elements are stacked within braces in a syntax statement, the user must select one of those elements. For example:  User *must* select A or B or C.
...	A horizontal ellipsis in a syntax statement indicates that a previous element may be repeated. For example: [,*itemname*]...;
	In addition, vertical and horizontal ellipses may be used in examples to indicate that portions of the example have been omitted.
▒	A shaded delimiter preceding a parameter in a syntax statement indicates that the delimiter *must* be supplied whenever (a) that parameter is included or (b) that parameter is omitted and any *other* parameter which follows is included. For example: *itema*[▒*itemb*] [▒*itemc*] means that the following are allowed: *itema* *itema*,*itemb* *itema*,*itemb*,*itemc* *itema*,,*itemc*

Δ

When necessary for clarity, the symbol Δ may be used in a syntax statement to indicate a required blank or an exact number of blanks. For example:

```
SET[(modifier)]Δ(variable);
```

underlining

When necessary for clarity in an example, user input may be underlined. For example:

```
NEW NAME? ALPHA
```

Brackets, braces or ellipses appearing in syntax or format statements which must be entered as shown will be underlined. For example:

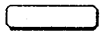
```
LET var[[subscript]] = value
```

Output and input/output parameters are underlined. A notation in the description of each parameter distinguishes input/output from output parameters. For example:

```
CREATE (parm1,parm2,flags,error)
```

shading

Shading represents inverse video on the terminal's screen. In addition, it is used to emphasize key portions of an example.



The symbol may be used to indicate a key on the terminal's keyboard. For example, RETURN indicates the carriage return key.

CONTROL*char*

Control characters are indicated by CONTROL followed by the character. For example, CONTROL Y means the user presses the control key and the character Y simultaneously.

NS X.25 PRODUCT OVERVIEW

SECTION 1

GENERAL INFORMATION

NS X.25 is an NS3000/V network link product. NS X.25 runs on HP 3000 computers running MPE-V/E operating systems. It has a standard X.25 programmatic interface and it implements Levels 1, 2, and 3 of the 1980 CCITT X.25 Recommendation.

NS X.25 includes the hardware and software components needed to connect an HP 3000 to a private or public Packet Switching Network (PSN). NS X.25 allows programmatic access to protocols at Level 3 and Level 4 through the Network Interprocess Communication (NetIPC) facility. It provides a variety of capabilities over X.25 networks; for example, communication between two or more connected networks is possible. NS X.25 also provides access to devices connected to public or private PADs. Figure 1-1 shows some connection possibilities enabled by NS X.25.

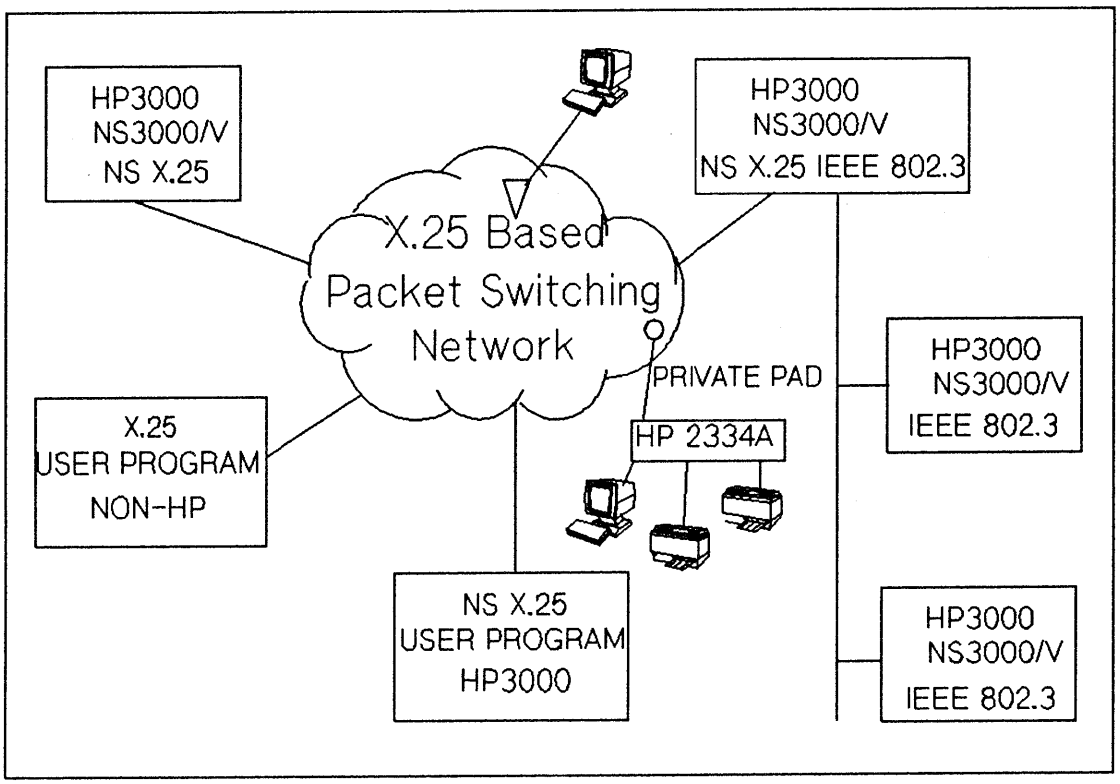


Figure 1-1. Product Connectivity

SYSTEM REQUIREMENTS

NS X.25 requires the following hardware:

- An HP 3000 Series 37, 37XE, 39, 40, 42, 48, 58, 64, 68, or 70, a MICRO 3000, 3000XE, 3000GX, or 3000LX. The system must have a minimum of two megabytes of memory. Systems that are now memory-limited must add one megabyte to maintain current performance.

- A dedicated Intelligent Network Processor (INP) board (part number 30020B for the HP 3000 Series 39 through 70 and part number 30244M for the HP 3000, MICRO 3000, 3000XE, 3000GX, 3000LX, Series 37, and Series 37XE).

- A cable appropriate to the connection: either a synchronous modem cable, a high-speed digital cable, or a direct connect interface cable.

NS X.25 requires the following software:

- The HP Multiprogramming Executive (MPE/V-E) operating system, version G.03.03 (V Delta 3 MIT) or later. PAD Support requires version G.03.04 (V Delta 4 MIT) or later.

NS X.25 software is composed of a number of subsystems, separate copies of which reside on each node in the network. The subsystems are defined as follows:

- **Node Management Configurator (NMC).** The Node Management Configurator subsystem provides the software that enables you to configure an HP 3000 as a network node. This subsystem includes NMMGR, the Node Management Configurator program.

- **Node Management Services (NMS).** The Node Management Services subsystem provides configuration file version checking, logging, and tracing. Logging enables network transactions to be recorded on a disc file. The recorded information can be used in network troubleshooting.

- **Link Support Services (LSS).** The Link Support Services subsystem contains two software modules: the Link Manager and the PC Link Manager. Both of these modules open, close, and otherwise control physical links.

- **Communication Services (CS).** Communication Services provide the diagnostic and link management software required by NS X.25.

- **Network Transport.** The Network Transport subsystem contains the protocol modules that correspond to Layers 1 through 4 of the Open Systems Interconnection (OSI) model. Network Interprocess Communication (NetIPC) is part of the Network Transport subsystem.

- **X.25.** The X.25 subsystem implements the 1980 CCITT X.25 Recommendation for creating and controlling virtual circuits and exchanging data packets on these virtual circuits.

- **PAD Support.** PAD Support for the NS X.25 link is a service within the NS architecture that allows communication between an HP 3000 host and remote terminals and printers connected to a Packet Assembler/Disassembler (PAD). The PAD is connected to a packet switching network.

All of the components necessary to allow NS X.25 to function on a node are depicted in Figure 1-2.

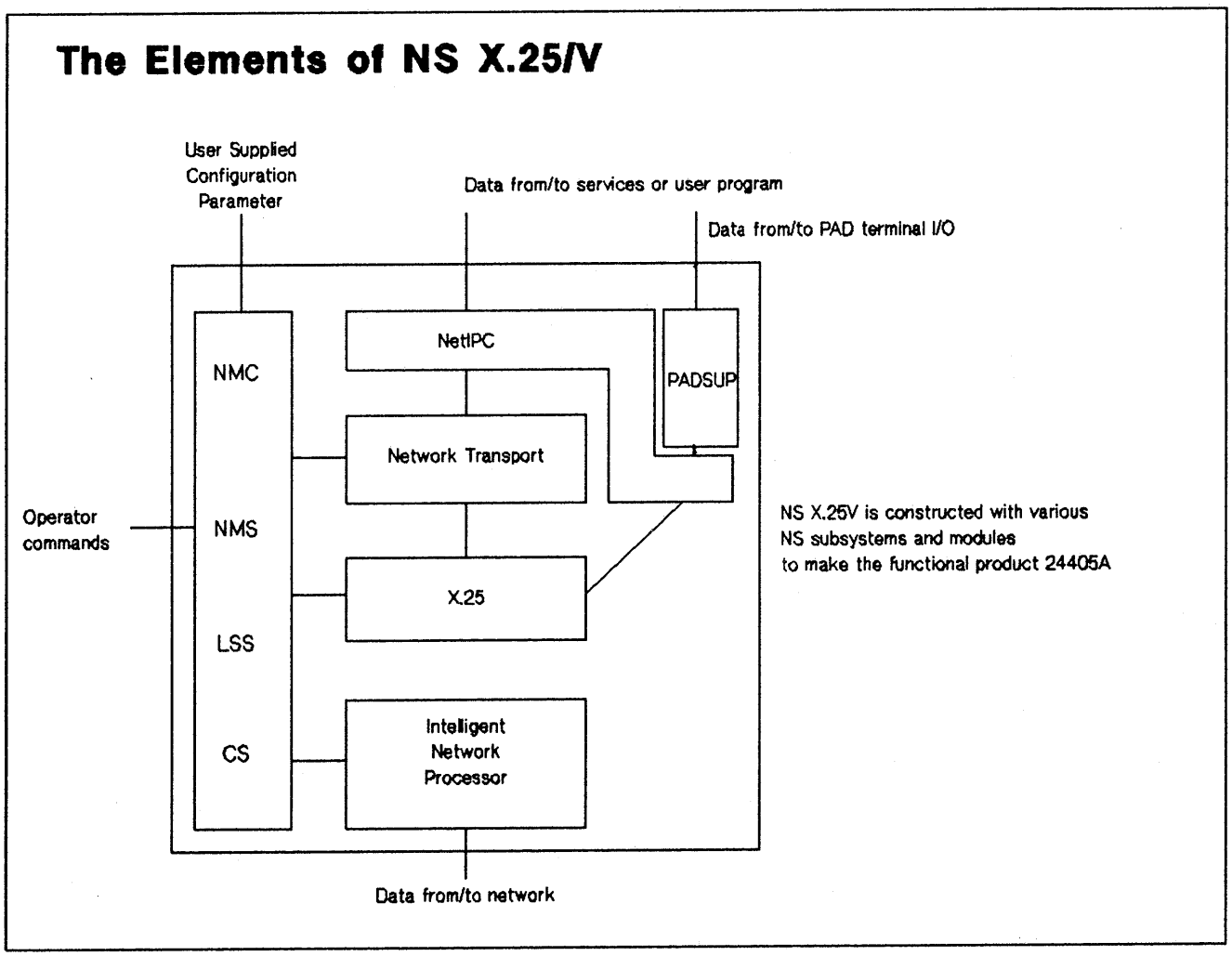


Figure 1-2. Product Components

X.25 SPECIFICATIONS

The NS X.25 link product is fully compatible with the 1980 CCITT Recommendation for synchronous host-to-network connections. It is certified for use on the largest Public Data Networks (PDNs), worldwide. Your HP sales representative can provide you with a current listing of certified networks.

Packet Level Capabilities

When NS X.25 is installed on your HP 3000, it is capable of both originating calls to and receiving calls from other hosts over an X.25 network. NS X.25 can operate in either data terminal emulating (DTE) mode or data circuit emulating (DCE) mode, depending on its operating environment. When connected to a public PSN, NS X.25 must emulate DTE. When connected to a private X.25 network, it may be configured for either DCE mode or DTE mode.

NS X.25 supports connections to either Switched Virtual Circuits (SVCs) or Permanent Virtual Circuits (PVCs). The opening and closing of virtual circuits (VCs) can be controlled by NetIPC intrinsics. Any number of VCs can be opened between a particular source and destination, within the configured limit (a maximum of 128 VCs per X.25 network interface). NetIPC intrinsics can also be used to control the sending and receiving of data packets. Using NetIPC intrinsics, you may access any of the following:

- The Call User Data (CUD) field in CALL REQUEST/INCOMING CALL packets.
- The D-bit and Q-bit in data packets.
- Cause and diagnostic codes.
- INTERRUPT and RESET packets.
- The no-activity time-out.

Link Level Capabilities

NS X.25 supports the Link Access Procedure Balanced (LAP-B) standard. It provides full duplex point-to-point communications over a synchronous network line. The link level protocol is downloaded to the INP board when the NS X.25 product is started.

X.25 OPTIONAL USER FACILITIES

NS X.25 implements most of the user facilities defined by the CCITT X.25 Recommendation as optional user facilities. For a description of each of the CCITT defined facilities refer to the HP publication *X.25: The PSN Connection.* The range of facilities available to you will depend in part on the conditions of your network subscription. Table 1-1 lists the optional user facilities which are supported by NS X.25. Note that certain facilities may be requested by DTE on a per-call basis. Facilities of this type are marked with an asterisk.

TABLE 1-1. NS X.25 OPTIONAL USER FACILITIES

CCITT X.25 REFERENCE NUMBER	FACILITY NAME	NS X.25 IMPLEMENTATION
7.2.2	FLOW CONTROL PARAMETER NEGOTIATION*	Window sizes 1 to 7. Packet sizes 16 to 1024 bytes.
7.2.3	THROUGHPUT CLASS NEGOTIATION*	Values indicated in CALL REQUEST/INCOMING CALL or in CALL ACCEPTED/CONNECTED packets are accepted. Possible values: 7 to 13 (i.e. 1200 to 57600 bits per second).
7.1.5	INCOMING CALLS BARRED OUTGOING CALLS BARRED	Supported. Supported.
7.1.7	ONE-WAY LOGICAL CHANNEL OUTGOING ONE-WAY LOGICAL CHANNEL INCOMING	Supported. Supported.
7.1.9	CLOSED USER GROUP (CUG)*	CUG numbers are inserted in CALL REQUEST/INCOMING CALL packets.
7.1.16	REVERSE CHARGING*	Supported.
7.1.17	REVERSE CHARGING ACCEPTANCE	Supported.
7.2.1	NONSTANDARD DEFAULT PACKET SIZES	Values from 4 to 10 are supported (16 to 1024 bytes).
7.1.2	NONSTANDARD DEFAULT WINDOW SIZES	Values selected for each direction of transmission may differ. All values from 1 to 7 are supported.

ADDITIONAL USER FACILITIES

NS X.25 offers an extra facility called local user groups. The local user group facility is similar to the closed group facility defined by the CCITT X.25 Recommendation. The local user group facility provides restricted access to and from remote hosts. There are two categories of local user groups - one for incoming calls and one for outgoing calls.

NS X.25 INSTALLATION AND SYSTEM CONFIGURATION

SECTION 2

The tasks associated with NS X.25 product installation are described in this section. To operate NS X.25, all the hardware and software components must be installed. You are responsible for performing the installation tasks outlined below, under Customer Installation Tasks. HP is responsible for performing the tasks listed under HP Representative Installation Tasks.

CUSTOMER INSTALLATION TASKS

You need to perform two tasks to prepare your system for the addition of NS X.25 before your HP representative arrives. You must:

- Install the physical link(s) to the network(s) which will be accessed. You may need to install modems and/or telephone lines, depending on the network requirements. Refer to Section 3 "Network Planning and Configuration" in the *NS3000/V Network Manager Reference Manual, Volume I* for information on network requirements.

- Perform a full system back-up.

HP REPRESENTATIVE INSTALLATION TASKS

Your HP representative will perform the following installation tasks:

- Install the product hardware (i.e. the INP board and the appropriate cable).
- Add product hardware characteristics to the I/O configuration file.
- Install the product software.

Each of these tasks is briefly discussed in the pages that follow.

Hardware Installation

One dedicated INP board and the appropriate cable (i.e. a synchronous modem cable, a high-speed digital cable, or a direct connect interface cable) is needed for each physical link to the public or private data network, or to another host. The INP board should be installed by your HP representative.

I/O Configuration

NS X.25 characteristics need to be added to the I/O configuration file. A new device driver and multiple virtual terminals must be specified. Also, PAD terminals and PAD printers need to be added to the I/O configuration file. The INP is the communications device used by NS X.25. An X.25 device driver (IOINP1) must be configured for every INP board in your system.

Virtual terminals (IOVTERM0) are configured in pools. You need to configure as many virtual terminals as are needed for concurrent access over all the NS links installed. Also, configure enough PAD devices (IOPADTRM for terminals and IOPADLP for printers) for your data communications needs.

These product specific characteristics are added to the I/O configuration file by way of the SYSDUMP dialogue. When you enter SYSDUMP, you are asked a series of questions. Your answers provide the information required by MPE for the I/O configuration of each device as well as general system configuration.

What follows is a sample SYSDUMP dialogue with the responses you might use to modify an existing I/O configuration file for an X.25 NI. Updates to IOINP1, IOVTERM0, IOPADTRM and IOPADLP are shown. Additionally, a sample configuration is listed for your reference.

Sample Dialogue - IOINP1/Device Driver

The SYSDUMP dialogue begins as listed below. Prompts are shown on the left and recommended responses are underlined and/or explained on the right.

:SYSDUMP	
ANY CHANGES?	YES
SYSTEM ID = HP32033v.uu.ff?	RETURN
MEMORY SIZE=nnnn (MIN=nnn,MAX=nnnn)?	RETURN
I/O CONFIGURATION CHANGES?	YES
LIST I/O DEVICES?	Enter YES to print a listing of the current I/O configuration. Enter NO or RETURN to continue.
LIST CS DEVICES?	Enter YES to print a listing of all the CS devices currently configured. Enter NO or RETURN to continue.
LIST DEVICE DEFAULTS?	RETURN
HIGHEST DRT=nnn (MIN=mm,MAX=ppp)?	Check to see if the value listed here as nnn is large enough to include all the data communications devices you are going to configure.
LOGICAL DEVICE #?	To specify the device to be added or removed, enter the logical device number (ldev) unique to that device.
DEVICE NAME?	RETURN
DRT #?	If adding a device, enter its Device Reference Table (DRT) entry number (assigned by the HP customer engineer).
UNIT #?	0
SOFTWARE CHANNEL #	0
TYPE?	17 (= INP device driver).
SUBTYPE?	Enter 1 or 3 where: 1 = non-switched line with modem cable/modem eliminator cable. 3 = hardwired line, synchronous transmission. The value entered here will be overridden by the value entered when you configure your link with NMMGR.

RECEIVE TIMEOUT?	RETURN **Default:** 20 *(Do not enter 0.)*
LOCAL TIMEOUT?	RETURN **Default:** 20 **Range:** 5-900 seconds; 0 disables the timer.
CONNECT TIMEOUT?	120 for Subtype 1 and 3. **Default:** 900 **Range:** 60-900 seconds; 0 disables the timer. The value entered here will be overridden by the value entered when you configure your link with NMMGR.
DUAL SPEED? (Subtype 1 only)	Enter YES if the local modem is dual speed (European models). Enter NO if it is single speed. A NO response causes the next step to be skipped.
HALF SPEED? (Subtype 1 only)	Enter YES if the local modem is to operate at half speed. Enter NO if it is to operate at full speed.
SPEED CHANGEABLE?	Enter YES to allow the speed of the line to be changeable.
TRANSMISSION SPEED?	Enter the transmission speed of the line in characters per second (Bit Rate/8). The value entered here will be overridden by the value entered when you configure your link with NMMGR. **Default:** The speed specified is ignored for connections with modems that provide internal clocking signals. For all other connections, the speed you specify becomes the default. The value entered here will be overridden by the value entered when you configure your link with NMMGR. **Speeds:** 150, 300, 600, 900, 1200, 2400, 4800, 7000
TRANSMISSION MODE?	For NS links, always enter 0.
PREFERRED BUFFER SIZE?	1024 words. The value entered here will be overridden by the value entered when you configure your link with NMMGR.
DRIVER CHANGEABLE?	NO
DRIVER OPTIONS?	0
DRIVER NAME?	IOINP1 For NS X.25, the driver name must be IOINP1.

```
DEVICE CLASSES?                    NSINP
```

Sample Dialogue - IOVTERM0/Virtual Terminals

The SYSDUMP dialogue begins as listed below. Prompts are shown on the left and recommended responses are underlined and/or explained on the right.

