

11 Boot Monitor and NVRAM

This chapter describes features of the terminal's Boot Monitor and NVRAM (non-volatile RAM), including Boot Monitor commands and the contents of NVRAM.

The following topics are covered in this chapter:

- ❑ “Boot Monitor Versions” on page 11-1
- ❑ “Boot Monitor Functions” on page 11-2
- ❑ “Using Boot Monitor Commands” on page 11-6
- ❑ “Updating the Boot Monitor on Explora Terminals” on page 11-11
- ❑ “Using Boot Monitor Setup Menus to Configure Terminals” on page 11-12
- ❑ “Using the NVRAM Utility to Configure Terminals” on page 11-20

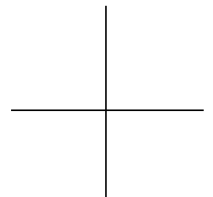
Boot Monitor Versions

The Boot Monitor version is displayed while the terminal boots. After the terminal boots, you can find the version in the Console's Statistics ⇒ Show Version window.

The Boot Monitor version required for a terminal depends on the terminal model and the interface boards installed in some terminal models. At the time of this manual's publication, Boot Monitor 2.8.3 is installed in all new HMX terminals, and Boot Monitor 2.8.2 is installed in new Explora and Explora Pro terminals. Boot Monitor 2.9.0 is installed in Explora 400/450, and Explora 700 terminals.

Older HMX terminals may have PROMs from version 2.7.1 or later, and older Explora terminals may have PROMs from version 2.7.6 or later.

Terminals with older versions of the Boot Monitor can run the most recent version of NCDware, however, you will not have access to features that require the newer Boot Monitor. See the *NCDware Release Notes* descriptions of new features and for information about Boot Monitor requirements.



Boot Monitor Functions

The Boot Monitor is firmware code in the terminal's boot PROM. The Boot Monitor performs many functions automatically and provides interactive access to Boot Monitor functions and to configuration information stored in NVRAM (non-volatile RAM).

Automatic Boot Monitor Functions

The Boot Monitor is activated when you turn on the terminal and controls the booting process as the terminal discovers its network address and loads an X server.

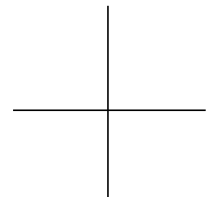
This section describes the automatic functions that occur when you turn on or reboot the terminal. The functions are listed in chronological order and described in more detail in the following subsections.

The Boot Monitor automatically:

- ☐ Displays the Boot Monitor version number and keyboard controller version number
- ☐ Runs self-tests, including memory and network interface tests and displays the results of the self-tests
- ☐ Requests or provides the terminal's IP address
- ☐ Requests and loads an X server image
- ☐ Verifies that the downloaded X server image:
 - Fits into the terminal's memory
 - Is the correct one for the terminal model
 - Has not been corrupted
- ☐ Displays the progress of the download process. Beginning with version 2.8, the Boot Monitor reports the size of the X server and displays a graphical bar showing the progress of the X server download process. Earlier versions display progressions of dots.

Self Tests and Commands for Testing

The Boot Monitor tests terminal memory and the terminal's network interface. The specific tests available for and run by default on the terminal depend upon the terminal model.



You can disable these tests using the **boot-test-ram** parameter, but this is not recommended.

The Boot Monitor **ex** command displays an Extended Tests menu, which lists the tests available for each terminal. (See Table 11-2 for a list of all the Boot Monitor commands.) NCD Technical Support may ask you to run tests if the results are needed for terminal troubleshooting.

The Boot Monitor's output during terminal booting includes the results of the tests.

Keyboard Controller and Supported Keyboards

The keyboard controller is part of the ASIC (application-specific integrated circuit) in the terminal base and serves as the interface between the terminal and the keyboard hardware.

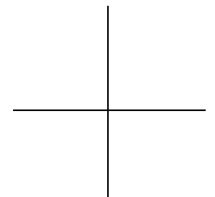
The Boot Monitor supports the following keyboard types:

- ☐ N-101/N-102-key keyboard group, including Windows 95-compatible and foreign language versions
- ☐ VT-220 keyboard group, including foreign language versions
- ☐ N-108LK keyboard group, including Nokia US, French, and German versions
- ☐ N-97 keyboard
- ☐ N-107 Sun Type 4-compatible
- ☐ N-123 Sun Type 5-compatible
- ☐ N-97 Kana and Hitachi Kana
- ☐ Nokia 122
- ☐ 3270-compatible

Address Discovery

By default, the Boot Monitor seeks the terminal's IP address by broadcasting alternating DHCP (Dynamic Host Configuration Protocol), BOOTP (Bootstrap Protocol) and RARP (Reverse Address Resolution Protocol) requests. These requests contain the terminal's Ethernet or Token-Ring address, which is set in NVRAM at the factory.