:SYSDUMP	
ANY CHANGES?	YES
SYSTEM ID = HP32033v.uu.ff?	RETURN
MEMORY SIZE=nnnn (MIN=nnn,MAX=nnnn)?	RETURN
I/O CONFIGURATION CHANGES?	YES
LIST I/O DEVICES?	Enter YES to print a listing of the current I/O configuration. Enter NO or RETURN to continue.
LIST CS DEVICES?	Enter YES to print a listing of all the CS devices currently configured. Enter NO or RETURN to continue.
LIST DEVICE DEFAULTS?	RETURN
HIGHEST DRT=nnn (MIN=mm,MAX=ppp)?	Check to see if the value listed here as nnn is large enough to include all the data communications devices you are going to configure.
LOGICAL DEVICE #?	To specify a device to be added or removed, enter the logical device number (ldev) of that device.
DEVICE NAME?	RETURN
DRT #?	For NS X.25 links, you must back reference the system console (i.e. # followed by the ldev number of the console).
UNIT #?	0
SOFTWARE CHANNEL #?	0
TYPE?	16
SUBTYPE?	Enter 0 in all cases.
ENTER [TERM TYPE #], [DESCRIPTOR FILENAME] ?	0
SPEED IN CHARACTERS PER SECOND?	0
RECORD WIDTH?	40

OUTPUT DEVICE?	Enter the same ldev as the LOGICAL DEVICE # requested above.
ACCEPT JOBS/SESSIONS?	YES
ACCEPT DATA?	NO
INTERACTIVE?	YES
DUPLICATIVE?	YES
INITIALLY SPOOLED?	NO
AUTO REPLY?	NO
DRIVER NAME?	IOVTERM0
DEVICE CLASSES?	**Enter the device class VTERM for each configured IOVTERM0 virtual terminal.**

Sample Dialogue - IOPADTRM and IOPADLP/PAD Devices

The SYSDUMP dialogue begins as listed below. Prompts are shown on the left and recommended responses are underlined and/or explained on the right. Most of the information given in the PAD dialogue below applies to both PAD terminals and PAD printers. Where differences exist between terminals and printers, they are stated.

NOTE

For NS X.25, PAD devices are back-referenced to the LDEV of the console, not the LDEV of the INP.

:SYSDUMP	
ANY CHANGES?	YES
SYSTEM ID = HP32033v.uu.ff?	RETURN
MEMORY SIZE=nnnn (MIN=nnn,MAX=nnnn)?	RETURN
I/O CONFIGURATION CHANGES?	YES
LIST I/O DEVICES?	Enter YES to print a listing of the current I/O configuration. Enter NO or RETURN to continue.
LIST CS DEVICES?	Enter YES to print a listing of all the CS devices currently configured. Enter NO or RETURN to continue.
LIST DEVICE DEFAULTS?	RETURN
HIGHEST DRT=nnn (MIN=mm,MAX=ppp)?	Check to see if the value listed here as nnn is large enough to include all the data communications devices you are going to configure.
LOGICAL DEVICE #?	To specify a device to be added or removed, enter the logical device number (LDEV) of that device.
DEVICE NAME?	RETURN
DRT #?	Enter the LDEV number of the console, preceded by a pound sign (#). To remove a device, enter 0; the dialogue returns to the LOGICAL DEVICE #? prompt.
UNIT #?	0
SOFTWARE CHANNEL #?	0
TYPE?	Enter 16 for terminals, 32 for printers.

SUBTYPE?	Enter 0 for terminal LDEVs designated for both incoming and outgoing calls; enter 1 for terminal LDEVs designated for outgoing calls only. For LDEVs assigned to printers, enter 14.
ENTER [TERM TYPE #], [DESCRIPTOR FILENAME] ?	Enter 24 for terminals; 18 or 26 for printers.
SPEED IN CHARACTERS PER SECOND?	Enter 0. **Default:** 240.
RECORD WIDTH?	40 for terminals; 66 for printers.
OUTPUT DEVICE?	For terminals, enter the same LDEV as the LOGICAL DEVICE # requested above. For printers, enter 0.
ACCEPT JOBS/SESSIONS?	YES for terminals; NO for printers.
ACCEPT DATA?	NO for terminals; NO for printers.
INTERACTIVE?	YES for terminals; NO for printers.
DUPLICATIVE?	YES for terminals; NO for printers.
INITIALLY SPOOLED?	NO
AUTO REPLY?	NO
DRIVER NAME?	Enter the appropriate name: IOPADTRM for PAD terminal IOPADLP for PAD printer
DEVICE CLASSES?	The usage of device class names is optional for PAD. If you wish to use device class names, you may want to use PADTERM for terminals and PADLP for printers.

Sample Configuration

LOG DEV #	DRT #	UNIT	CHAN	TYPE	SUB TYPE	TERMINAL TYPE	TERMINAL SPEED	REC WIDTH	OUTPUT DEV	MODE	DRIVER NAME	DEVICE CLASS ES
1	33	0	0	3	5			128	0		HIOMDSC2	DISC SPOOL SYSDISC
2	34	0	0	3	5			128	0		HIOMDSC2	DISC
6	40	0	0	32	4			66	0	S	HIOLPRT0	LP
7	35	0	0	3	3			128	0	R	HIOCTAP1	CTAPE SDISC
8	38	0	0	24	2			128	0	R	HIOTAPE2	TAPE
10	37	0	0	24	0			128	LP	JA	HIOTAPE0	JOBTAPE
11	39	0	0	32	8			66	0	S	HIOPPRT0	EPOC PP LASER
20	8	0	0	16	0	10	1920	40	20	JAID	HIOTERM1	TERM CONSOLE
21	8	1	0	16	0	10	960	40	21	JAID	HIOTERM1	TERM
22	8	2	0	16	0	10	960	40	22	JAID	HIOTERM1	TERM
23	8	3	0	16	0	10	960	40	23	JAID	HIOTERM1	TERM
24	8	4	0	16	0	10	960	40	24	JAID	HIOTERM1	TERM
25	8	5	0	16	0	10	960	40	25	JAID	HIOTERM1	TERM
26	8	6	0	16	0	10	960	40	26	JAID	HIOTERM1	TERM
27	8	7	0	16	0	10	960	40	27	JAID	HIOTERM1	TERM
100	36	0	0	17	1			0	0		IOINP1	NSINP
101#20		0	0	16	0	??	240	40	101	J ID	IOVTERM0	VTERM
102#20		0	0	16	0	??	240	40	102	J ID	IOVTERM0	VTERM
133#20		0	0	16	1	24	240	40	133	J ID	IOPADTRM	PADTERM
134#20		0	0	16	0	24	240	40	134	J ID	IOPADTRM	PADTERM
135#20		0	0	32	14	18	240	66	0		IOPADLP	PADLP
136#20		0	0	32	14	26	240	66	0		IOPADLP	PADLP

Software Installation

The software installation requirements for NS X.25 are the same as those for all the NS3000/V network links. These installation requirements are discussed in Section 4 "System Configuration" in the *NS3000/V Network Manager Reference Manual, Volume 1.* Refer to that manual for detailed information on software installation requirements. For the purpose of this summary, we are assuming concurrent operation of NS X.25 and NS3000/V.

NOTE

The system must have a minimum of two megabytes of memory and the Expanded System Table Microcode. Systems that are now memory-limited must add one megabyte to maintain current performance.

Before you activate NS X.25, you should check the limits in your system tables. The following guidelines indicate what the entries should be for the Code Segment Table (CST), the Data Segment Table (DST), the Process Control Block Table (PCB), and the I/O Queue Table (IOQ). For a more complete explanation of these settings and for the meanings of the items in italics refer to Section 4 "System Configuration" in the *NS3000/V Network Manager Reference Manual, Volume 1.*

For NS X.25:

CST: 54
DST: 4

For NS3000/V:

CST: 40
DST: 7 + (3 * *NumConn)*
PCB: 1 + *NumConn*
IOQ: 0

In addition, if you do not already have DS/3000:

CST: 21
DST: 2 + (3 * *NumLinks*) + *NumPad&Terms* + *NumSess* + *NumDSlines*
PCB: *NumLinks*
IOQ: 5 + *NumSess*

The following system parameters are recommended for NS3000/V and NS X.25:

Interrupt Control Stack: Increase to 2048 words for the Series 4X. Increase to 4096 words for the Series 6X.

Virtual Memory: Configure an additional 30K sectors of virtual memory. This may need to be increased if the number of TCP connections is more than the HP recommended value (32).

Maximum Number of Concurrent Running Programs: Increase to at least 20.

Maximum Code Segment Size: Increase to 16834 words.

Loader Segment Table Size: Increase to 32700 words.

Maximum Stack Size: Increase to 31232 words.

Maximum Extra Data Segment Size: Increase to 32764 words.

NS X.25 NODE CONFIGURATION

SECTION 3

After you have installed the product hardware and software (as described in Section 2), you must configure the NS X.25 Link to operate in accordance with the network's requirements. The following section provides step-by-step instructions that will enable you to configure a node for X.25 communications. However, before you configure your NS node, you must:

- Complete the Configuration Worksheets (see Appendix B).
- Run SYSDUMP to obtain a listing of the I/O configuration for your system.
- Obtain a copy of the PDN subscription, or
- Obtain a copy of the private PSN X.25 configuration parameters.

If you need detailed reference material or examples, please refer to Section 3 "Network Planning and Configuration" and Section 5 "The NMS Configurator (NMMGR)" in the *NS3000/V Network Manager Reference Manual, Volume 1.*

CONFIGURATION OVERVIEW

NOTE

From the perspective of the HP 3000, each port on an HP 2334A is considered a node and must be configured accordingly. Therefore, generic references to *node* in this section also apply to PAD terminals and printers connected to an HP 2334A that will be accessed by outgoing calls from a remote HP 3000.

Most of the configuration information required for the operation of the NS X.25 Link is contained in two files. The default names for these files are NSDIR.NET.SYS and NSCONF.NET.SYS. You can rename the NSCONF.NET.SYS file but the file name you specify must be in the group NET of the account SYS.

Each node must have a network directory file called NSDIR.NET.SYS. The network directory file lists the NS Node Names and IP Addresses for all the nodes on the network. A network directory file is analogous to a telephone directory. A telephone directory contains the names and addresses of persons who live within the vicinity, just as the network directory file contains the names and addresses of the nodes on the network.

The network configuration file, called NSCONF.NET.SYS, defines a node's interface to the network. Specifically, the file contains routing information that is essential to a network. The routing information defines the path from node to node. The configuration file's function parallels a street map's function. If you know who you need to talk to and you have their address, you can use a street map to show you how to get from your location to your destination. The network configuration file acts as a map to the location of nodes on the network.

You enter the information contained in the above two files through the use of the Node Management Services Configuration Manager (NMMGR). NMMGR is a utility program that presents a series of

VPLUS/3000 block-mode screens that display and accept configuration information to create or update the network directory file and/or the network configuration file.

There are two ways to configure your network through NMMGR. The first, called Manual Network Interface Configuration, makes use of the entire configuration interface. The second, called Guided Network Interface Configuration, presents a reduced set of screens that require minimal data entry.

Manual Network Interface Configuration is used for detailed configuration tasks. An example of such a task would be to modify a specific value in an existing configuration file. This process is more suited to the experienced user. For detailed information on manual configuration, please refer to Section 5 "The NMS Configurator (NMMGR)" in the *NS3000/V Network Manager Reference Manual, Volume I.*

You should use Guided Network Interface Configuration to create the network configuration file (NSCONF.NET.SYS) when you are defining a node's X.25 configuration for the first time. The program will lead you through the necessary screens and supply default values for many of the parameters.

This section documents the guided configuration process. Specifically, this section describes the simplest methods for:

- Using Guided Network Interface Configuration.
- Creating the network directory file (NSDIR.NET.SYS).

Note that the network directory file (NSDIR.NET.SYS) cannot be created or modified by way of guided configuration. Information for creating or modifying the network directory file appears later in this section. It is assumed that you are already familiar with the general operation of NMMGR. If you are not, please refer to the *NS3000/V Network Manager Reference Manual, Volume I.*

Leaving NMMGR Without Saving Configuration Information

If you find it necessary to leave NMMGR before the configuration process is complete, type EXIT on the command line, and then press [ENTER]. The program will warn you that you are in the middle of guided configuration. Press [TAB] to move the cursor back to the Command field. You will need to type the EXIT command and press [ENTER] a second time, if you still want to abandon the configuration process.

GUIDED NETWORK INTERFACE CONFIGURATION

The guided configuration program has two branches. The branch you use will depend on your task. One branch is called NETXPORT CONFIGURATION. This branch allows you to create or modify a network configuration file (NSCONF.NET.SYS). The other branch is titled ONLINE MODIFICATION.

The guided configuration program assumes certain default values for most of the configuration data required; however, you will be prompted to provide required information in some fields. The fields for which you must supply values are listed in the Configuration Worksheets. Remember, you must complete the worksheets before beginning the configuration process. See Appendix B for the sample worksheets.

The first step in the guided configuration process is to reach the Guided Network Interface Configuration screens. To reach these screens, perform the following steps.

Step 1

Issue the run command for NMMGR. To do this type RUN NMMGR.PUB.SYS at the MPE/V prompt (:), and then press (RETURN). You must have network manager (NM) and network administrator (NA) capability to run this program.

Step 2

The OPEN CONFIGURATION/DIRECTORY FILE screen is displayed. Type the name of the network configuration file you want to create or update in the Configuration file name field. The file name you specify must be in the group NET of the account SYS. Remember though, the file name NSCONF.NET.SYS is the default name expected by the Network Transport Software. After you finish typing the file name, press the appropriate soft key, either OPEN CONFIG (f1) or CREATE CONFIG (f2).

Step 3

The MAIN screen is displayed. Press Go To Guided (f3).

Step 4

The GUIDED SUBSYSTEM CONFIGURATION screen is displayed. Press Go To NET CONF (f1).

Step 5

The GUIDED NETWORK INTERFACE CONFIGURATION screen is displayed. Type the Network Interface Name (NI) in the Network Interface Name field. Use the same network name you specified in your Configuration Worksheets. Then press Go To X.25 (f5).

You will now be guided automatically, in a forward sequence, through the screens that require data entry for this configuration. The guided configuration program will supply default values in many of the fields. You will need to enter information in the remaining fields, as specified in your Configuration Worksheets.

The following steps show the sequence of screens the guided configuration program will take you through. You will only be able to move forward, since Prior Screen (f8) is disabled. If the node was previously configured, not all of the screens will appear, as noted in the explanation of that screen.

Step 6

The NODE NAME CONFIGURATION screen is displayed. Here, you need to assign a local NS Node Name. Use *nodename.domain.organization*, where the node name you choose will identify only your local X.25 node. After you have typed the node name in the Local NS Node Name field, press Update Data (f6).

NOTE

If this node has already been configured for a different network (i.e. a LAN or router network), then this screen will not be displayed.

Step 7

The LINK CONFIGURATION screen is displayed. The default link name, LAPBLINK, appears in the Link Name field. The default link type, LAPB, appears in the Types: field. These values are the correct values for X.25. Press Add (f5) to add them to the file.

NOTE

If LAPBLINK has been specified as the link name for a separate network, choose an alternative link name. The link name you use can be up to eight characters. The type for the X.25 link must be LAPB in all instances.

Step 8

The LINK CONFIGURATION: LAPB DATA screen is displayed. You are asked to enter the logical device number of the NS INP. Refer to your SYSDUMP listing for the logical device number of the NS INP. You must also select a local mode value (5=DTE or 6=DCE). If you are transmitting over a PDN (Public Data Network), you must specify 5. Finally, verify that the LAP-B parameter values entered on this screen match your subscription values. After you have entered and verified the information for this screen, press Update Data (f6).

Step 9

The GENERAL X.25 screen is displayed. If you are transmitting over a PDN, you must use X.25-PDN as the network name. Press TAB to move the cursor to the Local X.25 Address Key field and enter the local X.25 address key. You should use the "node" part of your local node name as the local X.25 address key. For example, if *tiger.d.o* is your local node name, then you would specify *tiger* as the local X.25 address key. When you have entered the local X.25 address key, press Update Data (f6). You will automatically be moved to the next screen.

Step 10

The X.25 LOCAL ADDRESS & VIRTUAL CIRCUIT ASSIGNMENT screen is displayed. Press TAB to move the cursor to the Local X.25 Node Address field and enter your local X.25 node address. Additionally, you need to enter the lowest and highest values for the Two-Way Switched Virtual Circuits (SVC), as specified by your subscription. Press TAB to move the cursor to the Two-Way Switched Virtual Circuits (SVC) field. After you have made these additions, verify that the values you entered match the subscription values. Press Update Data (f6).

Step 11

The X.25 NETWORK & FLOW CONTROL PARAMETERS screen is displayed. If you are transmitting over a PDN, the default value 1 will be displayed in the X.25 Packet Level field. You need to check the Default Values for Flow Control Parameters against the subscription values. These values must match. Press Update Data (f6).

Step 12

The X.25 USER FACILITIES SETS screen is displayed. The following default values should be listed in the Name and Type fields: PADFSET SVC, POOLFSET SVC, STDPFSET PVC, STDSFSET SVC. These are the settings that need to be used for a PDN network. Press Next Screen (f8).

NOTE

On the X.25 USER FACILITIES SETS screen, you can either accept the displayed user facility set or modify the user facility set to match your subscription service. If your network is not a PDN, you should change the values in these fields to match the values specified in your subscription service.

Step 13

The X.25 SVC ADDRESS KEY PATHS screen is displayed. Type your X.25 address key in the X.25 Address Key field. Press TAB to move the cursor to the X.25 Address field; type your local X.25 node address. Press TAB to move the cursor to the Default Facility Set field; type STDSFSET. (For PAD, type PADFSET if you will accept reverse charging; otherwise type STDFSET. Also, if you wish to accept incoming calls from all PADs, you can type PAD in the X.25 Address Key field and enter all zeroes in the X.25 Address field.) You must add this information for every X.25 node on your IP network. You can enter this information all at once, up to the limit on the screen. After you have entered all the required values for each node, verify that the addresses you entered are correct and the same as those on your Configuration Worksheets. Press Update Data (f6). Press Next Screen (f8) to move to the next screen.

Step 14

The IP PROTOCOL CONFIGURATION screen is displayed. Enter the IP address from your configuration worksheets for the X.25 NI you are configuring in the IP Internet Address field. Press Update Data (f6).

Step 15

The NEIGHBOR GATEWAYS screen is displayed. If your network is an intranet network, (as opposed to an internet network) press Next Screen (f8). This will bring you to the the VALIDATE CONFIGURATION FILE screen (see Step 17 below).

If your network is an internet network, you must enter the gateway node name in the Gateway Name field. The gateway node name should reflect the NS node name of the gateway you wish to use between this node (X.25) and a node on another IP network (i.e. LAN or router network). After you have typed the gateway node name in the Gateway Name field, press Add (f5) to add the gateway node name to the network.

Step 16

The NEIGHBOR GATEWAY REACHABLE NODES screen is displayed. Type the gateway IP address in the Neighbor Gateway IP Internet Address field. The cursor is automatically forwarded to the IP Network Address field; type the IP network number for the reachable network. The cursor is automatically forwarded to the Hops field; type the number of hops necessary to reach the remote network. Press Update Data (f6) then press Next Screen (f8). This will bring you back to the NEIGHBOR GATEWAYS screen. If you need to add other gateways, repeat Step 15 and Step 16. Otherwise, press Next Screen (f8) to go to Step 17.

Step 17

The VALIDATE CONFIGURATION FILE screen is displayed. To check for inconsistencies between the values you entered in the network configuration file and the values on your Configuration Worksheets, press Validate NETXPORT (f1). Press RETURN when you are finished viewing the screen's content. Use the TAB key to move the cursor to the Command field. Type EXIT and then press ENTER.

If you found errors in the network configuration file, refer to Section 5 "The NMS Configurator (NMMGR)" in the *NS3000/V Network Manager Reference Manual, Volume 1* for instructions on using direct branching. Direct branching is a facility that will allow you to modify specific values in the network configuration file.

You have completed the process for creating the network configuration file (NSCONF.NET.SYS). You now need to create the network directory file (NSDIR.NET.SYS).

NOTE

For PAD access on outgoing calls, an additional screen is required. This screen can be accessed using manual configuration only, not through guided configuration. This screen contains LDEV-to-nodename mapping information. Section 5 includes a detailed explanation of the LDEV-to-nodename mapping scheme. Appendix C, which contains configuration worksheets, includes a worksheet for you to list LDEVs and their corresponding nodenames.