A host running BOOTP/DHCP and configured with information about the terminal may respond with the terminal's IP address. Depending on the



protocol implementation and the information in the host's database, DHCP/BOOTP can return other information as well. For a complete list of supported DHCP/BOOTP options, see Chapter 3, Booting—Address Discovery.

Alternatively, a host running RARP and configured with information about the terminal may respond with the terminal's IP address. RARP responses contain only the address of the terminal and the address of the host that responded to the request.

If the subnet mask is not supplied in a BOOTP/DHCP response or if BOOTP/DHCP is not used for address determination, you can use ICMP (Internet Control Message Protocol) to determine the subnet mask.

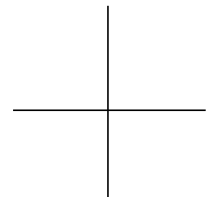
Instead of using network protocols, you can set network addresses in the terminal's NVRAM. Addresses can be saved in NVRAM by using remote configuration files, terminal configuration menus, TELNET, the Boot Monitor Setup menus, or the NVRAM utility. Boot Monitor Setup menus are described in "Using Boot Monitor Setup Menus to Configure Terminals" on page 11-12, and the NVRAM utility is described in "Using the NVRAM Utility to Configure Terminals" on page 11-20. The other configuration methods are described in Chapter 6, Terminal Configuration Methods; Chapter 9, Using Configuration Menus; and the *NCDware System Administrator's Guide for UNIX Systems*.

X Server Downloading

After obtaining the terminal's network address and subnet mask, the Boot Monitor sends multiple requests for an X server and loads an X server and support files from a host answering the request or from a local file system on a PCMCIA card.

The Boot Monitor interleaves TFTP (Trivial File Transfer Protocol), NFS (Network File System), and MOP (Maintenance Operation Protocol) requests to download an X server and support files. You can use remote configuration parameters or the Boot Monitor Setup menus to disable file transfer requests selectively, and you can use the Boot Monitor Setup menus to change the order of the requests.

The Boot Monitor supports downloading from multi-homed hosts (hosts with more than one interface on the same network).



BOOTP/DHCP may also supply a specific X server filename specification. You can use the Boot Monitor's manual boot commands to override the filename specification in the BOOTP/DHCP response.

When downloading an X server using TFTP, the Boot Monitor displays the names of the downloaded file and the boot host after X server download is completed and every time a TFTP transfer is attempted.

When downloading an X server using MOP, the Boot Monitor retains the DECnet node number and displays the node number and name after X server download is completed.

To improve the reliability of downloaded files, the Boot Monitor generates UDP checksums for network packages that it transmits and verifies.

Display Blanking

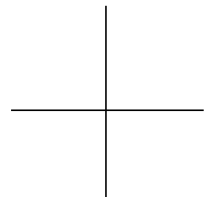
The Boot Monitor blanks the monitor's display automatically after 10 minutes of idleness to avoid a burn-in effect.

Interactive Boot Monitor Functions

The interactive components of the Boot Monitor are:

- ☐ **Boot Monitor commands**—Commands for controlling X server downloading, troubleshooting, and testing
- ☐ **Boot Monitor Setup**—A menu-based utility for simplifying the initial configuration of a terminal when you are using only a few terminals, when you are not using an address discovery protocol, or when booting the terminal from a local file system
- ☐ **The NVRAM utility**—A command-line utility for reading and changing any information stored in the terminal's NVRAM

The interactive components are described in following sections.



Using Boot Monitor Commands

Boot Monitor utility commands provide access to all interactive Boot Monitor functions, including the Boot Monitor Setup menus (**se** command) and the NVRAM utility (**nv** command).

Starting the Boot Monitor Utility

To start the Boot Monitor utility, use one of the following methods:

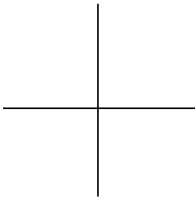
- ❑ After the terminal begins to boot, press the Escape key (the F11 key on VT220-style or N-108 keyboards) when one of the following messages appears:
TFTP load <ESC> to abort
NFS load <ESC> to abort

The terminal displays the Boot Monitor prompt (>).