CREATING THE NETWORK DIRECTORY FILE

Every node on an X.25 network must have a network directory file. The file, in all instances, must be called NSDIR.NET.SYS. The network directory file lists the NS Node Names and IP Addresses for all the nodes on the network.

You create the network directory file by running the NMMGR program and providing, when prompted, essential information. But, before you create the network directory file you must complete the Configuration Worksheets (see Appendix C). You will refer to these worksheets while using NMMGR to create your network directory file.

NMMGR can be used to both create a network directory file and to update an existing network directory file. What follows is a step-by-step procedure for creating a network directory file (NSDIR.NET.SYS). If you wish to update an existing network directory file, or need detailed information on manual configuration, refer to the Network Directory section in the *NS3000/V Network Manager Reference Manual, Volume I.*

Step 1

Issue the run command for NMMGR. To do this type RUN NMMGR.PUB.SYS at the MPE/V prompt (:), and then press [RETURN]. You must have network manager (NM) and network administrator (NA) capability.

Step 2

The OPEN CONFIGURATION/DIRECTORY FILE screen is displayed. Press the appropriate function key, either Create Directory ([f4]) or Open Directory ([f3]).

Step 3

The NETWORK DIRECTORY MAIN screen is displayed. This is the main directory screen from which all directory functions are accessed. Press UPDATE Dir ([f1]) to begin constructing the network directory file.

Step 4

The NETWORK DIRECTORY SELECT NODE NAME screen is displayed. On this screen, you add the node name of the nodes on your network to the network directory file, one node at a time. There are line numbers on the screen next to each Node Name. Type the line number of the Node Name field that will contain this node's name after it has been added to the network directory file. Press [TAB] to move the cursor to the New Node Name field and enter the node name of the X.25 NI you are configuring. Press ADD ([f5]) to add the listed node name to the network directory file. Remember that PAD devices accessed by outgoing calls are also considered nodes and should be listed in your worksheets.

Step 5

The NETWORK DIRECTORY DATA screen is displayed. On this screen, you must enter the path report data for the node whose name appears in the Node Name field. Type the IP address in the IP Address field for the node listed in the Node Name field. The cursor will automatically move to the Type* field; enter 3 to specify the type for an X.25 node. The cursor will automatically move to the Additional Address field; type the X.25 address key for the node listed in the Node Name field. Remember, you can refer to your Configuration Worksheets for this data. After you have entered the path report data for the node listed in the Node Name field, press Update Data ([f6]). (For each PAD device, the value

configured here maps to a real X.25 address configured for the HP 2334A port to which the PAD device is connected.)

You will need to repeat Step 4 and Step 5 for every node you want to add to the network directory file (NSDIR.NET.SYS). If you need to add more nodes to the network directory file, press Prior Screen ([f8]) to return to the NETWORK DIRECTORY SELECT NODE NAME screen. After you have added the node names and the path report data to the network directory file, press [TAB] to move the cursor to the Command field. Type EXIT, and then press [ENTER].

NOTE

When specifying path report data for an NS LAN node or a Router node, the Type must be 1 with an Additional Address of NONE. When specifying path report data for an X.25 node, including PAD devices accessed by outgoing calls, the Type will be 3 and the Additional Address will be the X.25 address key you specified in your network configuration file (NSCONF.NET.SYS).

You have now created the network directory file (NSDIR.NET.SYS).

LOGGING CONFIGURATION

Logging can be used for many purposes. For instance, it can be used to record events such as errors and console commands. It can also be used to examine the behavior of a node.

Logging is automatically enabled for the network transport (Subsystem 3) when you create the network configuration file (NSCONF.NET.SYS) in Guided Network Interface Configuration. HP recommends that you temporarily enable Class 5 when you have created or updated the network configuration file. This is advisable because X.25 packet exchanges are logged in Subsystem 3 and Class 5 of the network configuration file. While these are enabled, you can examine the X.25 behavior of a node.

In addition, for PAD support logging, you can enable Network Services (Subsystem 6), classes 2, 3 and 5 in the NMCONFIG.PUB.SYS configuration file. You can also enable Class 4 for detailed logging.

Once you have verified that the X.25 connection works, you should disable Class 5 of Subsystem 3 and Class 4 of Subsystem 6. By disabling these classes, you will prevent excessive console and/or disc logging messages. For more information on logging, and instructions on logging configuration modification, refer to the Logging Configuration section in the *NS3000/V Network Manager Reference Manual, Volume I.*

NS X.25 PRINCIPLES OF OPERATION

SECTION 4

This section shows examples of the commands used for:

- Starting NS X.25.
- Opening a connection.
- Using an existing X.25 connection.
- Closing an existing X.25 connection.
- Shutting down an X.25 network.

It also explains the function of these commands and their accompanying logging messages.

STARTING NS X.25

You start NS X.25 by entering a sequence of two commands, NETCONTROL START and NSCONTROL START, at the MPE prompt (:). The example below shows a typical start-up procedure, with NS logging classes 1 to 5 enabled for on-line display. It assumes that the configuration is valid, that the INP board, the connection cable, and the network are functioning, and that no previous commands have been issued.

Both the commands and the logging messages are shown as they would appear on your console. To clarify the meaning of specific commands and messages, line numbers have been assigned which correspond to the numbered explanations that follow in the example. The line numbers are shown in parentheses to the left of the associated lines.

Example

```
(1)  :NETCONTROL START;NET=X25NET

(2)  ** NETXPORT Control Process; Transport start
     - Loc: 50; Class: 4; Parm= %000030; PIN: 24

(3)  ** NETXPORT TCP SIP; General protocol start
     - Loc: 10; Class: 4; Parm= %000000; PortID: %000231 %026127
     ** NETXPORT PXP SIP; General protocol start
     - Loc: 8; Class: 4; Parm= %000000; PortID: %000231 %026175
     ** NETXPORT IP Update; General protocol start
     - Loc: 3; Class: 4; Parm= %000000; PortID: %000231 %026243
     ** NETXPORT PXP; PM activated
     - Loc: 6; Class: 5; Parm= %000000; PortID: %000241 %000036

(4)  ** NETXPORT X.25 NI; Network interface start
     - Loc: 78; Class: 4; Parm= %000000; PortID: %000252 %002320

(5)  ** NETXPORT IP; Protocol start
     - Loc: 102; Class: 4; Parm= %000000; PortID: %000252 %002366

(6)  ** NETXPORT X.25; Protocol start
```

```
     - Loc: 5018; Class: 4; Parm= %000022; PortID: %000252 %002434

(7)  ** NETXPORT X.25; RESTART sent
     - Loc: 721; Class: 5; Parm= %000000; PortID: %000252 %002434

     ** NETXPORT X.25; CAUSE/DIAG codes
     - Loc: 721; Class: 5; Parm= %000000; PortID: %000252 %002434

(8)  ** NETXPORT Control Process : STATIC UPDATE; Update
     - Loc: 167; Class: 5; Parm= %000000; PortID: %000231 %026061

(9)  ** NETXPORT X.25; RESTART received
     - Loc: 754; Class: 5; Parm= %000000; PortID: %000252 %002434

     ** NETXPORT X.25; CAUSE/DIAG codes
     - Loc: 754; Class: 5; Parm= %003631; PortID: %000252 %002434

(10)  ** NETXPORT X.25; PM activated
     - Loc: 754; Class: 4; Parm= %000000; PortID: %000252 %002434

(11)  :NSCONTROL START,NET=X25NET1

(12) NSSTATL NETWORK SERVICE STARTED.
     NSSTAT NETWORK SERVICE STARTED.
     HDSPNS NETWORK SERVICE STARTED.
     PDS NETWORK SERVICE STARTED.
     LOOPBACK NETWORK SERVICE STARTED.
     RPML NETWORK SERVICE STARTED.
     RPM NETWORK SERVICE STARTED.
     PTOPL NETWORK SERVICE STARTED.
     PTOP NETWORK SERVICE STARTED.
     RFAL NETWORK SERVICE STARTED.
     RFA NETWORK SERVICE STARTED.
     NFTL NETWORK SERVICE STARTED.
     NFT NETWORK SERVICE STARTED.
     VTRL NETWORK SERVICE STARTED.
     VTR NETWORK SERVICE STARTED.
     VT NETWORK SERVICE STARTED.
     PADL NETWORK SERVICE STARTED ON NETWORK X25NET1.
     PAD NETWORK SERVICE STARTED ON NETWORK X25NET1.
```

Explanation

1) A user with network manager (NM) capability types the NETCONTROL START command at the MPE prompt (:). The required network interface (NI) name is identified in the NET parameter. In this example, the name X25NET is configured to identify an X.25 NI. Because a configuration file is not specified, the network transport control process reads the NSCONF.NET.SYS file for the required configuration data.

2) Command syntax is checked and verified. In this example, the network transport is inactive so the control process is awakened, as indicated in this message. The NSCONF.NET.SYS file is read and validated.

3) The control process starts the transport general protocols (transmission control protocol [TCP] packet exchange protocol [PXP], and internet protocol update [IPU]). Configuration values for these protocols are read from the NSCONF.NET.SYS file and they are stored for later use. As Level 4 entities, TCP and PXP are used by every NI defined for the node. IPU routes the store and forward messages between NIs on the local node. The activated PXP protocol module message signifies that the NetIPC socket registry is opened. The user defined local node name, also defined for all NIs, is read from the NSCONF.NET.SYS file.

4) This message indicates that the X.25 NI called X25NET was located and is being started. Configuration data for the NI type X.25 known as X25NET is read from the NSCONF.NET.SYS file and is stored for later use. X25NET buffer ports are created and the data structure is initiated.

5) The IP module for X25NET is started. The local IP address for X25NET is read from the NSCONF.NET.SYS file and stored for future use.

6) Level 3 of X.25 is started. Configuration parameters (X.25) are read from NSCONF.NET.SYS and stored for later use and X.25 tables are initiated. The configuration parameters noted include DTE/DCE definition, flow control parameters, and virtual circuit allocation. The LAP-B code is downloaded from a disc file to the LAP-B firmware on the INP board. Level 2 operation is enabled. The NSDIR.NET.SYS file is read and path reports that match the local IP network are downloaded to the X25NET NI.

7) X.25 signals that it is sending a RESTART packet to initiate the DTE/DCE Level 3 interface. It assumes that Levels 2 and 1 are present; that is, that LAP-B has completed the download to the INP board. If they are not, an error will be detected. The X.25 cause and diagnostic codes encoded in the RESTART packet are displayed. PARM= %000000 indicates that DTE is restarting from shutdown.

8) Internet gateway information is detected for X25NET in the NSCONF.NET.SYS file. The gateway name is stored and will be used if an internet connection is requested.

9) A RESTART packet is received from the network. This indicates that Levels 1, 2, and 3 are ready on both the X25NET (DTE) side and the network (DCE) side. X.25 enters the packet level ready state. The cause and diagnostic codes in the incoming RESTART packet (PARM= %003631) indicate that the network is operational.

10) X.25 signals that it is ready to receive connection requests. Network transport and link initiation is complete. Programmatic access to Levels 3 and 4 is possible.

11) A user types the NSCONTROL START command at the MPE prompt (:), with the NET= parameter, to initialize the network services. Because no particular service is specified, all those found are started, including the PAD and PADL services on the network specified. The NET= parameter must be included in order to start the PAD and PADL services on specified networks.

12) In this example, all the NS services are installed. A message is displayed by each service.

OPENING A CONNECTION

The DSLINE and REMOTE commands are used to make a host-to-host connection using NS services. In the following example, a connection is being attempted for the first time. NS logging classes 1 to 5 have been enabled for on-line display. Both the command and the logging messages are presented as they would appear on your console. Subsequent requests to the same node may not display these messages. Line numbers shown in parentheses to the left correspond to the numbered explanations that follow.

Example

```
(1)  :DSLINE NODEA.DOMAIN.ORGANIZATION

(2)  ENVIRONMENT 1: NODEA.DOMAIN.ORGANIZATION

(3)  :REMOTE

(4)  ** NETXPORT TCP; PM activated
     - Loc: 3; Class: 5; Parm= %000000; PortID: %000271 %000036

(5)  ** NETXPORT X.25; CALL sent
     - Loc: 723; Class: 5; Parm= %000010; PortID: %000252 %002434

(6)  ** NETXPORT X.25; CALL CONF received
     - Loc: 865; Class: 5; Parm= %000010; PortID: %000252 %002434

(7)  ** NETXPORT X.25; VC opened
     - Loc: 865; Class: 5; Parm= %000010; PortID: %000252 %002434

(8)  NODEA#
```

Explanation

1) A user types the DSLINE command with the name of the requested node (NODEA.DOMAIN.ORGANIZATION) at the MPE prompt (:). In this example, the fully qualified NS node name is shown. The domain and organization portions only need to be supplied if the remote node specified is not in the same domain and organization as the local node. The name, NODEA, is looked up in the local node's network directory file. Note that the X.25 call packet is not sent at this point.

2) A path report for NODEA is found in the local node's network directory file (NSDIR.NET.SYS) and an environment is established for the remote node.

3) The user types the REMOTE command at the MPE prompt (:) to signal a connection request to the remote node (NODEA). The request is passed to the NS transport using the path report for NODEA, which consists of the NS node name, the IP address, and an additional address (i.e. the X.25 address key). The NS transport attempts to establish an outgoing path to NODEA, resolving

intranet and/or internet questions by referring to user supplied configuration data in the NSCONF.NET.SYS file.

For intranet requests, the X.25 address key is used to find the X.25 address and the facility set to be used for the call. For internet connections, the local node needs three addresses to define the intranet and internet path to the remote node. These include the IP address for the destination node, the IP address of the X.25 NI on the gateway node, and the X.25 address of the gateway node.

4) A TCP protocol module is initiated and tied to the user. The TCP protocol module will attempt to communicate with the remote TCP protocol module once the X.25 virtual circuit is established.

5) The local node sends a connection request (REMOTE) to NODEA. The logging message indicates that X.25 is sending a call request packet. The logical channel number (LCN) is displayed in the PARM= %000010, octal 10 decimal 8.

Note, that if configured, the outgoing local user group (LUG) can prevent a call from being sent. The configuration default is a disabled outgoing LUG, whereby calls may be made to all X.25 addresses in the SVC Path Table. Refer to the X.25 Network Interface Configuration section in the *NS3000/V Network Manager Reference Manual, Volume I.*

6) The remote node (NODEA) confirms the call request. We know this because a call confirmation packet is received on LCN 8 (PARM= %000010). This message confirms that the remote node is ready to accept the upper level (TCP/IP) connection request. The called X.25 address is found in the remote NSCONF.NET.SYS file. The called address is mapped to both an X.25 address key and a facilities set at the remote node. Note that if the remote incoming LUG has been enabled, the calling address was found.

7) NS X.25 establishes a virtual circuit (VC) to the remote node. Both the local node and the remote node are ready to exchange data. TCP/IP packets are first exchanged and then user data is exchanged.

8) The source and destination IP addresses are verified across the established virtual circuit. If the address is correct, the local TCP protocol module requests the remote TCP protocol module to establish a Level 4 connection. The connection is established, the local and remote virtual terminal (VT) processes communicate to display the NODEA# prompt.

USING AN EXISTING CONNECTION

The DSLINE and REMOTE commands are always used to contact a remote node. In the example below, a connection has already been established, and the user wants to use the existing connection. NS logging classes 1 to 5 have been enabled for on-line display. Both the commands and the logging messages are presented here as they would appear on your console. Line numbers shown in parentheses to the left correspond to the numbered explanations that follow.

Example

```
(1)  :DSLINE NODEA.DOMAIN.ORGANIZATION

(2)  ENVIRONMENT 1: NODEA.DOMAIN.ORGANIZATION

(3)  :REMOTE

(4)  ** NETXPORT TCP; PM activated
     - Loc: 3; Class: 5; Parm= %000000; PortID: %000271 %000104

(5)  NODEA#
```

Explanation

1) The user types the DSLINE command with the required node name (NODEA.DOMAIN.ORGANIZATION) at the MPE prompt (:).

2) Because of a previous connection to NODEA, the path report data is found cached in the network transport.

3) The user types the REMOTE command at the MPE prompt (:) to signal a request to the remote virtual terminal (VT) server.

4) A TCP protocol module for the local user is initiated and a unique PortID is registered for the connection.

5) The NODEA# prompt indicates that the remote VT server is ready to receive service requests. The remote TCP protocol module is initialized and a unique PortID has been registered for the connection. Note that no X.25 packets exchanges are logged because this TCP connection has been multiplexed on the existing X.25 virtual circuit to NODEA. If the first connection is cleared, this connection will keep the X.25 VC open. As long as a TCP protocol module for NODEA is enabled, the virtual circuit to NODEA will not be cleared.

CLOSING DOWN A CONNECTION

The DSLINE;CLOSE command is used to close a connection between the local node and the remote node. In the example below, NS logging classes 1 to 5 have been enabled for on-line display. Both the command and the logging messages are presented here as they would appear on your console. Line numbers shown in parentheses to the left correspond to the numbered explanations that follow.

Example

```
(1) :DSLINE NODEA.DOMAIN.ORGANIZATION;CLOSE

(2) ** NETXPORT TCP; PM deactivated
    - Loc: 57; Class: 5; Parm= %000000; PortID: %000271 %000036

(3) ENVIRONMENT 1: NODEA.DOMAIN.ORGANIZATION
    :
    :
    :
    :
(4) ** NETXPORT X.25; CLEAR sent
    - Loc: 724; Class: 5; Parm= %000010; PortID: %010252 %002434
    ** NETXPORT X.25; CAUSE/DIAG codes
    - Loc: 724; Class: 5; Parm= %000000; PortID: %000252 %002434

(5) ** NETXPORT X.25; INACTIVITY timer expired
    - Loc: 850; Class: 5; Parm= %000010; PortID: %000252 %002434

(6) ** NETXPORT X.25; CLEAR CONF received
    - Loc: 750; Class: 5; Parm= %000010; PortID: %000252 %002434

(7) ** NETXPORT Control Process; Path verify
    - Loc: 163; Class: 5; Parm= %000000; PortID: %000231 %026061
```

Explanation

1) The user types the DSLINE;CLOSE command at the MPE prompt (:). A warning message is displayed if this command is entered while in an active remote session.

2) A message is displayed that confirms that the local TCP protocol module created for this connection is deactivated as well as the remote TCP protocol module.

3) The map between path report data for NODEA is disabled. Subsequent requests to NODEA will require the issuance of the DSLINE command. Note that an X.25 clear request packet is not sent. This is because the TCP protocol module never explicitly orders X.25 to close the virtual circuit. The X.25 virtual circuit will remain established until an inactivity timer expires.

4) NS X.25 signals that it has sent a clear request packet on logical channel number (LCN) 8 (PARM= %000010). The inactivity timer is expired which means that no X.25 data packets have been exchanged on LCN 8. Note that the cause and diagnostic codes placed in the clear request packet are zeros (PARM= %000000).

5) X.25 confirms that the inactivity timer has expired (PARM= %000010).

6) The local node receives a clear confirmation packet which confirms the arrival of the clear request packet at NODEA. The virtual circuit is cleared. If a TCP protocol module still existed at NODEA for the local node, then the virtual circuit will be re-opened by the remote TCP and a call request packet will be sent to the local node.

7) The control process acknowledges the clearing of the virtual circuit by signaling the deletion of the pointer to the path report in the path cache.

ESTABLISHING A PAD SESSION

The "Session Interface" portion of Section 5 lists the steps on how to use a PAD interactively. For a logon sequence, the following logging messages will appear at the console, provided that Subsystem 3, Class 5 has been configured and console logging has been enabled:

Example

```
(1)  ** NETXPORT X.25; CALL received
     - Loc: 815; Class: 5; Parm= %000001; PortID: %000224 %002434

(2)  ** NETXPORT X.25; CALL CONF sent

     - Loc: 728; Class: 5; Parm= %000001; PortID: %000224 %002434

(3)  ** NETXPORT X.25; VC opened

     - Loc: 707; Class: 5; Parm= %000001; PortID: %000224 %002434
(4)  15:49/#S11/78/LOGON FOR: MANAGER.SYS,PUB ON LDEV #302
```

For a logoff sequence, the following logging messages will appear:

```
(5)  16:32/#S11/78/LOGOFF ON LDEV #302

(6)  ** NETXPORT X.25; CLEAR RECEIVED
     - Loc: 750; Class: 5; Parm= %000001; PortID: %000224 %002434

(7)  ** NETXPORT X.25; CLEAR CONF sent
     - Loc: 727; Class: 5; Parm= %000001; PortId: %000224 %002434
```

Explanation

1) The PAD sends a connect request to the host node. The logging message indicates that X.25 is sending a call request packet. The logical channel number is displayed in Parm= %000001 (octal).

2) The host node confirms the incoming PAD call request by sending a call confirmation. This message means that the upper-layer PAD Support Software is communicating with the PAD device.

3) NS X.25 establishes a virtual circuit with the PAD device to exchange data.

4) The PAD user logs on to the host node.

5) The PAD terminal logs off the remote host. The PAD LDEV is made available for the next PAD call.

6) The host node receives a clear-request packet from the PAD device on logical channel number 1.

7) The host node sends a clear-confirmation packet, and the virtual circuit is cleared.

ACCESSING A PAD DEVICE

To programmatically access a PAD device, refer to the "Programmatic Interface" portion of Section 5. For a device-open sequence, the following logging messages will appear at the console, provided that you have Subsystem 3, Class 5 configured and console logging enabled:

Example

```
(1)  ** NETXPORT X.25; CALL sent
     - Loc: 723; Class: 5; Parm= %000020; PortID: %000224 %002434

(2)  ** NETXPORT X.25; CALL CONF received
     - Loc: 865; Class: 5; Parm= %000020; PortID: %000224 %002434

(3)  ** NETXPORT X.25; VC opened
     - Loc: 865; Class: 5; Parm= %000020; PortID: %000224 %002434
```

When you release the device, the following logging messages will appear:

```
(4)  ** NETXPORT X.25; CLEAR RECEIVED
     - Loc: 750; Class: 5; Parm= %000020; PortID: %000224 %002434

(5)  ** NETXPORT X.25; CLEAR CONF sent

     - Loc: 727; Class: 5; Parm= %000020; PortId: %000224 %002434
```

Explanation

1) The host node sends a connect request to the PAD. The logging message indicates that X.25 is sending a call request packet. The logical channel number is displayed in Parm= %000020 (octal).

2) The PAD confirms the outgoing PAD call request by sending a call confirmation.

3) NS X.25 establishes a virtual circuit with the PAD device to exchange data.

4) The PAD receives a clear-request packet from the host node on logical channel number 20 (octal).

5) The PAD sends a clear-confirmation packet, and the virtual circuit is closed.

SHUTTING DOWN NS X.25

The NETCONTROL STOP command is used to request an immediate shutdown of NS X.25. In the example below, NS logging classes 1 to 5 have been enabled for on-line display. Both the command and the logging messages are presented here as they would appear on your console. Line numbers shown in parentheses to the left correspond to the numbered explanations that follow.

Example

```
(1) :NETCONTROL STOP

(2) ** NETXPORT PXP; PM deactivated
    - Loc: 54; Class: 5; Parm= %000000; PortID: %000244 %000036

(3) ** NETXPORT Control Process : STATIC UPDATE; Update
    - Loc: 170; Class: 5; Parm= %177777; PortID: %000215 %026061
    ** NETXPORT Control Process; Path verify
    - Loc: 163; Class: 5; Parm= %000000; PortID: %000215 %026061

(4) ** NETXPORT X.25; RESTART sent
    - Loc: 721; Class: 5; Parm= %000000; PortID: %000237 %002434
    ** NETXPORT X.25; CAUSE/DIAG codes
    - Loc: 721; Class: 5; Parm= %000000; PortID: %000237 %002434

(5) ** NETXPORT IP; Protocol stop
    - Loc: 105; Class: 4; Parm= %000000; PortID: %000237 %002366
    ** NETXPORT X.25; Protocol stop
    - Loc: 5023; Class: 4; Parm= %000000; PortID: %000237 %002434
    ** NETXPORT X.25 NI; Network interface stop
    - Loc: 79; Class: 4; Parm= %000000; PortID: %000237 %002320

(6) ** NETXPORT TCP SIP; General protocol stop
    - Loc: 43; Class: 4; Parm= %000000; PortID: %000215 %026127
    ** NETXPORT PXP SIP; General protocol stop
    - Loc: 21; Class: 4; Parm= %000000; PortID: %000215 %026175
    ** NETXPORT IP Update; General protocol stop
    - Loc: 19; Class: 4; Parm= %000000; PortID: %000215 %026243

(7) ** NETXPORT Control Process: Transport stop
    - Loc: 51; Class 4; Parm= %000000; PortID: %000215 %026061
```

Explanation

1) A user with network manager (NM) capability types the NETCONTROL STOP command at the MPE prompt (:). The NET parameter is not specified. Every active NI found is deactivated. Every connection and NS service is terminated. A more graceful shutdown is achieved by typing NSCONTROL STOP at the MPE prompt (:) to deactivate the services before shutting down the transport.

2) The NetIPC socket registry is deactivated.

3) The control process reads the internet gateway entry in the X.25 NI and disables the associated internal tables. IPU is informed that access to the associated IP network is closed. TCP is informed that a path verification should be made for all the existing TCP connections.

4) NS X.25 sends a restart packet to clear the switched virtual circuit (SVC) and to reset any permanent virtual circuit (PVC). The cause and diagnostic codes signify a shutdown of this node to the network. The RESTART sent message indicates that the restart packet has left X.25. It does not mean that the restart packet has appeared on the communications line. NS X.25 does not wait for a restart confirmation packet to continue shutting down the network.

5) The X.25 NI protocols (IP and X.25) are shutdown.

6) The general protocols (TCP, PXP, and IPU) are shutdown.

7) The control process signals that the termination of the network transport, including the X25NET NI and link, is complete. NS X.25 is shutdown. The NSCONF.NET.SYS file is released. Level 2 on the INP board is released and the local node is now logically disconnected from the network.

X.25 PAD SUPPORT

SECTION 5

PAD support (PADSUP) for the NS X.25 3000/V link is a service within the NS architecture that allows communication between an HP 3000 host and remote terminals and printers connected to a Packet Assembler/Disassembler (PAD). PADSUP passes character streams from the host application program to the X.25 layer below. The X.25 layer manages reliable data exchange with the remote PAD. A PAD is a device that converts asynchronous character streams used by terminals and printers into X.25 protocol packets that can be transmitted over a packet switching network (PSN). If the PAD is a service provided by the PSN administration, it is referred to as a *public PAD*. If the PAD is in the user's domain and is external to the public PSN (such as the HP 2334A or HP 2334A Plus), it is called a *private PAD*.

Figure 5-1 shows an example of X.25 networks with PAD devices. The two networks shown are public data networks. These networks have public PADs to which terminals can connect. Also shown are two HP 2334A cluster controllers, which are private PADs. The drawing shows terminals and printers connected to each private PAD.

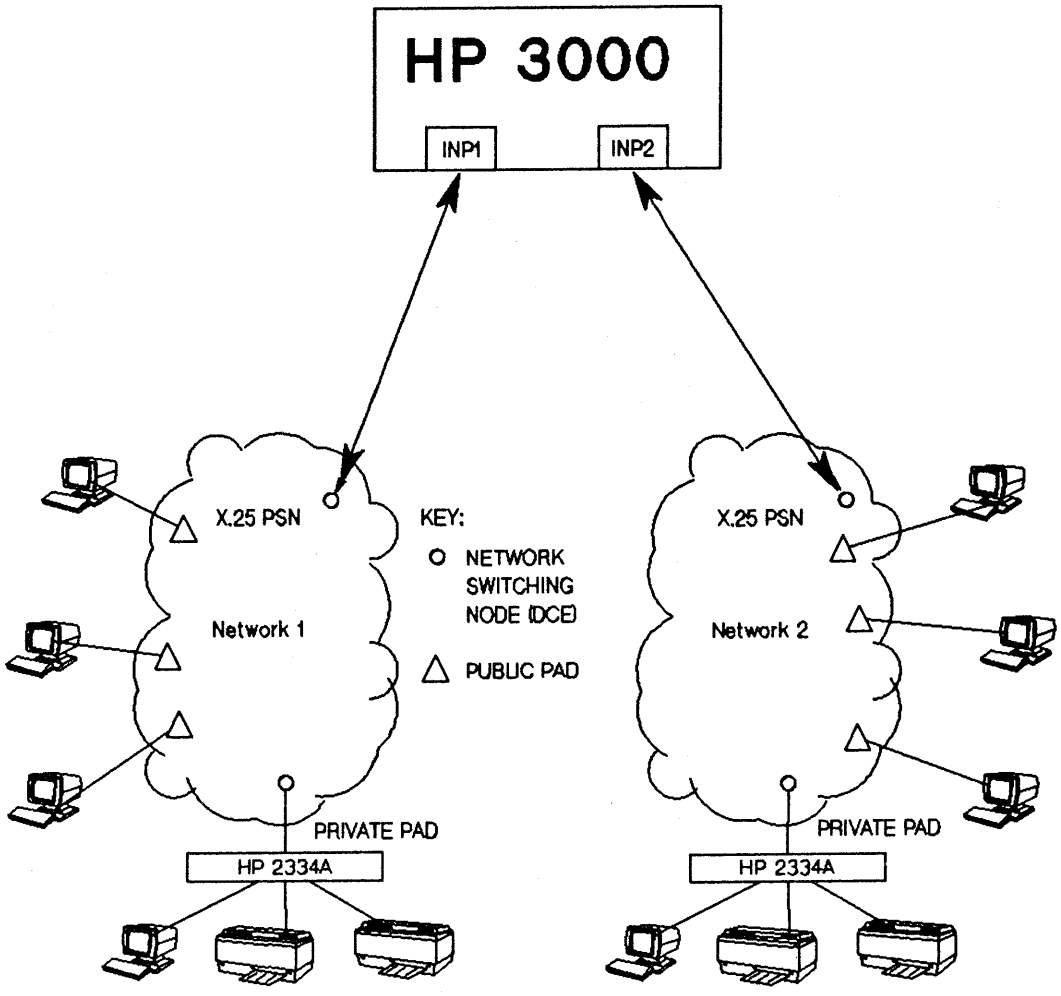


Figure 5-1. X.25 Networks and PAD Devices

The two main functions of the PADSUP are to accept incoming calls and to generate outgoing calls. Accepting incoming calls means that a person at a terminal connected to a public or private PAD can log on to a remote HP 3000 that is running NS X.25 3000/V and has PAD support, thus establishing a session. Generating outgoing calls means that a remote HP 3000 application running independently from a PAD device can access this device for input/output by using the FOPEN intrinsic. When generating outgoing calls to a PAD device, the device must be connected to an HP 2334A.

Two of the early sections in this chapter describe incoming and outgoing calls in more detail. This chapter also deals with such topics as security, development of applications, sample terminal and printer configurations, and supported devices.

The PAD information in this section is primarily geared toward a user or programmer. PAD information is also located in other parts of this manual. In addition to this manual, PAD information can be found in these manuals: *Network Manager Reference Manual, Volume I* (configuration information), *Network Manager Reference Manual, Volume II* (NSCONTROL information), and the *NS3000/V Error Message and Recovery Manual.*

In addition, for details regarding the HP 2334A, see the *HP2334A Plus X.25 Multiplexer Reference Documentation.* For details about file system intrinsics, discussed later in this section, refer to your MPE file system intrinsics documentation.

SECURITY FEATURES

PAD support on NS X.25 3000/V includes the following security features:

- You can start up a network for system-to-system communications without starting PAD services. Also, if you do start PAD services, you can start incoming and outgoing services separately. For details, refer to the NSCONTROL START command information in the *NS3000/V Network Manager Reference Manual, Volume II.*

- You can restrict incoming-call access to specific private PADs by using features such as local user groups and address keys. For details, refer to the X.25 Network Interface Configuration section in the *NS3000/V Network Manager Reference Manual, Volume I.*

- You can configure the address key PAD into the X.25 Address Key Paths (see Step 13 on page 3-5) if you want the HP 3000 to accept incoming calls from any PAD. However, because configuring PAD does allow access to your system from any PAD on the network, use general system security features (i.e. passwords) to protect your system.

SESSION INTERFACE

This section first describes how to begin a session with a remote HP 3000 from a PAD terminal, then lists PAD-specific considerations for your session.

Logon Sequence

To use a PAD interactively, perform these three steps:

- Connect to the PAD.
- Connect to the host HP 3000.
- Log on to the HP 3000.

If you are not directly connected to a PAD, you need to dial in through a modem to either a public PAD, which is part of a public data network, or a private PAD, such as an HP 2334A.

Once you are connected to the PAD, you will receive the prompt you need to be able to connect to the host HP 3000. The prompt from the HP 2334A PAD, for example, is the following character: @. At the prompt, enter the address of the HP 3000 to which you wish to connect. For specific information about a public data network, refer to your network administrator and the PSN-supplied documentation.

After connecting to an HP 3000, you will receive a colon (:) prompt, which means that you can enter your logon string and begin your session just like any other user on the system. During logon, you do not need to specify the terminal type as long as terminal type 24 was associated with the PAD terminals in the MPE I/O configuration. Terminal type 24 is required for a PAD terminal that will use block mode. Terminal type 24 may be used even if you are not using block mode applications. See the I/O configuration dialogue in Section 2.

Applications Considerations

General PAD Restrictions

The following are some of the restrictions of the PAD:

- In character mode data transfer, special end-of-record characters that may have been defined by the host HP 3000 application are not recognized by the PAD. Therefore, all data must be forwarded with [RETURN]. Special end-of-record characters are, however, recognized by the PAD support software on the host HP 3000. If a special end-of-record character has been defined, it must be included immediately before [RETURN] in the data to be read. The [RETURN] key would then be used only to signal the PAD to forward the data, and would be ignored by the PAD support software on the host HP 3000. For example, suppose the character $ has been defined as the special end-of-record character. When entering data to be read by an application on the HP 3000, you might type:

  xxxxxxx$[RETURN]

  where xxxxxxx is data.

You would have to know ahead of time that $ was defined as the end-of-record character by the HP 3000 application. When the PAD encounters [RETURN], it will forward the data to the HP 3000. When the PAD support software on the HP 3000 reads the data, it will know that the $ denotes the end of the record and will ignore [RETURN]. It will also ignore any characters between the special end-of-record character and [RETURN].

If the end-of-record character on the HP 3000 also is [RETURN], only one [RETURN] needs to be transmitted. Both the PAD and the HP 3000 would read the same [RETURN] as the end of record.

- If the completion of reading data is determined by the length of a character string, the data still must be forwarded with [RETURN].
- Some control sequences (such as [CONTROL]X and [CONTROL]Y) must be forwarded with [RETURN]. The [RETURN] will be ignored by the PAD support software on the HP 3000.
- A PAD terminal cannot be used as a console terminal.
- Binary transfers between a PAD terminal and the HP 3000 are not supported.
- All devices that you connect to a PAD must support XON/XOFF flow control.
- A PC application searching for DC1 as a read trigger character will not work because the read trigger is not sent over a PAD connection.

Characteristics of a Public PAD

The following are some of the ways in which a terminal operating across a public PAD differs from a local terminal:

- If XON/XOFF flow control (X.3 parameter 12) is not supported by the PAD, data overrun may occur during large-data transfers from the PAD to the terminal.
- Some public PADs will not echo escape sequences entered from the keyboard.
- Some public PADs do not echo the backspace character ([CONTROL]H). Nevertheless, the preceding character will be edited out by the terminal driver when the data reaches the HP 3000.
- Some public PADs (such as Telenet) demonstrate a problem running VPLUS applications when the data read from the terminal fits exactly into a multiple of the packet size. This problem can be avoided by disabling the use of the More Bit, which can be accomplished by modifying a local PAD parameter. Contact your PSN representative for details.
- Some characteristics of public PADs can be changed by subscribing to specific PAD X.3 parameters. For more information, contact your PSN representative.

VPLUS/3000 Block Mode Considerations

The following are important considerations that pertain specifically to VPLUS/3000 block mode applications:

- The end-of-record character cannot be changed. It must be a Record Separator.
- The G and H straps of the terminal must be set to YES.
- The terminal must be configured as terminal type 24 during system I/O configuration.
- No program modifications are required if you use VPLUS/3000 applications exclusively to access the terminal. (You must have a VPLUS/3000 version of at least B.03.15 to use it over a PAD.)
- **Non-VPLUS/3000 block mode applications are not supported.**

WARNING

Block mode communication over a PAD requires that the terminal being used support XON/XOFF flow control and automatic keyboard locking. Attempting to run a block mode application from a block mode terminal or terminal emulator which does not support these two features may result in data loss or data duplication. These are the same restrictions that apply to DS X.25 PAD support. If your terminal does not support XON/XOFF flow control and automatic keyboard locking, you still can run character mode applications.

It is the customer's responsibility to verify that any terminals being used over PAD connections which have access to block mode applications support these features. Information on specific terminals is provided in the "Configuring the Terminal" and "Device-Specific Information" sections later in this chapter. If you have any questions regarding terminals and the use of block mode, contact your HP representative.

Restarting Echo

If you accidentally lose the echo at your terminal, you can restart it from the system's perspective by either running an application program that executes an FCONTROL 12 or logging off and then logging on again.

In addition to performing one of the above steps, you may be able to first restart echo from the PAD perspective to see what you are doing in the meantime. This requires you to locally modify X.3 parameter number 2. For example, on the HP 2334A, here is the procedure for restarting echo at your terminal:

- CONTROL P (You will receive this prompt:@)
- `set 2:1` RETURN (The echo now should be turned on.)

Be cautious whenever you first restart echo on your terminal. Because this technique changes only the PAD's view of echo, the echo is still off from the system's perspective. This means that applications will not work properly unless you also performed one of the steps mentioned above for restarting echo from the system's perspective.

Logoff Information

When you log off, your connection to the HP 3000 is terminated. However, if you simply perform a re-logon without explicitly logging off, you will not lose your connection to the HP 3000 and your terminal type will not be reset.

PROGRAMMATIC INTERFACE

In addition to the logon capabilities previously described, PAD support software allows you to make outgoing calls to PAD devices connected to an HP 2334A. This means that an HP 3000 application can programmatically access a terminal or printer on an HP 2334A. Such programmatic access is possible with the HP 2334A because each of its ports has a unique address within the network. This unique address is configured with NMMGR and is part of an LDEV-to-nodename mapping scheme that is required for a device to be accessed from an application program running on an HP 3000. An LDEV is a logical device number.

The LDEV-to-nodename mapping scheme, described below in detail, includes visiting the X.25 PAD Device Configuration Screen. You must use manual configuration to reach this screen because it is not visited during guided configuration.

This screen, shown in Figure 8-9 of the *NS3000/V Network Manager Reference Manual, Volume I*, is displayed when you press the function key for Go To X25PAD at the Network Transport Configuration Selection Screen (Figure 8-1). It is also displayed when you type the path name:

```
@NETXPORT.X25PAD
```

in the command window of any screen and press (ENTER).

Each LDEV on this screen corresponds to an LDEV configured for a PAD terminal or PAD printer on an HP 2334A during system I/O configuration. See the PAD information in Section 4 of the *NS3000/V Network Manager Reference Manual, Volume I* for further details on system configuration.

In NS3000/V, each device connected to an HP 2334A port and accessed from an application running on a remote HP 3000 is considered a separate node. Therefore, the device must be configured as a node name in the network directory file (NSDIR.PUB.SYS). A node name must be configured in the form *nodename.domain.organization*. (See Section 3 of the *NS3000/V Network Manager Reference Manual, Volume I* for details on node names.) In addition to configuring a node name to represent each device, an Additional Address must be configured to represent a unique X.25 address of an HP 2334A port. See the Network Directory Data Screen in the Network Directory section of the *NS3000/V Network Manager Reference Manual* for more information about this field. Each node name in Figure 8-9, therefore, must match a node name configured in the Network Directory Data Screen.

The relationship among MPE I/O configuration, network configuration and network directory configuration is illustrated with the example shown in Figure 5-2. In this example, a PAD terminal is included in the MPE I/O configuration and is assigned an LDEV of 32. This LDEV also is assigned a subtype of 1, which indicates that this device will be used for outgoing calls only. For a detailed description of LDEV subtypes 0 and 1, see Section 4 of the *NS3000/V Network Manager Reference Manual, Volume I*. In the network configuration file in our example, LDEV 32 is mapped to the node name PADTRM32.C.D. In the network directory, this node name is mapped to the IP address C 192.001.000 003, which then maps to the X.25 symbolic name PADTRM32. In the network configuration file again, the symbolic name PADTRM32 is mapped to the X.25 address 311040800022. This completes the mapping scheme. Note that the X.25 Address Key field in the network configuration file must contain the same value as the Additional Address field in the network directory file. (The network portion of the IP address must match the network portion of the IP address configured for the NI on which the outgoing call should be placed. For each LDEV-to-nodename mapping, a unique node portion of the IP address must be configured. The actual X.25 address is the same as that configured for the port during HP 2334A configuration.)