- ❑ Abort a running X server by typing a key combination. The terminal displays the Boot Monitor prompt. Table 11-1 lists the access key combinations for each keyboard type.

Table 11-1 Boot Monitor Access Key Combinations

Keyboard Type	Key Combination
101-key	Ctrl-Left Alt-Setup
102-key, Windows-95 compatible, US English, and IBM/PS2	Caps Lock-Left Alt-Setup
VT220-compatible	Ctrl-Compose-F3
108-key	Ctrl-Left Alt-F3
97-key	Left Alt-Caps Lock-Setup
107-key (Sun Type-4-compatible)	Stop-A (L1-A)
122-key (3270-compatible Lexmark)	Alt Rule-Home
123-key (Sun Type-5-compatible)	Stop-A (L1-A)
Kana	Left Alt-Caps-Setup



- ❑ Disable automatic booting so the terminal displays the Boot Monitor prompt instead of automatically booting the next time it is reset. Set the value of the **boot-automatically** parameter to “false.” (Setup ⇒ Change Setup Parameters ⇒ Booting ⇒ Boot automatically at power-up)

Issuing Commands to the Boot Monitor

You can type the Boot Monitor commands listed in Table 11-2 after the prompt (>). Follow each command by a carriage return.

Table 11-2 Boot Monitor Commands

Command	Function
bd [<i>file</i>]	Boots the specified X server (<i>file</i>) via MOP. If <i>file</i> is not specified, boots the file identified in the NCP database on the host system for the terminal.
bl	Boots the X server stored in the NCD terminal's local file system.
bn [<i>file</i> [<i>NCD_IP</i> <i>host_IP</i> [<i>gateway_IP</i> [<i>subnet_mask</i>]]]]	Boots the terminal from the network using NFS. You can specify the X server image file (<i>file</i>), the IP address of the terminal (<i>NCD_IP</i>), and the IP address of the host (<i>host_IP</i>). For example: bn Xncdhmx 192.43.153.225 192.43.153.23 If you are specifying either the host or the IP address, you must specify both <i>and</i> specify the filename. If you are booting through a gateway, supply the address of the gateway (<i>gateway_IP</i>) and the subnet mask (<i>subnet_mask</i>), if any. If you do not specify a complete pathname, a default value of /tftpboot is used.

Table 11-2 Boot Monitor Commands (Continued)

Command	Function
bt [<i>file</i> [<i>NCD_IP</i> <i>host_IP</i> [<i>gateway_IP</i> [<i>subnet_mask</i>]]]]	
	<p>Boots the terminal from the network using TFTP. You can specify the X server image file (<i>file</i>), the IP address of the terminal (<i>NCD_IP</i>), and the IP address of the host (<i>host_IP</i>). For example:</p> <pre>bt Xncdhmxx 192.43.153.225 192.43.153.23</pre> <p>If you are specifying either the host or IP address, you must specify both <i>and</i> specify the filename.</p> <p>If you are booting through a gateway, supply the address of the gateway (<i>gateway_IP</i>) and, if you are using one, the subnet mask (<i>subnet_mask</i>).</p>
da	Displays the Ethernet, IP, and node addresses of the terminal, along with the subnet mask and the Ethernet, IP, and node addresses of the boot host.
dm [<i>address</i>]	Displays memory.
dr	Displays registers.
ds	Displays DLC, IP, TFTP, and MOP statistics.
ex	Displays the Extended Tests menu. Tests available depend on the terminal from which you run the command. The extended tests are for use of NCD Technical Support. If your terminal requires their use, an NCD Technical Support person will help you to run the test and will interpret the results.
km	Maps navigation functions for the Boot Monitor Setup menus. See “Programming Navigation Keys for Boot Monitor Setup Menus” on page 11-18.
ks	Displays keyboard statistics.
nf <i>readsize</i>	Sets the NFS and TFTP read size. The read size must be from 128 bytes to 8192 bytes.
nv	Runs the NVRAM utility for reading and changing the contents of the terminal’s NVRAM. See “Using the NVRAM Utility to Configure Terminals” on page 11-20 for more information.