Appendix C contains configuration worksheets, and includes an LDEV-to-nodename mapping worksheet. You should complete this worksheet to keep track of this information. Also, you should complete an X. 25 Node Intranet Routing Table (Appendix C), which contains related information involved in the LDEV-to-nodename mapping scheme.

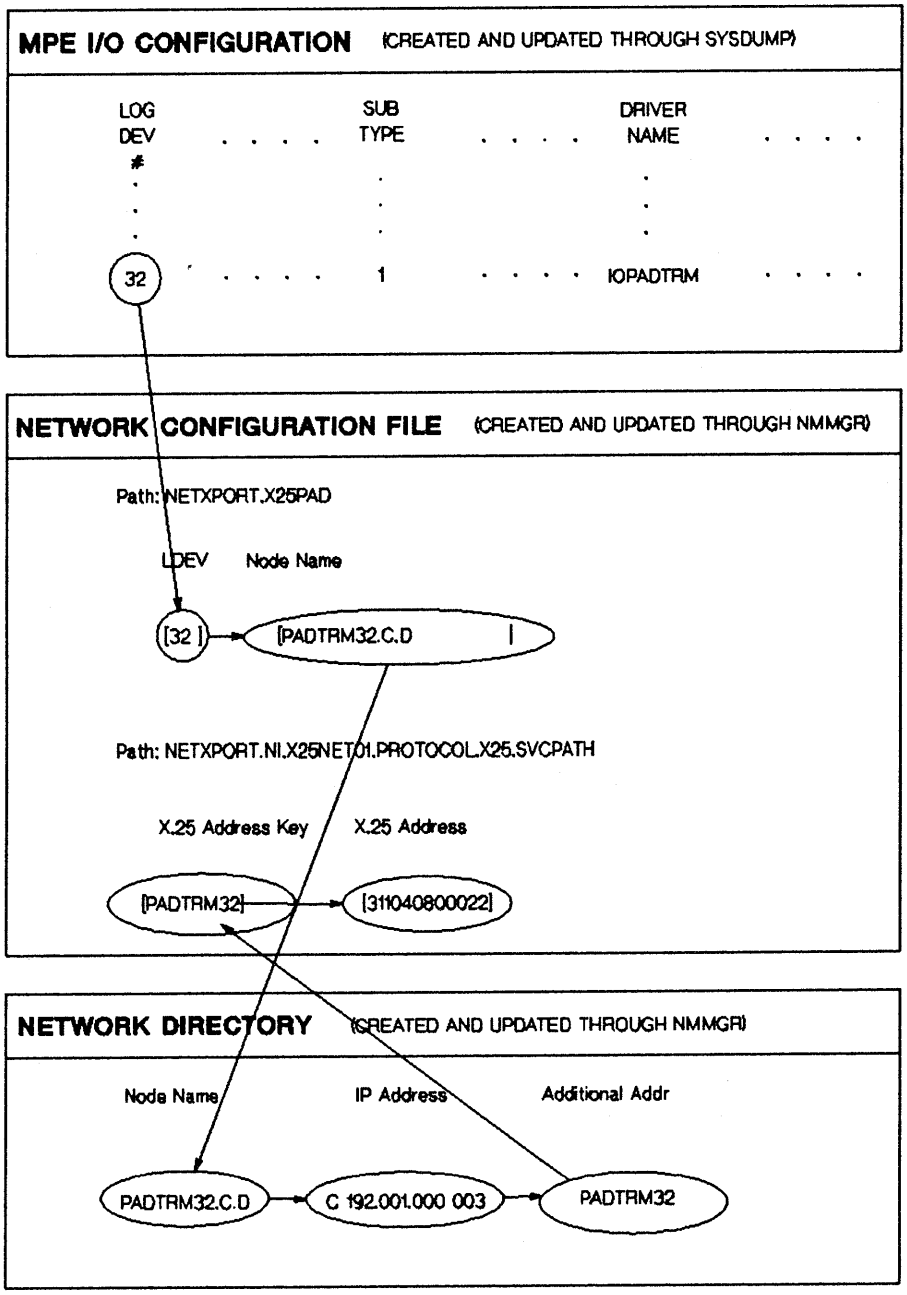


Figure 5-2. Relationship among MPE I/O configuration, network configuration and network directory.

Your applications will use the FOPEN intrinsic to open PAD devices. A device can be referenced by either its LDEV or its device class name, both of which should first be configured during system configuration. Shown below are some sample PAD device system configurations. The fields to pay attention to here are LOG DEV # and DEVICE CLASSES. (All the fields are described in detail in Section 4 of the *NS3000/V Network Manager Reference Manual, Volume I.*)

LOG DEV #	DRT #	UNIT	CHAN	TYPE	SUB TYPE	TERMINAL TYPE	TERMINAL SPEED	REC WIDTH	OUTPUT DEV	MODE	DRIVER NAME	DEVICE CLASSES
31	#20	0	0	16	1	24	240	40	31	J ID	IOPADTRM	PADTERM
32	#20	0	0	16	1	24	240	40	32	J ID	IOPADTRM	PADTERM
33	#20	0	0	32	14	18	240	66	0		IOPADLP	PADLP
34	#20	0	0	32	14	18	240	66	0		IOPADLP	PADLP
35	#20	0	0	32	14	26	240	66	0		IOPADLP	PADLP

Logical device numbers (LOG DEV) 31 and 32 are terminals, and they both have PADTERM configured as their device class name (DEVICE CLASSES field). Logical device numbers 33, 34 and 35 are printers, and they all have PADLP configured in the DEVICE CLASSES field. Shown next are two examples of the FOPEN intrinsic. The first example shows a specific logical device number referenced; the second example shows a device class name referenced.

Programmatic Access of a Specific Device

This program segment illustrates how to FOPEN the printer with logical device number 33 in the preceding sample:

```
byte array device (0:3) := "33 ";
```

filenum:=FOPEN(*formaldesignator,foptions,aoptions,recsize,device*)

Programmatic Access Using a Device Class Name

This program segment illustrates how to FOPEN one of the printers with device class name PADLP in the preceding sample:

```
byte array device (0:7) := "PADLP   ";
```

filenum:=FOPEN(*formaldesignator,foptions,aoptions,recsize,device*)

All available printers with the same device class name are considered by MPE to be part of a pool. Therefore, you can specify a device class name in order to have the best chance of being able to immediately access a printer. You probably would want to use this method of specifying a device class name, instead of specifying one LDEV, if it does not matter which printer with the specified class name is opened. In this example, the first available printer with device class name PADLP will be opened.

In this example, all the printers shown have the device class name PADLP. You also could have additional printers configured with different device class names.

File Equations

For applications that have been written, you might need to re-direct the output using file equations. As with the FOPEN intrinsic, either a specific logical device number or a device class name can be referenced. This reference would occur in the device parameter.

The following is an example of a file equation that references a specific device:

```
:FILE OUT;DEV=34

:FCOPY FROM=OUTPUT;TO=*OUT
```

This sequence of commands would cause the file OUTPUT to be printed on the printer configured as LDEV 34 in the sample on the previous page.

The following is an example of a file equation that references a device class name:

```
:FILE OUT;DEV=PADLP

:FCOPY FROM=OUTPUT;TO=*OUT
```

This sequence of commands would cause the file OUTPUT to be listed on one of the printers configured with device class name PADLP.

Using PAD Printers

Remote printers can be accessed programmatically only, and they must be connected to an HP 2334A. Remote printers connected to an HP 2334A are supported in both spooled and non-spooled environments. Spooling allows a non-sharable device, such as a line printer, to appear to be shared by several users. During system configuration, PAD printers cannot be configured as "initially spooled" devices.

Two terminal types--18 and 26--are supported. Three important considerations to keep in mind for terminal type 26 are: 1) A status request is performed only for FOPEN, FCLOSE, and Device Close instead of for every I/O operation, 2) Retries on status requests are performed when no answer is received from the printer, 3) After each Device Close, a wait-time takes place before disconnecting in case an FOPEN follows immediately.

One important consideration for terminal type 18 is that no status requests are performed.

HP 2334A Configuration

See the *HP2334A Plus X.25 Multiplexer Reference and Service Manual* for information on how to configure the HP 2334A. Two items to be aware of are profile numbers and callable port pools, both of which are described in detail in the HP 2334A manual. Callable port pools are another facility provided by the HP 2334A which can reference a pool of devices instead of referencing a specific logical device number.

Disconnecting a Device

The FCLOSE intrinsic is used to close a device and terminate a connection.

APPLICATION DEVELOPMENT

FCONTROLs

All FCONTROLs work except as noted below:

1. The following FCONTROLs are no-operations. They return CCE but have no effect:

0	general device control
2	complete input/output
3	read Hardware Status Word
10	change terminal input speed
11	change terminal output speed
23	disable parity checking
24	enable parity checking
36	set parity
37	allocate a terminal
40	return terminal speed (Note: value returned is meaningless)

2. The following FCONTROLs return CCL. The file error is FSERR42 (OPERATION INCONSISTENT WITH DEVICE TYPE):

5	rewind file
6	write EOF
7	space forward to tape mark
8	space backward to tape mark
9	rewind and unload tape
18	disable tape mode
19	enable tape mode

3. The following FCONTROLs return CCL. The file error is FSERR49 (UNIMPLEMENTED FUNCTION):

26	disable binary transfers
27	enable binary transfers

4. The following FCONTROLs work, but not the same way as with local terminals:

41	set unedited mode	This will disable editing of data received by IOPADTRM (the driver name for PAD terminals). Depending on the PSN, the PAD may still edit certain characters out of the data (such as BACKSPACE) before forwarding the data to IOPADTRM.

Some FCONTROLs can be used to change the X.3 parameter setting on the remote PAD. These are FCONTROLs 12, 13, 14, and 15:

Corresponding to X.3 parameter number 2, FCONTROL 12 turns on echo; FCONTROL 13 turns off echo. Corresponding to X.3 parameter number 7, FCONTROL 14 disables break; FCONTROL 15 enables break.

For detailed information on X.3 and X.28 parameters, see Appendix B.

NOTE

FCONTROLs 28 and 29 disable and enable user block mode, which is *not supported.*

Other Intrinsics

FDEVICECONTROL is not supported.

CONFIGURING THE TERMINAL

The following steps will explain how to configure your terminal. In the first step, required only for older terminals, you need to make sure that you have the correct ROMs. The second step sets the G and H straps. The third step sets baud rate and parity, and also enables XON/XOFF flow control.

1. ROM Checking

For HP 2624B, HP 2622A, or HP 2623B terminals to support automatic keyboard locking, you need certain ROMs in your terminal. To check whether you have these ROMs, perform the following procedure. (If you are using a terminal with which automatic keyboard locking is standard, skip to Step 2.)

- Press [AIDS]. A set of softkeys will appear at the bottom of your screen. They will be similar to the following, although they need not be exactly the same.

Figure 5-3. Softkeys shown in response to pressing [AIDS].

- Press service keys. Your softkeys will change to those shown in Figure 5-4.

Figure 5-4. Softkeys shown in response to pressing service keys.

Again, these titles might not match exactly. The key you want is [f6], the IDENTIFY ROMS key.

- Press [f6]. A list of character ROMs and firmware ROMs will appear on your screen.

See "Device-Specific Information" later in this chapter for lists of firmware ROMS supported for different terminals.

2. The Terminal Configuration Screen

Two default configuration settings on this screen must be changed if you will be using your terminal in block mode over a PAD.

- Press the User System key on your terminal. A set of softkeys will be displayed; press config keys. Your softkey display will change again:

Figure 5-5. Softkeys shown in response to pressing config keys.

Notice that [f5] is labelled terminal config. The labels on your keys may not correspond exactly. (In particular, [f3] and [f4] may be labelled datacom1 config and datacom2 config, or datacomm config and ext dev config, respectively.)

- Press [f5], the terminal config key.

Your screen will change to a menu of various terminal characteristics, with the active values already listed. All you need to be concerned with are the parameters governing the G and H straps, and the softkey definitions. If these straps are not already set to YES, follow these steps:

- [TAB] the cursor to the field labelled InhHndShk(G)
- Press [f2], the NEXT CHOICE key. The NO will change to a YES.
- [TAB] to the Inh DC2(H) field, and follow the same procedure to change the NO to a YES.
- All other fields should have their default values. The screen should look like that shown in Figure 5-6.
- Press [f1], the SAVE CONFIG key, to keep this configuration. Your softkeys will change back to those shown in Figure 5-3.

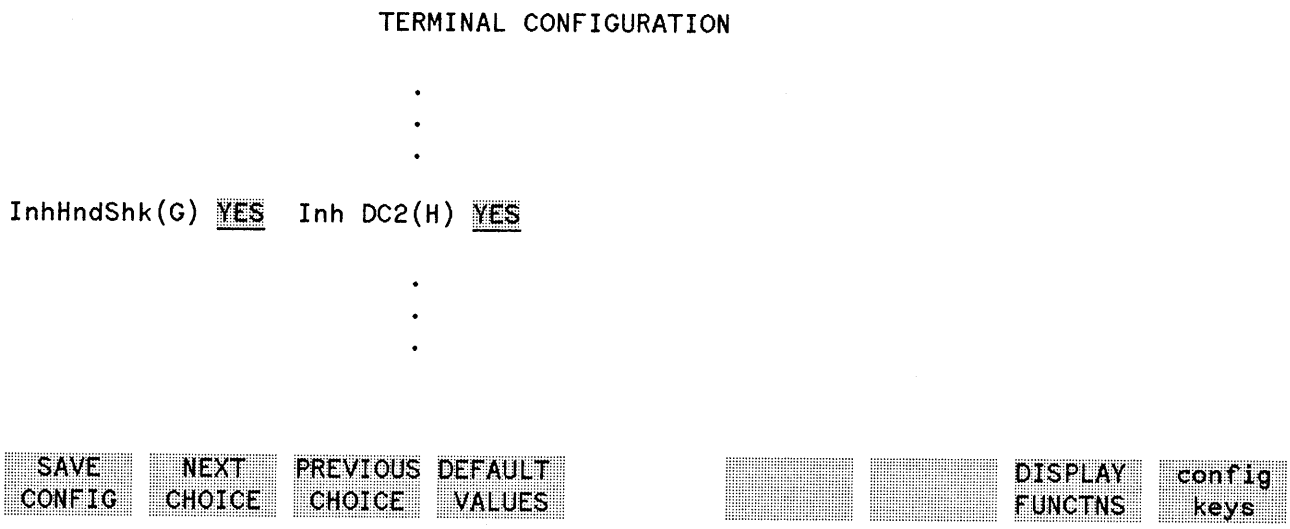


Figure 5-6. The Terminal Configuration Screen after making the correct changes.

3. The Port Configuration Screen

For the rest of the configuration, you need to use a different configuration screen, one that covers topics directly related to data communications.

- Press [f8], the config keys key. Your softkeys will be displayed as they were in Figure 5-5.
- Press [f3], port1 config (or datacom1 config or similar key name).

Follow the steps below to set the correct values for the critical fields on the Port Configuration Screen.

- Press [f2], the NEXT CHOICE key, which will change BaudRate, until it matches the baud rate of your PAD and modem. (Your network administrator can give you this information.)
- Make sure Parity is 0's and Chk Parity is NO; if they are not, use the [TAB] key to move the cursor there and change them using the NEXT CHOICE key.
- [TAB] to the RecvPace field, and press [f2], the NEXT CHOICE key, until the value is Xon/Xoff.
- [TAB] to the XmitPace field, and do the same as in the preceding step.
- All other fields should have their default values. Your screen should look like the one shown in Figure 5-7.
- Press [f1], the SAVE CONFIG key, when you are finished.

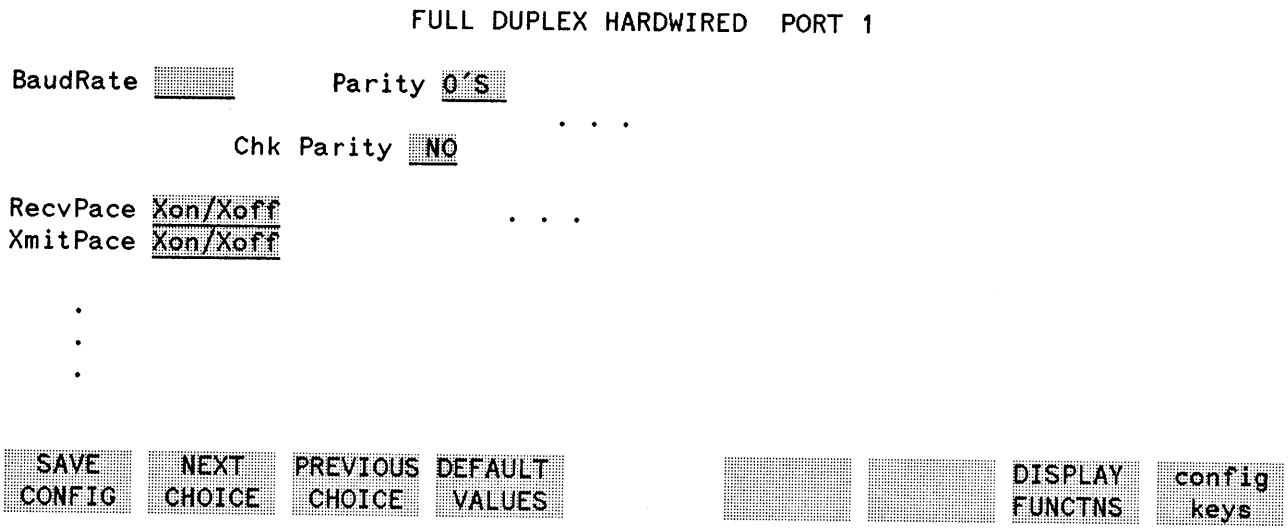


Figure 5-7. The Full Duplex Hardwired Screen after making the correct changes.

DEVICE-SPECIFIC INFORMATION

Supported Block Mode Terminals

To use VPLUS block mode communication over a PAD, your terminal or terminal emulator must support automatic keyboard locking and must use only XON/XOFF flow control for block mode transfers. These features are available on most newer HP terminals. Some older terminals, such as the HP 2622A, HP 2623B and HP 2624B, may require firmware upgrades. The HP 2382 and HP 264x are among the terminals that cannot be upgraded and are not supported for running block mode applications. Consult your HP representative if you have any questions.

The following HP terminals and PCs can use block mode communications over a PAD:

HP 150, HP 2622A, 2623B, 2624B (the previous three must have updated ROMs), 2625A, 2672A, 2628A, Vectra, Vectra CS, Vectra ES, Vectra ES/12, 2392A, 2393A, 2394A, 2397A, 700/92, 700/94.

Necessary Firmware ROMs

Refer to "ROM Checking" earlier in this section for the steps needed to determine the ROMs you have.

The following must be among the firmware ROMs for the HP 2624B terminal:

1818-1701
1818-3139
1818-3140
1818-3141
1818-3142
1818-3143

The following must be among the firmware ROMs for the HP 2622A terminal:

1818-3199
1818-3200
1818-3201
1818-3202 (optional: for thermal printer)
1818-3203

The following must be among the firmware ROMs for the HP 2623B terminal:

1818-3223 2334
1818-3224 2334
1818-3225 2334
1818-3226 2334
1818-3227 2334
1818-3228 2334

Supported Printers

The following printers are supported as either spooled or non-spooled devices connected to the HP2334A:

HP 2601A, 2602A, 2631B HP 2563A
HP 2932A, 2933A, 2934A HP 2686A/D,2687A(formatting capabilities not supported)

NS X.25 TROUBLESHOOTING

SECTION 6

This section discusses troubleshooting techniques for problems encountered while starting the network or establishing a connection. This discussion begins with generic problem descriptions but includes procedures for using specific tools.

It is suggested that you read Section 4 "NS X.25 Principles of Operation" in this manual to ensure that you are familiar with the product's function before you begin the troubleshooting process. You should also refer to the *NS3000/V Error Message and Recovery Manual* for general troubleshooting information.

HOW TO RESOLVE PROBLEMS

A recommended method for resolving problems is to characterize the situation in which the problem occurs and then investigate which of the possible causes may have led to the problem. Finding the actual cause is often sufficient to suggest a resolution.

For example, assume that you are unable to open a line with the DSLINE command or are unable to initiate a PAD connection. A possible cause of the problem is that the syntax of the command is incorrect. If so, you can resolve the problem by correcting the command and reissuing it. However, if the syntax is correct, you will have to look for another possible cause.

In most cases you must first characterize the problem, and then investigate the possible causes. The difficult part of troubleshooting is identifying the actual cause of the problem. Once you know the actual cause, you can take an appropriate action to resolve the problem.

It is important to ask questions when you are trying to characterize a problem. Begin by asking global questions, and then make your questions more specific. By doing this, you can begin to isolate your trouble.

LEVEL BY LEVEL VERIFICATION

NS X.25/V architecture is based on the Open Systems Interconnection (OSI) Reference Model and it therefore has certain inherent self-diagnostic capabilities. For example, if Level 3 (the X.25 packet level) has been verified as working, then you can assume that both Level 2 (the network link software and the LAP-B firmware) and Level 1 (the physical connection) are properly functioning. Conversely, if Level 3 is not working, then you should verify that Level 2 and Level 1 are working as they should. This process will help you identify and isolate the non-functioning level.

DIAGNOSTIC TOOLS

NS X.25 comes with its own set of diagnostic tools. The tools currently available are:

- Node commands. Node commands provide an on-line status report of the network transport. For more information on node commands, refer to Section 1 "Commands" in the *NS3000/V Network Manager Reference Manual, Volume II.*

- On-line programs. The on-line programs provided with NS X.25 will verify the function of Level 3 and Level 4. To use the on-line programs, you must be able to start the product. Information on the on-line programs is documented later in this section and in Section 2 "Software and Line Verification" in the *NS3000/V Network Manager Reference Manual, Volume II.*

- Off-line products. Off-line products verify that Level 1 and Level 2 are working. NS X.25 does not have to be working to use these off-line products. These products will only indicate a pass or fail for the level tested. They do not provide diagnostic information.

Diagnostic information is provided by the NS logging facility. This facility must be enabled while you are troubleshooting NS X.25. The logging messages can be directed to the console, to a file, or to both the console and a file. Refer to Section 3 "NS X.25 Node Configuration" in this manual and Section 4 "Logging Location Codes" in the *NS3000/V Network Manager Reference Manual, Volume I* for detailed information on this facility.

PROBLEMS ENCOUNTERED WHILE STARTING NS X.25/V

When you have problems starting the network, it is usually because your network configuration or your system configuration is invalid. Refer to Section 4 "NS X.25 Principles Of Operation" for the commands used to bring up the network. To aid the troubleshooting process in this instance, it is advised that you monitor the logging messages on the system console. These messages indicate the status of the start-up procedure. Refer to Section 4 "Logging Location Codes" in the *NS3000/V Network Manager Manual, Volume I* for more information on Logging Configuration.

As you monitor these messages, you should note the error message, and then refer to Table 6-1 for a possible cause. Once a cause for the error has been isolated, you should take corrective action. If the message displayed on the console is not listed in Table 6-1, refer to the *NS3000/V Error Message and Recovery Manual* for a message definition.

Table 6-1. Error Messages Encountered While Starting NS X.25

Error Message	Cause	Action
CS error 10	You specified an invalid LDEV number in the system configuration file.	Specify the correct LDEV number.
CS error 117	You may have specified an invalid DRT number, or you may have a faulty INP board, or your INP board is not connected to the backplane, or the HP-IB is not connected to the INP board.	Step through the possible causes one-by-one until you isolate the problem. Take corrective action as follows: • Respecify the DRT number. • Replace the faulty INP board. • Secure the connections to and from the INP board.
CS error 161	DTE or DCE is misconfigured.	Correct the incorrect entries in @LINKCONF.LAPBLINK.
CS error 12	The LDEV number specified in @LINK.LAPBLINK is not the same as the LDEV number in your system configuration file.	Check to see which LDEV number is incorrect and then modify it.
CS error 161	The cable connecting the INP board to the modem may be loose, or the modem might be malfunctioning, or you may not be using the correct cable to connect the INP board to the cable, or level 2 and/or level 3 is not responding.	Step through the possible causes one-by-one, until you isolate the problem. Take corrective action as follows: • Tighten the cable between the INP board and the modem. • Replace the modem. • Exchange the wrong cable for the right cable. • Run an on-line and/or off-line test.

PROBLEMS ESTABLISHING A REMOTE CONNECTION

If problems occur when you try to establish a connection to a remote node after you have brought up the network, the following message will be displayed:

```
VTERROR 39
REMOTE NOT ACCEPTING SERVICE REQUESTS
```

The above message is the local virtual terminal's (VT) interpretation of the problem. The local VT assumes that its remote peer is not answering its call. While this may be why you received the error message, there are many other occurrences that might result in the same error message being displayed. Among them are:

- The local network transport could not determine the intranet or internet route necessary to reach the remote node specified in the DSLINE command.
- The remote VT detected an error.

In this troubleshooting process, you must first try to narrow the possible cause of this message. The tree diagram shown in Figure 6-1 will help you isolate the cause of the VTERROR 39 message.

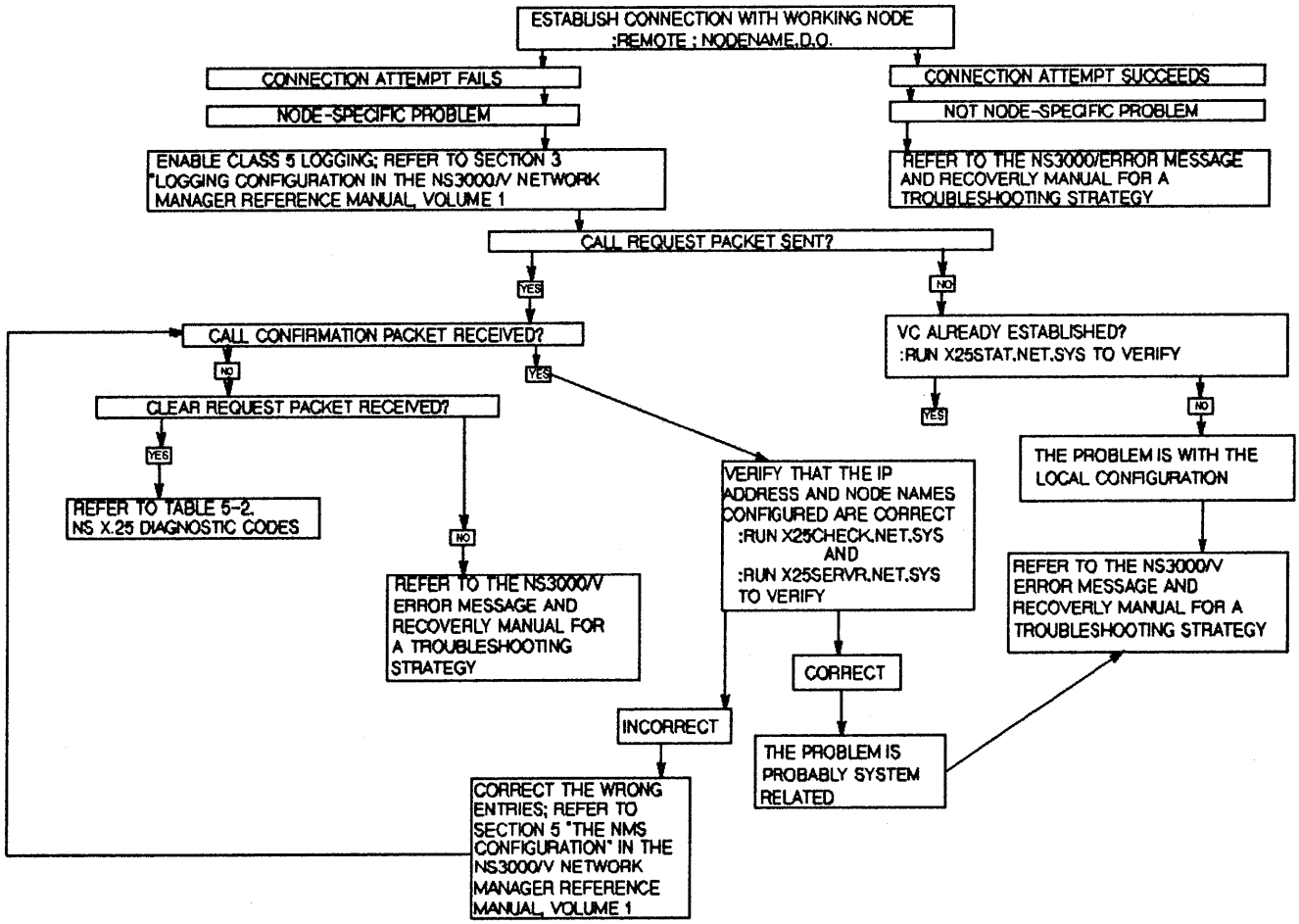


Figure 6-1. Tree Diagram for Troubleshooting VTERROR 39

Once you have identified and isolated the problem, you can take the appropriate action. That corrective action might be to modify the network configuration file (NSCONF.NET.SYS) or the network directory file (NSDIR.NET.SYS). Please refer to the *NS3000/V Network Manager Reference Manual, Volume 1* for instructions on updating these files; you may also need to refer to the *NS3000/V Error Message and Recovery Manual* for troubleshooting information.

NS X.25 DIAGNOSTIC CODES

Table 6-2 lists specific NS X.25 diagnostic codes. Reasons for the codes are explained in the table.

NOTE

Refer to Table 4-7A in Section 4 "Logging Location Codes" in the *NS3000/V Error Message and Recovery Manual* for an explanation on recovering cause and diagnostic codes.

Table 6-2. NS X.25 Diagnostic Codes

Code (decimal)	Diagnostic	Reason
21	Packet Type Invalid for State P2	DTE received an unexpected packet while waiting for a CALL CONF.
22	Packet Type Invalid for State P3	DCE received an unexpected packet while waiting for a CALL CONF.
24	Packet Type Invalid for State P5	An unexpected packet was received after a call collision occurred.
34	Packet Not Allowed	An incoming CALL packet was received on a one-way outgoing SVC.
38	Packet Too Short	The calling address in the CALL packet received was too short.
39	Packet Too Long	The call user data field in the CALL CONF packet received was too long or the Fast Select Facility was selected, although it is not supported.
40	Invalid GFI	The D-bit facility was requested on an SVC but this facility has not been configured.

NS X.25 DIAGNOSTIC CODES (cont'd)

Code (decimal)	Diagnostic	Reason
64	Call Set-Up Problem	There could be a number of causes, including: • An invalid facility field length: too short or doesn't match buffer length. • DCE rejected the CALL because it detected a call collision. • No configured address key was found and the reserved POOL entry is not configured. • The facility set defined can not be found in the facility set table. • The X.25 address or address key do not satisfy the IN-LUG tests. • No free entry was found in the connection table. • An incompatible IP address was found in the first data packet. • A CALL socket on the remote system was not created with the same protocol address or with the catch-all capability. • The remote process issued an IPCRecvcn in deferred acceptance and rejected the incoming call.

NS X.25 DIAGNOSTIC CODES (cont'd)

Code (decimal)	Diagnostic	Reason
65	Facility Code Not Allowed	The facility requested is either not supported or allowed. The facility requested may be one of the following: • Reverse charge in a CALL CONF packet. • The fast select facility. • Throughout Class Negotiation is not configured. • Closed user group facility in CALL CONF packet. • Bilateral closed user group. • Packet size negotiation is not configuration. • Windows size negotiation is not configuration. • RPOA facility.
66	Facility Parameter Not Allowed	There could be a number of causes, including: • An invalid facility field length was specified. • The value specified is out of the range for this facility. • Reversse charging has been requested, but it is not configured.
67	Invalid Called Address	An invalid BCD address has been specified in the called address field.
68	Invalid Calling Address	An invalid BCD digit was specified in the calling address field.
69	Facility Field Too Long	Only 63 bytes are allowed in the facility field.

X.25 UTILITY PROGRAMS

Two utility programs, X25STAT and X25CHECK/X25SERVR, are provided with NS X.25. The X25CHECK/X25SERVR utility program establishes an X.25 virtual circuit to a user defined remote node. The X25STAT utility program provides an on-line status for an active X.25 Network Interface (NI). NS X.25 must be installed for these utility programs to run.

X25STAT

The X25STAT program returns several types of status information for an active X.25 Network Interface (NI). You must have node manager (NM) capability to run this program. X25STAT lists X.25 specific information that can not be obtained from other sources. For instance, you can request:

- General information about a specific NI.
- The status of a switched virtual circuit (SVC).
- The status of a permanent virtual circuit (PVC).
- The status of an address key.
- The status of flow control.

There are a number of commands that you can use to gather NS X.25 specific information. An on-line help facility is also available for your reference and the EXIT command lets you leave the program. The X25STAT commands are:

- SELECT or S. Use this command to specify the X.25 NI that you want information about.

- GENERAL or G. This command displays general X.25 configuration information for the NI selected.

- KEY or K. Displays either the status of the X.25 address key for the NI specified or the status of all the address keys configured in the SVC and PVC path tables for the selected NI. The format of the returned data will depend on the request specified and on whether or not a connection is established.

- FACSET or FS. Returns information on a particular facility set or lists all the facility sets configured for the selected NI. The format of the returned data will depend on the request specified.

- InLUG or I. Displays the information configured for the incoming LUG table for the selected NI.

- OutLUG or O. Displays the information configured for the outgoing LUG table for the selected NI.

- HELP. When you type this command, an on-line help facility is displayed. In it, commands and command syntax are explained.

- EXIT or E. Exits the X25STAT program and returns you to the MPE/V prompt (:).

To run the X25STAT program type RUN X25STAT.NET.SYS at the MPE prompt (:) and then press (RETURN). The >>>FUNCTION? prompt will be displayed. At the >>>FUNCTION? prompt, you must type either SELECT or S. At the network name prompt, you must type the name of the X.25 NI that you wish to gather information about. After you have typed the X.25 NI name at the network name prompt, press (RETURN).

The program is ready to gather specific information for the NI named. Now, you can enter any X25STAT command. In the example below, the NI name entered was X25NET. Each X25STAT command is listed with its automatically generated output. User input is underlined for your quick reference. The example is presented here as it would appear on your terminal.

X25STAT Example

```
:run X25STAT.NET.SYS

X.25 Link Status [A0104028] (C) Hewlett-Packard Company 1988

>>> FUNCTION? Select
network name: x25net
**** NETWORK INTERFACE SELECTED ****

>>>FUNCTION? InLUG
**** LUG IN STATUS INFORMATION ****
NO INLUG CONFIGURED

>>>FUNCTION? OutLUG
**** LUG OUT STATUS INFORMATION ****
NO OUTLUG CONFIGURED

>>>> FUNCTION? GENERAL
**** NETWORK GENERAL INFORMATION ****

NETWORK INTERFACE NAME:X25NET
X25 NI STATE  :X25 R1 state. Ready for VC open
LOCAL NODE ADDRESS :58702013040051
X.25 PACKET LEVEL  :DTE

DEFAULT FLOW CONTROL VALUES
IN Packet Size          :128
OUT Packet Size         :128
IN Window Size          :2
OUT Window Size         :2
IN Throughput Class     :10
OUT Throughput Class    :10

TRACE

FIRST PVC           :0
LAST PVC            :0
FIRST SVC IN        :0
LAST  SVC IN        :0
FIRST SVC IN/OUT    :1
LAST SVC IN/OUT     :20
```

```
FIRST SVC OUT        :0
LAST SVC OUT         :0

>>>FUNCTION? FACSET
facility set name: @
**** FACILITY SET STATUS ****

FACILITIES SET NAME            :POOLFSET
ENTRY TYPE                     :SVC
PACKET SIZE NEGOTIATION        :NO
INCOMING PACKET SIZE           :128
OUTGOING PACKET SIZE           :128
THROUGHPUT CLASS NEGOTIATION   :NO
INCOMING THROUGHPUT CLASS      :11
OUTGOING THROUGHPUT CLASS      :11
WINDOW SIZE NEGOTIATION        :NO
INCOMING WINDOW SIZE           :2
OUTGOING WINDOW SIZE           :2
END TO END ACKNOWLEDGMENT      :NO
ACCEPT REVERSE CHARGE          :NO
MAKE REVERSE CHARGE            :NO
CLOSED USER GROUP SELECTION    :NO
CLOSED USER GROUP NUMBER       :NO

>>>FUNCTION? KEY
X.25 ADDRESS KEY: @

5 ADDRESS KEY             :POOL
ENTRY TYPE                :SVC
VIRTUAL CHANNEL NUMBER    :1
FACILITIES SET NAME       :POOLFSET
REMOTE NET ADDRESS        :111111111111111
Established               :NO
X.25 STATE                :P1

X.25 ADDRESS KEY          :RAINBOW
ENTRY TYPE                :SVC
VIRTUAL CHANNEL NUMBER    :20
FACILITIES SET NAME       :STDSFSET
REMOTE NET ADDRESS        :58705320110101
Established               :YES

EFFECTIVE FLOW CONTROL VALUES
In Packet Size            :128
Out Packet Size           :128
In Window Size            :2
Out Window Size           :2
In Throughput Class       :0
Out Throughput Class      :10
X.25 STATE                :D1

>>>FUNCTION? EXIT
```

```
END OF PROGRAM
:
```

X25CHECK/X25SERVR

X25CHECK/X25SERVR is actually a pair of programs you can use to verify that a Level 3s connection has been established between your local node and the remote node you are trying to contact. Additionally, these programs return values you can use to estimate and evaluate the network's performance. They also can be used to establish a connection with remote X.25 DTE.

X25CHECK/X25SERVR programs work together to diagnose conditions between two nodes. X25CHECK runs on the node you are testing (i.e. the local node) and X25SERVR runs on the remote node. The two programs, running concurrently, can verify the establishment of a virtual circuit between the local node and the remote node.

X25CHECK

The X25CHECK program runs at Level 3 on your local node. The program tries to establish a virtual circuit with the remote node. After the program has established a virtual circuit, it sends the remote node the same message five different times. The program then measures the time period between sending the message and receiving a response from the remote node.

To run the X25CHECK program, perform the following steps:

- Type `RUN X25CHECK.NET.SYS` at the MPE prompt (:) and then press RETURN. You must have node manager (NM) capability to run this program.
- X25CHECK will initialize the test and then ask for the name of the network you wish to test. Type the name of the network and then press RETURN.
- X25CHECK will ask you to supply the name of the node you wish to test. Type the name of the node and then press RETURN.
- X25CHECK will ask you if you want to send a call packet to the remote node with or without data. HP recommends that you first send the call packet without data. This will verify the establishment of a virtual circuit between nodes. After it has sent and received the call packet, X25CHECK will list performance measurements.
- X25CHECK will ask you if you would like to run the test one more time. HP recommends that you type `Y` and press RETURN. If you type `N`, the program will terminate.
- X25CHECK will initialize the test again and then ask for the name of the network you wish to test. Type the name of the network and then press RETURN.
- X25CHECK will ask you to supply the name of the node you wish to test. Type the name of the node and then press RETURN.
- X25CHECK will ask you if you want to send a call packet to the remote node with or without data. HP recommends that this time you send the call packet with data. After it has sent and received a data packet to the remote node five times, X25CHECK will list performance measurements.

- X25CHECK will ask you if you would like to run the test one more time. Type N and press (RETURN). The program will terminate.

In the example below, the network tested was called X25NET2. The node tested was called LUMPY. The example is presented here as it would appear on your console. User input is underlined for your quick reference.

X25CHECK Example

```
:RUN X25CHECK.NET.SYS

X25CHECK (A.01.04) (c) COPYRIGHT Hewlett-Packard Company 1988.

Initialization of the test...
Enter the name of the network you are working on ()>X25NET2

Enter the name of the node you want to check ()>LUMPY

Do you want to send only a CALL packet (no DATA)? (y/n)>Y

CALL packet sent ...
CALL CONF packet received ...
CLEAR packet sent ...

The following figures have been measured on the network:
Set up time:   664 ms

Do you want to run the test once again? (y/n)>Y

Initialization of the test...

Enter the name of the network you are working on (X25NET2)> (RETURN)

Enter the name of the node you want to check (LUMPY)> (RETURN)

Do you want to send only a CALL packet (no DATA)? (y/n)>N

CALL packet sent ...
CALL CONF packet received ...

DATA packet sent ...
DATA packet received ...

DATA packet sent ...
DATA packet received ...

DATA packet sent ...
DATA packet received ...

DATA packet sent ...
DATA packet received ...
```

```
DATA packet sent ...
DATA packet received ...

CLEAR packet sent ...

The following figures have been measured on the network:
Set up time:   278 ms
Transit time:10546 ms

Do you want to run the test once again? (y/n)>N

END OF PROGRAM
:
```

X25SERVR

X25SERVR is a peer program. X25CHECK cannot run unless X25SERVR is running on the remote node. For the purposes of this discussion, the local node is the node running X25CHECK and the remote node is the node running X25SERVR. This program waits for data packets to be sent from the node that is running X25CHECK and then responds accordingly.

To run the X25SERVR program, perform the following steps:

- Type RUN X25SERVR.NET.SYS at the MPE prompt (:) and then press RETURN. You must have node manager (NM) capability to run this program.
- X25SERVR will ask you to supply the name of the network you wish to test. Type the name of the network and then press RETURN. The remote node is now ready to receive a call packet from the local node. After it receives the call packet, it will send the packet back to the local node. The remote node will wait for a data packet. For every data packet received, it will send a data packet back to the local node. These transactions will be displayed on the console.
- After you have finished running the X25CHECK program on the local node, you need to abort the X25SERVR program. Press RETURN. Type ABORT at the MPE prompt (:) and then press RETURN. The program will terminate.

In the example below, X25SERVR was started. After it was started, X25CHECK was started on the local node. The network tested was called X25NET2. The example is presented here as it would appear on your console. User input is underlined for your quick reference.

X25SERVR Example

```
:RUN X25SERVR.NET.SYS

X25SERVR (A.01.04) (c) COPYRIGHT Hewlett-Packard Company 1988.

Enter the name of the network you are working on ()>X25NET2

Waiting for a CALL...
Call Received...
```

```
Data packet received...
Data packet received...
Data packet received...
Data packet received...
Data packet received...
Data packet received...

Waiting for a CALL...

:ABORT
PROGRAM ABORTED PER USER REQUEST. (CIERR 989)
```

NS X.25 IMPLEMENTATION OF THE 1980 CCITT RECOMMENDATION

APPENDIX A

This appendix describes the differences between the 1980 CCITT X.25 Recommendation and HP's NS X.25 implementation. Only the differences between the CCITT recommendation and HP's implementation are cited. Similarities between the recommendation and the implementation are not documented in this section.

The chapters and chapter sub-headings listed in this appendix correspond to the chapters and chapter sub-headings listed in the 1980 CCITT Recommendation. Each heading is accompanied by an explanation that describes the the difference between the CCITT X.25 Recommendation and HP's NS X.25 implementation. They are numbered here as they are in the CCITT X.25 Recommendation, for your quick reference.

NS X.25 is quite similar to the 1980 CCITT X.25 Recommendation. However, there are two main differences. They are:

- Datagrams are not supported.
- NS X.25 can emulate DCE to allow direct connections to DTE.

CHAPTER 3

Description of the Packet Level DTE/DCE Interface

NS X.25 requires data fields of packets to contain an integral number of octets.

3.1 Logical Channels

NS X.25 refers to logical channels as virtual circuits. A virtual circuit is a concatenation of the logical channel group number (most significant) and the logical channel number (least significant). NS X.25 supports VC numbers from 0 to 4095. A consecutive range of PVCs, one-way incoming SVCs, one-way outgoing SVCs, and two-way SVCs can be configured. However, the total number of VCs (SVC+PVC) can not exceed 128 per physical link.

3.2 Basic Structure of Packets

NS X.25 supports all packet types except datagram, datagram service, and DTE reject.

3.3 Restart Procedures

The number of retries for a restart packet is one. When the retry count is 0, an error will be logged (NS logging Class 5). The diagnostic code will be 52 if configured as X.25-DDN or acting as DCE. In all other cases, it will be 48.

3.4 Error Handling

If one of the following errors is detected in the received packet, the packet is discarded. An error is logged (NS logging Class 5) and a diagnostic code is displayed.

error	diagnostic code
Packet size <2 bytes	38
Invalid GFI	40
Unassigned VC	36

For DTE:

No further action is taken and the state of the virtual circuit(s) remains unchanged.

For DCE:

A diagnostic packet is sent with the corresponding diagnostic code. The state of the virtual circuit(s) remains unchanged.

3.4.1 Diagnostic Packet

For DTE:

Incoming diagnostic packets are logged (NS logging Class 5). The state of the virtual circuit(s) remains unchanged.

For DCE:

A diagnostic packet is sent after two time-outs have occurred for any of the following: a clear reset, a reset, or a restart. The diagnostic code for the packet will be 50 for clear, 51 for a reset, and 52 for a restart.

3.5 Effects of the Physical and the Link Level on the Packet Level

NS X.25 will issue a restart packet after the NS control process (CP) has opened the INP. This will occur after the NETCONTROL START command has been issued or after the CP has re-opened the INP after a CS error. NS X.25 will remain in this state until either a restart packet or a restart confirmation packet is received from the network, or the CP informs NS X.25 that the link is about to be closed.

The CP may inform NS X.25 that the INP is closing down because either a NETCONTROL STOP command was issued or an INP or port translator error occurred. If the closure is due to the issuance of the NETCONTROL STOP command, NS X.25 will attempt to send a restart packet. It should be noted that NS X.25 will not wait for a restart confirmation packet. If the closure is due to an error, NS X.25 will not try to send a restart packet.

NOTE

An open message from the CP does not indicate that Level 2 is up. NS X.25 will wait until it receives a restart packet from the network or it receives a message from the CP.

CHAPTER 4

Procedures for Virtual Circuit Services

4.1.2 Call Request Packet

The called address is always inserted. NS X.25 will insert the calling address that has been configured in the X.25 Address field on the X.25 Local Address and Virtual Circuit Assignment screen. If an address has not been configured, there will be no calling address in the call request packet.

4.1.3 Incoming Call Packet

NS X.25 processes the calling address of the incoming packet in the following manner:

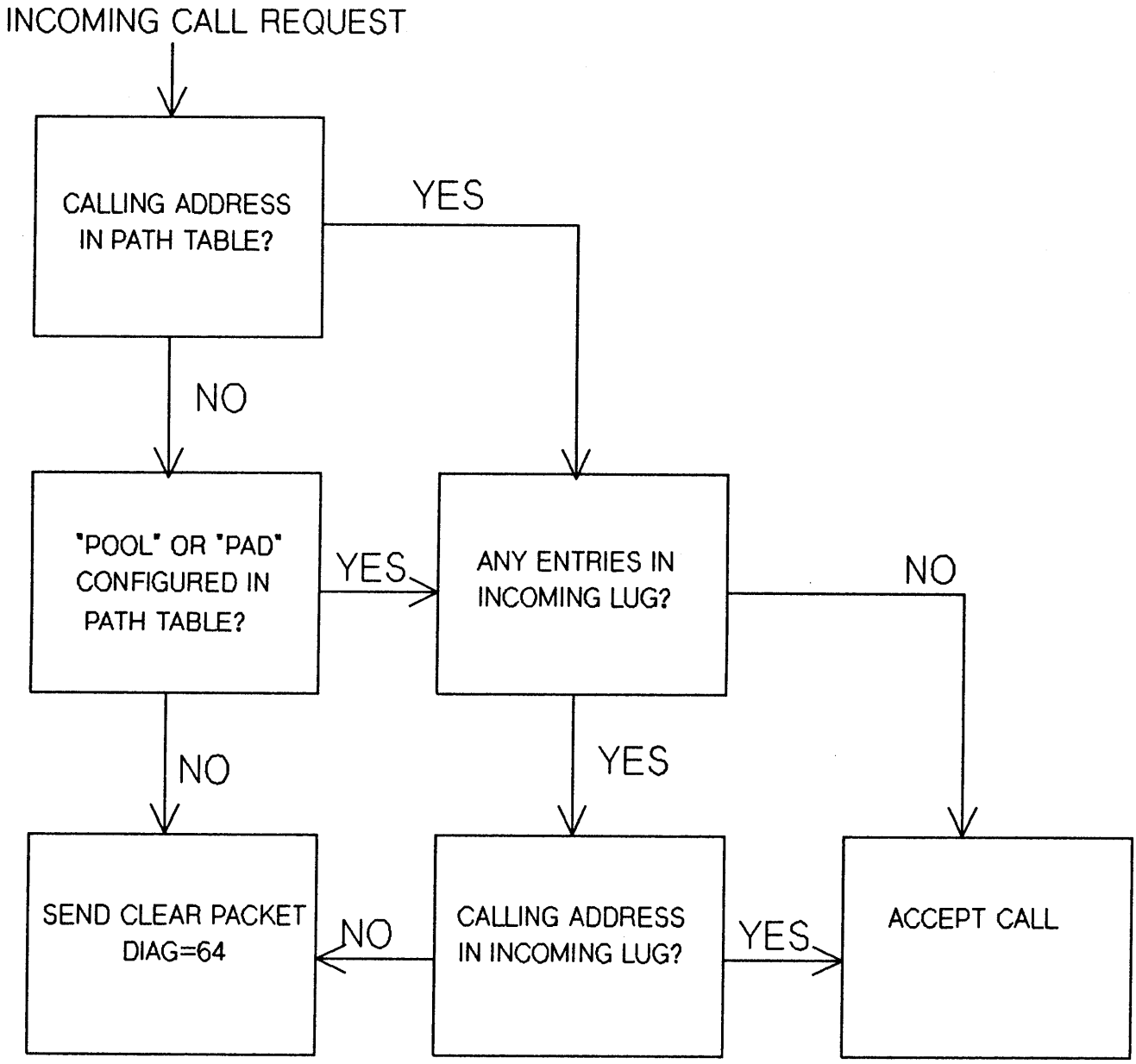


Figure A-1. Incoming Call Packets

4.1.6 Call Collision

HP follows the CCITT recommendation when call requests and incoming calls are transmitted simultaneously on the same virtual circuit.

4.1.11 Call Progress Signals

NS X.25 does not use or issue call progress signals.

4.3.2 User Data Field Length of Data Packets

The following bytes per packet are supported: 16, 32, 64, 128, 256, 512, 1024.

- A non-default maximum length may be selected as default for all virtual calls.
- A value other than the default may be selected for each PVC.
- HP supports negotiation of maximum length on a per call basis.
- The user data field must contain an integral number of octets.

4.3.3 Delivery Confirmation Bit

The use of a D bit is supported only through the NetIPC interface.

Use of the D bit can be configured for each switched virtual circuit. If configured, the following will occur:

- The call packet will have the D bit set to 1.
- The call confirmation packet will always have the D bit set to 0.
- If the IPCSend flag has the D bit set to 1, then the last data packet D bit will be set to 1.

If not configured, then:

- The call packet will have the D bit set to 0.
- If the incoming call has the D bit set to 1, then clear the packet.
- If the IPCSend flag has the D bit set to 1, then an error is passed to IPC.
- If the D bit is set to 1 when receiving data packets, then the reset diagnostic code will be 0.

4.3.4 More Data Mark

Packets issued:

- The M bit will be set to 1 in full packets.
- The M bit will be set to 0 in the packet sequence.

Packets received:

- If a packet is empty then issue a reset with diagnostic code 38.

4.3.6 Qualifier Bit

The Q bit will be set according to the IPCSend flag.

Packets issued:

- The Q bit will be set to 1 in the packet sequence.

Packets received:

- If the Q bit is inconsistent in sequence then issue a reset with diagnostic code 83.

4.3.7 Interrupt Procedure

Packets issued:

- 1 byte of data.

Packets received:

- If less than 4 bytes, then issue a reset with diagnostic code 39.

4.4.1.1 Numbering of Data Packets

Module 8 sequence numbering is supported. Extended packet numbering (module 128) is not supported. A packet received with SN bits set to 10 (module 128) is regarded as an invalid GFI and the packet is discarded. An error is logged (NS logging Class 5). The diagnostic code will be 40.

4.4.1.2 Window Description

NS X.25 supports window sizes between 1 and 7. The default is 2. A non-default window size may be selected for all virtual calls. A value other than the default may be selected for each PVC. NS X.25 supports negotiation on a per call basis.

4.4.1.3 Flow Control Principles

A P(S) sequence error is regarded as a local procedural error. It will cause a reset with a diagnostic code 1. An incorrect P(R) will cause a reset with a diagnostic code 2.

4.4.1.4 Delivery Confirmation

NS X.25 acknowledges each data packet received with the D-bit set by issuing a receiver ready packet when the NetIPC user has acknowledged the incoming data packet.

4.4.1.6 Receive Not Ready Packets

NS X.25 does not issue receive not ready packets but accepts and processes incoming receive not ready packets.

CHAPTER 5

Procedures for Datagram Service

NS X.25 does not support Datagram service.

CHAPTER 6

Packet Formats

6.2.1 Call Requests and Incoming Call Packets

Packets issued:

- Called address is always inserted.
- Calling address is inserted if it is configured in the local address field.
- The facilities field length is always inserted even though its value may be 0.

The format of the call user data field is as follows:

- TCP/IP connection: Byte 0 = 11001100.
- Level 3 access: Byte 0 = 11111100.
- Byte 1 = 10101010.
- Byte 2/3 = Protocol relative address.

Packets received:

- Refer to 4.1.3 Incoming Call Packet. If a facility has not been configured but is present in the incoming call packet, then the call is cleared with a diagnostic code 65.

6.2.2 Call Accepted and Call Connected Packets

Issued:

- Calling and called addresses are not inserted.
- If no facilities are coded, the address length field and the facility length field are not inserted.
- If facilities are coded, an address field is inserted that contains all zeros.

6.2.3 Clear Request and Clear Indication Packets

Packets issued:

A diagnostic field is always inserted. For DTE, the cause code is always 0. For DCE, the cause code may be set to any one of the following:

```
 0  No additional information
 3  Invalid facility request.
19  Local procedure error.
25  Reverse charging acceptance
    not subscribed.
41  Fast select acceptance
    not subscribed.
64  Facility field length >63 bytes.
```

Packets received:

- If the packet is greater than 5 bytes, a clear packet with a diagnostic code 39 is sent. Packets with less than 5 bytes are accepted if the bytes are correct. If the packet is less than 4 bytes, a clear packet with a diagnostic code 38 is sent.

6.2.4 Clear Confirmation Packets

Packets issued:

- 3 bytes of data.

Packet received:

- If the packet is greater than 3 bytes, a clear packet with a diagnostic code 39 is sent.

6.4 Datagram and Datagram Service Signal Packets

Not supported.

6.5.2 Receive Not Ready Packets

Receive not ready packets are not issued but NS X.25 processes incoming receive not ready packets.

6.5.3 Reset Request and Reset Indication Packets

Packets issued:

- A cause and diagnostic code is always inserted.
- For DTE the cause is always 0.
- For DCE the cause may be one of the following:

```
0  Reset on PVC.
5  Local Procedure Error.
```

Packets received:

- If the packet is greater than 5 bytes, a reset packet with a diagnostic code 39 is sent. If the packet is less than 4 bytes, a clear packet with a diagnostic code 38 is sent.

6.5.4 Reset Confirmation Packets

Packets issued:

- 3 bytes of data.

Packets received:

- If the packet is greater than 3 bytes, a clear packet with a diagnostic code 39 is sent.

6.6.1 Restart, Request, and Restart Indication Packets

Packets issued:

- A cause and diagnostic code is always inserted.
- For DTE the cause code is always 0.
- For DCE the cause code may be one of the following:

```
1  Local procedural error.
3  Network operation.
7  Network operational.
```

Packets received:

- If the packet is greater than 5 bytes then an error is logged (NS logging Class 5). The diagnostic code will be 39. If acting as DCE, a diagnostic packet is issued.

6.6.2 Restart Confirmation Packets

Packets issued:

- 3 bytes of data.

Packets received:

- If the packet is greater than 3 bytes then it is discarded. An error is logged that indicates a diagnostic code 39.

6.7 Diagnostic Packets

Packets issued:

- Only if DCE.

Packets received:

- They are logged.

6.8.1 DTE Reject Packet

Packets issued:

- None sent.

Packets received:

- A reset packet is issued with a diagnostic code 37.

6.8.2 Fast Select Facility

Not supported. A call packet which contains the fast select facility is cleared with a diagnostic code 65.

CHAPTER 7

Procedure and Formats for Optional User Facilities

7.1.1 Extended Packet Sequence Numbering

Not supported.

7.1.2 Non Standard Default Window Sizes

Supported. Different values may be selected for each direction of transmission.

7.1.3 Default Throughput Class Assignment

Supported. Different values may be selected for each direction of transmission.

7.1.4 Packet Retransmission

Not supported.

7.1.5 Incoming Call Barred

This is a network facility. NS X.25 does not need to do anything to support this facility.

7.1.6 Outgoing Call Barred

Same as incoming call barred (except uses one-way logical channel incoming).

7.1.7 One-Way Logical Channel Outgoing

Supported.

7.1.8 One-Way Logical Channel Incoming

Supported.

7.1.9 Closed User Groups

The closed user group (CUG) number that has been configured is inserted into the call request packet. In an incoming call packet the closed user group number is ignored. If the network type is PSS, CUB = 00 is not available.

7.1.10 Closed User Groups With Outgoing Access

If a CUG number was not specified at configuration time, then a CUG number is not inserted in the call request packet.

7.1.11 Closed User Groups With Incoming Access

NS X.25 supports this facility since CUG numbers are ignored when receiving incoming call packets.

7.1.14 Bilateral Closed User Group

Not supported.

7.1.15 Bilateral Closed User Group With Outgoing Access

Not supported.

7.1.16 Reverse Charging

Supported.

7.1.17 Reverse Charging Acceptance

Supported.

7.1.18 RPOA Selection

Not supported.

7.2.1 Non-Standard Default Packet Sizes

Supported.

7.2.2 Flow Control Parameter Negotiation

Supported.

7.2.3 Throughput Class Negotiation

Supported. However, the negotiation value is fixed in the configuration and it is not a function of the NS X.25 resource load.

7.2.4. Fast Select

Not supported. A call request/incoming call packet which contains this facility will be rejected.

7.2.5 Fast Select Acceptance

Not supported.

7.2.6 D-Bit Modification

Not applicable.

7.4.2.5.1 Coding for Packet Sizes

Values from 4 to 10 (16 to 1024 bytes) are supported.

7.4.2.5.2 Coding for Window Sizes

All values from 1 to 7 are supported.

7.4.2.6 Coding of Throughput Class Negotiation Facility

Values from 7 to 13 (1200 to 57600) are supported.

7.4.2.7 Coding of Fast Select Facility

Not supported.

7.4.2.8 Coding of Datagram Non-Delivery Indication

Not supported.

7.4.2.9 Coding of Datagram Delivery Confirmation

Not supported.

X.28 AND X.3

APPENDIX B

X.28 COMMANDS

CCITT Recommendation X.28 controls the interface between the terminal and the Packet Assembler-Disassembler (PAD). Various commands specified by this recommendation allow you to communicate with the PAD for such tasks as manipulating the virtual circuit and changing various PAD parameters.

Some networks may have extra commands, or may use these commands in a different way. As always, contact your network administrator for assistance.

If you are in data transfer mode during a PAD session on an HP 2334A, you must type CONTROL P before executing any of the following commands.

Setting up the Virtual Circuit

This command is network-specific. Ask your network administrator for the proper command for your network.

Listing X.3 Parameters

PAR? RETURN

Entering this command will list the current values of all the X.3 parameters (described later in this chapter) in this form:

```
PAR1:value,2:value...
```

Or, to check on the values of specific parameters, you can use the following variation. Let us say you want the value of parameters 8 and 9:

PAR? 8,9 RETURN

The PAD will respond with:

```
PAR8:0,9:0
```

and you will find that 8 and 9 each have the value 0.

Changing X.3 Parameters

SET parameter number:desired value[,parameter number:value[,,,parameter number:value]] RETURN

Let us say you want to change the value of 8 to 0, and 9 to 3·

SET 8:0,9:3 (RETURN)

Changing and Listing Parameters

SET parameter number:desired value[,parameter number:value[,,,parameter number:value]](RETURN)

This command is like entering a SET command, followed by a PAR command. It works the same way as an ordinary SET command, but responds with the new value of the parameter. Again, let's say you want to change the value of parameter 8 to 0, and 9 to 3:

SET? 8:0,9:3

The PAD will respond with:

PAR8:0,9:3

Calling a Status Request

STAT (RETURN)

This command tells you the status of your circuit, that is, whether it is FREE or ENGAGED.

Resetting the Virtual Circuit

RESET (RETURN)

This command resets your virtual circuit. All protocol sequence numbers are set to 0. Any data in transit will be lost.

Clearing the Virtual Circuit

CLR (RETURN)

This command clears your virtual circuit. It differs from RESET in that CLR completely disconnects the virtual circuit, while RESET keeps the circuit connected.

Transmitting an Interrupt Packet

INT (RETURN)

This command sends an interrupt packet to the remote HP 3000 and has the same effect as pressing (BREAK) would have during a normal local session.

Selecting an X.3 Parameters Profile

PROF[identifier] (RETURN)

This command resets the X.3 parameters to the profile specified in the `identifier` parameter as defined by the PDN. If no profile identifier is provided, the X.3 parameters will be set according to the initial profile values specified when the terminal is connected to the PAD.

PAD SERVICE SIGNALS

You will receive these signals only if Parameter 6 (PAD Service Signals) is set to 1 or 4. (Default is 1.)

Table B-1. PAD Service Signals.

Format	Meaning
RESET DTE	The remote DTE has reset the virtual circuit
RESET ERR	Reset due to local procedure error
RESET NC	Reset to network congestion -- there are too many users on the network
CLR	Clear indication -- the PAD is clearing your virtual circuit
COM	Call connected -- you have successfully connected to the remote HP 3000 (response to the PDN-specific set-up command). Press RETURN to get the initial colon (:) prompt from the HP 3000.
ERROR	The PAD did not recognize the command you just tried to enter. Check the manual, and try again.
ENGAGED	Call established (response to STAT command)
FREE	Call not established (response to STAT command)
PAR*param:value*	Response to SET command.

X.3 PARAMETERS

While X.28 controls the PAD itself, CCITT Recommendation X.3 specifies the PAD parameters for terminals. These parameters contain information about the terminal's characteristics, and define what action should be taken by the PAD on specific input (such as pressing (BREAK)). These parameters can be pre-set by the network, set by the terminal user, or set by the remote computer.

There are a total of 18 parameters defined by X.3. Parameters 1-12 are required on all PDNs, while parameters 13-18 are optional. Your network may or may not implement them. Please contact your network administrator.

The following is a list of the parameters and their meanings, according to the X.3 standard. Some PDNs may not follow the standard exactly. HP's default selection, set by the HP 3000, is printed in **bold** type.

Required Parameters

Table B-2. Parameter 1: Escape From Data Transfer

Values	Meaning
0	Escape not possible
1	**Possible with DLE (CONTROL)P)**
32 - 126	Possible with defined character

This parameter specifies whether or not you can escape from data transfer mode to command mode. In other words, this parameter determines whether or not you can give the PAD X.28 command signals once you have started data transfer.

Table B-3. Parameter 2: Echo

Values	Meaning
0	No echo
1	Echo

This parameter determines whether or not the PAD echoes characters that are entered from the terminal. Default is echo on.

If this parameter is set to 0, your keyboard input will not appear on the screen.

Table B-4. Parameter 3: Data Forwarding Signal

Values	Meaning
0	No data forwarding character
1	Alphanumerics
2	(RETURN)
4	ESC, BEL, ENQ, ACK
8	DEL, CAN, DC2
16	ETX, EOT
32	HT, LF, VT, FF
64	All other characters in columns, 0 and 1 (that is, those characters whose hexadecimal ASCII representation begins with a 0 or a 1), plus DEL.

This parameter signals to the PAD when a packet should be sent. For example, if this parameter is set to 0, a packet will be sent only when full, or when the timer expires (see Parameter 4). With the parameter set to 2, a packet will be sent whenever you press (RETURN), and so on. While 0 uses the network most efficiently, it is not suitable for interactive use. Therefore, the default value is 2, (RETURN).

Values of 4, 8, 16, 32, and 64, although they are defined separately, cannot be used individually. Instead, X.3 defines combinations of these values. Therefore, only the following numbers may be entered for this parameter:

0
2
6 (a combination of 2 and 4)
18 (a combination of 2 and 16)
126 (a combination of 2, 4, 6, 8, 32, and 64)

Table B-5. Parameter 4: Idle Timer

Values	Meaning
0	No time out
1 - 255	Increments of 1/20 of a second

Setting this parameter to other than 0 forces a packet creation after the defined number of seconds, if there is data in the PAD's buffer.

Table B-6. Parameter 5: Ancillary Device Control

Values	Meaning
0	No use of XON and XOFF for flow control
1	Use of XON and XOFF for flow control

This parameter allows flow control using XON and XOFF (DC1 and DC3) for the PAD to the terminal.

Table B-7. Parameter 6: PAD Service Signals

Values	Meaning
0	No service signals
1	Service signals other than prompt
4	Prompt service signals

This parameter selects whether or not PAD service signals are transmitted. (Refer to Table B-1.) As in Parameter 3, only certain combinations of these values are valid. These combinations are:

0
1
4
5 (a combination of 1 and 4)

This parameter is not set by the PAD Support software.

Table B-8. Parameter 7: Procedure on BREAK

Values	Meaning
0	No action
1	Interrupt packet sent
2	Reset packet sent
4	Indication of break PAD message
8	Escape from data transfer
16	Discard output

This parameter defines what the PAD will do after receiving a BREAK signal from the terminal.

As in Parameter 3, only certain combinations of these values are valid. These combinations are:

0
1
2
8
21 (a combination of 1, 4, and 16)--21 is the default

Table B-9. Parameter 8: Discard Output

Values	Meaning
0	Normal data delivery
1	Discard output

This parameter defines what will happen to the output of the HP 3000. That is, if this parameter is set to 1, your terminal will be used as an input-only device.

Table B-10. Parameter 9: (RETURN) Padding

Values	Meaning
0	No padding
1 - 7	Number of padding characters

Mechanical devices such as printing terminals can take some time to (RETURN) after printing a line. Padding characters, usually blanks, give the terminal time to get back to the beginning of the line. Without these padding characters, the first few characters at the head of a new line could be lost.

Table B-11. Parameter 10: Line Folding

Values	Meaning
0	No line folding
1 - 255	Characters per line

This parameter determines how many characters are printed per line. That is, if this parameter is set to 20, and the output line is 80 characters long, then (RETURN) and line feed will be inserted by the PAD to convert the line into four 20-character lines.

Table B-12. Parameter 11: Terminal Speed

Values	Meaning
0	110 bit/sec
1	134.5
2	300
3	1200
4	600
5	75
6	150
7	1800
8	200
9	100
10	50
11	75/1200
12	2400
13	4800
14	9600
15	19200
16	48000
17	56000
18	64000

This parameter is used for information only. It cannot be changed.

Table B-13. Parameter 12: PAD Flow Control

Values	Meaning
0	No use of XON and XOFF
1	Flow control with Xon and XOFF

This parameter is the counterpart to Parameter 5. It allows the terminal to use XON and XOFF (DC1 and DC3) to halt the PAD's transmission of data.

Optional Parameters

Parameters 13-18 are optional. NS X.25 does not attempt to set them; your network administrator will tell you if your network supports them. They are mainly editing features.

Table B-14. Parameter 13: Linefeed Insertion

Values	Meaning
0	No LF insertion
1	Insert LF after each (RETURN) to terminal
2	Insert LF after each (RETURN) from terminal
4	Insert LF after each (RETURN) sent as echo to the terminal

With this parameter set to a value other than 0, the PAD automatically inserts a LF if it senses a (RETURN).

As in Parameter 3, only certain combination of these values are possible. These combination are:

0
1
4
5 (a combination of 1 and 4)
6 (a combination of 2 and 4)
7 (a combination of 1, 2, and 4)

Table B-15. Parameter 14: Linefeed Padding

Values	Meaning
0	No LF padding
1 - 7	Number of padding characters

As in Parameter 9, this parameter allows padding characters to give the terminal time to execute the linefeed.

Table B-16. Parameter 15: Editing

Values	Meaning
0	No editing during data transfer
1	Editing during data transfer

This parameter tells the PAD whether to recognize editing characters, such as BACKSPACE.

Table B-17. Parameter 16: Character Delete

Values	Meaning
0 - 127	Character delete character

The value of this parameter indicates which ASCII character should be used as a character delete character ((CONTROL)H). For example, a value of 32 would mean that the blank would be used.

Table B-18. Parameter 17: Line Delete

Values	Meaning
0 - 127	Line delete character

As in Parameter 16, the value of this parameter indicates which ASCII character should be used as a line delete character ((CONTROL)X).

Table B-19. Parameter 18: Line Display

Values	Meaning
0 - 127	Line display character

As in Parameters 16 and 17, the value of this parameter indicates which ASCII character should be used as a line display character. The line display character reprints a line. It is useful when you have heavily edited a line, and you wish to see what you have done.

CONFIGURATION WORKSHEETS

APPENDIX

C

This appendix contains the worksheets necessary for configuration of X.25 nodes. All necessary tables and required fields are included, as well as blank sheets for all necessary maps.

CATENET MAP

X.25 NETWORK MAP

X.25 NETWORK TABLE

NETWORK NAME:

IP NETWORK ADDRESS:

NODE NAME	IP NODE ADDRESS	CENTRAL ADMIN. NODE? (Y/N)	GATEWAY NODE (Y/N)	X.25 ADDRESS

X.25 INTERNET ROUTING TABLE

NETWORK NAME:

IP NETWORK ADDRESS:

GATEWAY NODE	IP NODE ADDRESS	DESTINATION NETWORK/ADDRESS	HOPS NEEDED TO REACH DESTINATION NETWORK

After you choose to perform Guided Configuration, you select the Go To NET CON function key to perform first-time configuration of a node.

The Guided Network Interface Configuration screen will then prompt you to provide a name for the Network Interface you are going to configure. The Network Interface Name should be the same as the name you used to identify the network on your local network map.

You must first type the NI name and then select the appropriate topology function key to indicate the type of this Network Interface (X.25). If you are configuring a new network interface, Guided Configuration immediately begins supplying the default values for the X.25 NI type.

For all NI types, you will first visit the Node Name Configuration Screen, shown below. (This screen is always visited during loopback guided configuration, but is visited for LAN, router, PC-router, X.25 and gateway half guided configurations only if a node name has not already been configured.)

NOTE

References to the figure numbers and the page numbers pertain to screens shown in the *NS3000/V Network Manager Reference Manual, Volume I.* References in this appendix to various section numbers also refer to the *NS3000/V Network Manager Reference Manual, Volume I.*

NODE NAME CONFIGURATION (NETXPORT.NODE.NAME) Fig. 8-3, p. 8-5

Local NS Node Name _____

Name of the node you are configuring. Must be in the form *node.domain.organization.*

X.25 NODE INTRANET ROUTING TABLE

NODE NAME:

IP NODE ADDRESS:

NETWORK NAME:

DESTINATION NODE	DEST. NODE'S IP ADDRESS	X.25 ADDRESS KEY	X.25 ADDRESS	FAC.SET NAME

LDEV-TO-NODENAME MAPPING FOR OUTGOING PAD CALLS

LDEV	CORRESPONDING NODENAME

X.25 NODE INTERNET ROUTING TABLE

NODE NAME:

IP NODE ADDRESS:

NETWORK NAME:

GATEWAY NODE/IP ADDRESS	DESTINATION NETWORKS/ IP ADDRESSES	HOP COUNT

X.25 CONFIGURATION SCREENS

LINK CONFIGURATION (LINKCONF) Fig. 7-1, p. 7-4

Link Name _____

Press Add to accept the default link name, LAPBLINK. Otherwise, assign a link name that is eight alphanumeric characters or fewer. The first character must be alphabetic.

This link name associates the node you are configuring with the set of LAPB Link Data specified below.

Type: LAP-B.

For X.25, Link type must be LAP-B.

LINK CONFIGURATION: LAP-B (LINKCONF.*linkname*) Fig. 7-9, p. 7-19

Logical device _____

The ldev number for the appropriate INP as configured in SYSDUMP.

Local Mode (5=DTE, 6=DCE) _____

If one side of a link is configured as a DTE, the other side must be configured as a DCE. For all connections to a public PSN, you must use DTE local mode.

Default values are supplied for the remaining LAP-B parameters. You should check these values against those recorded on your network subscription form and press Update Data to include them in the current node's configuration file.

X.25 CONFIGURATION SCREENS (cont'd)

GENERAL X.25 (NETXPORT.NI.*niName*.PROTOCOL.X25) Fig. 12-4, p. 12-9

X.25 Network Identification _____

Enter the name of the local PSN (e.g. TRANSPAC, DDN, etc.) or accept the default (X.25-PDN).

Local X.25 Address Key _____

Enter the key representing the node you are configuring for mapping purposes. The key may have up to eight alphanumeric characters ; the first character must be alphabetic.

Inactivity Timer ____

Accept the default value of 5 or enter another value to clear any unused SVCs after the specified number of minutes (up to 32767). If you enter a value of 0 , the timer will be disabled.

X.25 LOCAL ADDRESS & VC ASSIGNMENT (NETXPORT.NI.*niName*.PROTOCOL.X25.VCSPEC) Fig. 12-5, p. 12-11

Local X.25 Node Address_____

Enter the local X.25 network address for your node as provided by the network administration.

Lowest	Highest	
___	___	Permanent Virtual Circuits
___	___	Two-Way Switched Virtual Circuits
___	___	One-Way Incoming SVCs
___	___	One-Way Outgoing SVCs

Enter values for the first and last VCs subscribed for in these categories.

Example: For ten SVCs beginning with SVC number one, enter 1 under Lowest and 10 under Highest.

X.25 CONFIGURATION SCREENS (cont'd)

X.25 NETWORK & FLOW CONTROL PARAMETERS
(NETXPORT.NI.*niName*.PROTOCOL.X25.VCSPEC.FLOWCNTL) Fig. 12-6, p. 12-13

X.25 Packet Level (DTE=1,DCE=0)___

Enter either 1 (for all public PSN connections), or 0 if the local X.25 protocol will operate in DCE mode.

Packet Size _____

If desired, enter a value as a default packet size for all VCs.

Possible Values: 16, 32, 64, 128, 256, 512, 1024.

Window Size _____

If desired, enter a value as a default window size for all VCs.

Possible Values: 1, 2, 3, 4, 5, 6, 7.

Throughput Class _____

If desired, enter a value as default throughput class for all VCs. The value entered must be equal to or lower than the value calculated in function of the line speed as follows:

Speed:	1200	2400	4800	9600	19200	48000	57600
Class:	7	8	9	10	11	12	13

X.25 CONFIGURATION SCREENS (cont'd)

X.25 SVC ADDRESS KEY PATH (NETXPORT.NI.*niName*.PROTOCOL.X25.PATH)
Fig. 12-10, p. 12-21

X.25 Address Key _____

Enter the X.25 Address Key for a destination node (included in the X.25 Node Intranet Routing Table). The key may have up to eight alphanumeric characters; the first character must be alphabetic. POOL is the Address Key reserved for calls from nodes whose addresses are not specified in the X.25 Address Key Path Table. PAD is the address key used if you want a host HP 3000 to accept incoming calls from all PADs.

X.25 Network Address _____

Enter the X.25 Address of the remote node represented by the current X.25 Address Key (alongside this entry in the X.25 Node Intranet Routing Table). This address may have up to 15 decimal digits (refer to network subscription form for public PSN connections). No address is required for POOL entries. For PAD entries, you need to enter all zeroes. If you do configure entries for both POOL and PAD, these entries must be different from each other.

Default Facility Set Name _____

Enter the name of the facility set corresponding to the SVC identified by the current X.25 Address Key. The name can have up to eight alphanumeric characters; the first character must be alphabetic. You will be prompted to provide path data for each of the remote nodes you expect to communicate with. Press **Next Screen** to continue Guided Configuration.

IP PROTOCOL CONFIGURATION (NETXPORT.NI.*niName*.PROTOCOL.IP) Fig. 11-3, p. 11-7

IP Address _____

Full IP address of the node being configured. Refer to the X.25 Network Table.

X.25 CONFIGURATION SCREENS (cont'd)

Note: This page contains information for one gateway. Before you proceed, make copies of this page for additional gateways. During Guided Configuration, press the **Next Screen** function key when finished configuring information for a gateway. This returns you to the first screen shown on this page. If you are finished for all gateways, press the **Next Screen** key again.

NEIGHBOR GATEWAYS (NETXPORT.NI.*niName*.INTERNET) Fig. 11-9, p. 11-23

Gateway Name _____

Assign a name (maximum eight alphanumeric characters) to a gateway that is on the network to which the node belongs. Refer to Catenet Map and X.25 Network Map.

NEIGHBOR GATEWAY REACHABLE NETWORKS (NETXPORT.NI.*niName*.INTERNET.*gatewayn*) Fig. 11-10, p. 11-24

Neighbor Gateway IP Internet Address _____

Full IP address of the gateway node. Refer to X.25 Network Table.

IP Network Number

_____(1)

_____(2)

_____(3)

_____(4)

Refer to X.25 Node Internet Routing Table. On the actual screen, you also will need to fill out a node portion for each IP Network Number, even though the node portion is ignored. You can simply enter zeros for these node portions.

Hops

_____(1)

_____(2)

_____(3)

_____(4)

Refer to X.25 Node Internet Routing Table for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network numbers.

NETWORK DIRECTORY INFORMATION

After reading the Network Directory section of the *NS3000/V Network Manager Reference Manual, Volume I*, you can complete the information below for all nodes you wish to manually configure into your network directory file. For each node you have configured as a destination node in your Node Configuration file you must make a full entry in the Network Directory.

Node Name	Global or Local	IP Address	Type*	Additional Address **

*Type: 1=IP, 2=IP/LAN802.3, 3=X.25

**For Type 3 (X.25 ACCESS) this address will be the X.25 Address Key you designate in your Node Intranet Routing Table.

SUBSEQUENT X.25 NODES

If you are adding an X.25 node, be sure to complete this information and update the corresponding maps and tables.

Link Name _____

Type = LAP-B.

Logical Device _____

DTE/DCE for LAP-B _____

IP Address of the node being configured

_____

X.25 Node Name _____
(This name is for path table information to follow; the name represents a destination node on the network.)

IP Internet Address of the destination node _____

X.25 Address of destination node _____

X.25 Address Key _____

SVC or PVC _____

Fac Set Name _____

From X.25 Node Name, above, to this point, information must be repeated for all paths to be configured.

See next page for additional X.25 fields for internet configuration.

SUBSEQUENT X.25 NODES (cont'd)

Gateway Names 1)_____ 2) _____ 3) _____

Neighbor Gateway IP Internet Addresses

1) _____ 2)_____ 3) _____

For first gateway:

IP Network Number _____ Hops _____

IP Network Number _____ Hops _____

IP Network Number _____ Hops _____

IP Network Number _____ Hops _____

Be sure to add IP network numbers and hops for other specified gateways.

GLOSSARY

APPENDIX D

C

Catenet

A group of computer networks that are connected to one another.

F

Facilities Set

A facilities set defines the various X.25 connection parameters and X.25 facilities that can be negotiated for each virtual circuit on a per call basis.

Full Gateway

A node that belongs to more than one network and can communicate with each network to which it belongs by using store and forward. A full gateway has one IP address for each network.

G

Gateway Half

A node that belongs to at least one network and also has a gateway half network interface configured. The gateway half network interface includes an X.25 link connecting the node to another gateway half node, called a partner gateway half. Together, the gateway half partners function as a full gateway by performing store and forward over their connecting link.

I

Internet Hop Count

The number of full gateways plus the number of gateway-half links that a packet must pass through in moving from one network to another.

Internet Routing

Internet routing involves all the processes required to route a packet from a node on one network to a destination node on another network.

Intranet Routing

Intranet routing involves all the processes required to route a packet from one node in a network to another node in the same network.

IP Address

A complete IP address comprises a network address and a node address. The network address identifies a network and a node address identifies a node within a network.

L

Local Node

The term local node usually means the node that you are configuring or to which you are logged on.

N

Network

A group of computers connected so that they can exchange information and share resources.

Network Directory

A repository with connection information about all nodes in a catenet.

Node

A computer in a network, or a port (terminal or printer) on a PAD.

NS

NS is used to distinguish the network services (NS3000/V services) and the NS links from DS/3000 links and services.

NS X.25

NS X.25 refers to the NS X.25 3000/V Link product used with the NS3000/V network services.

NS X.25 3000/V Link

The NS X.25 network link for MPE-V/E based systems provides a network connection on HP 3000 systems to private and public X.25 packet switched networks (PSNs). The NS X.25 3000/V Link can be used in conjunction with NS3000/V network services.

NS X.25 PAD Support

A service within the NS architecture that allows communication between an HP 3000 host and remote terminals and printers connected to a PAD.

P

PAD

A Packet Assembler/Disassembler connected to a packet-switching network.

R

Remote Node

A remote node is any other node in the catenet; that is, any other node than the local node.

Routing

Routing refers to the process used to determine the path that packets, or fragments of a message, take through a network to reach a destination node.

X

X.25 Address

This is the X.25 address provided by the network administration if you are connected to a Public Data Network (PDN).

X.25 Address Key

An X.25 address key is a label that maps a node's IP address to its X.25 address and its associated X.25 parameters.

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