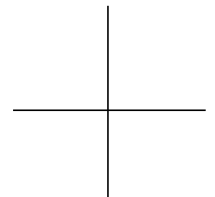


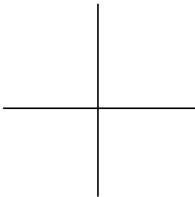
Table 11-2 Boot Monitor Commands (Continued)

Command	Function
pi [<i>timeout</i> <i>NCD_IP</i> <i>host_IP</i> [<i>gateway_IP</i> [<i>subnet_mask</i>]]]	
	<p>Using ICMP protocol, pings the host to determine the round-trip time to get to the host and get back. The default time before timing out (<i>timeout</i>) is 10 seconds.</p> <p>Always specify the IP address of the terminal (<i>NCD_IP</i>) and the IP address of the host (<i>host_IP</i>).</p> <p>If you are pinging through a gateway, supply the address of the gateway (<i>gateway_IP</i>) and the subnet mask (<i>subnet_mask</i>), if any.</p>
rs	Resets the terminal.
se	Displays the initial Boot Monitor Setup menu. See “Using Boot Monitor Setup Menus to Configure Terminals” on page 11-12.
sm	Shows the memory configuration.
tr 4 16	Sets the Token-Ring interface speed.
ud	Uploads an X server image to a host on a DECnet network.
un [<i>file</i> [<i>NCD_IP</i> <i>host_IP</i> [<i>gateway_IP</i> [<i>subnet_mask</i>]]]]	
	<p>Uploads an X server image to a host on a TCP/IP network, using NFS. You can specify the X server image file (<i>file</i>), the IP address of the terminal (<i>NCD_IP</i>), and the IP address of the host (<i>host_IP</i>).</p> <p>If you are specifying either the host or IP address, you must specify both <i>and</i> specify the filename.</p> <p>If you are uploading through a gateway, supply the address of the gateway (<i>gateway_IP</i>) and, if you are using one, the subnet mask (<i>subnet_mask</i>).</p>

Table 11-2 Boot Monitor Commands (Continued)

Command	Function
<code>up</code> [<i>file</i> [<i>NCD_IP</i> <i>host_IP</i> [<i>gateway_IP</i> [<i>subnet_mask</i>]]]]	
	Uploads an X server image to a host on a TCP/IP network, using TFTP. You can specify the X server image file (<i>file</i>), the IP address of the terminal (<i>NCD_IP</i>), and the IP address of the host (<i>host_IP</i>). If you are specifying either the host or IP address, you must specify both <i>and</i> specify the filename. If you are uploading through a gateway, supply the address of the gateway (<i>gateway_IP</i>) and, if you are using one, the subnet mask (<i>subnet_mask</i>).
<code>wd</code> ¹	Display or change the wireless domain.
<code>wr</code> ¹	Display or change the roaming configuration of a wireless terminal.
<code>ws</code> ¹	Change or reset the security ID for a wireless terminal.
<code>zk</code>	Clear keyboard statistics
<code>zs</code>	Clear all statistics gathered during the execution of bn , bt , bd , pi , up , and ud .
<code>!</code>	Repeats the last command.
<code>?</code>	Lists all Boot Monitor commands.

¹ These commands are available only if the Boot Monitor supports wireless.



Updating the Boot Monitor on Explora Terminals

On Explora 400/450, and 700 series terminals you can download an updated Boot Monitor from the remote configuration file.

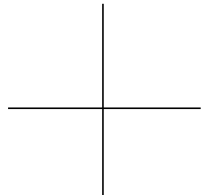
To download a new Boot Monitor version, set the **boot-prom-update-file** parameter to the absolute pathname of a file that contains a new Boot Monitor image. Such files are available from NCD whenever the Boot Monitor is updated. When it boots, the terminal attempts to update its boot PROM with the new image. The update process begins as soon as the terminal receives and verifies the entire update file.

If the X server detects that the Boot Monitor in the terminal is an earlier version, it downloads the new version. If the terminal's Boot Monitor is the same or a later version, no action is taken. The update process takes about 15 seconds.

Caution

Do not turn off power to the terminal while the Boot Monitor is being updated. If the update process is interrupted before the new Boot Monitor is written to PROM, the Boot Monitor will not have the settings necessary to operate the terminal. In that case, you would have to return the base to the factory for rework.

For this reason, NCD recommends that you promptly reboot terminals as soon as you have configured them for Boot Monitor update and that you not configure terminals for Boot Monitor update when power outages are likely to occur.



Using Boot Monitor Setup Menus to Configure Terminals

Using the Boot Monitor Setup menus, you can change a subset of terminal configuration parameters. Using Boot Monitor Setup, you can set the following:

- ☐ Network addresses required for booting and network communication
- ☐ Files and directories needed for booting
- ☐ The order of booting attempts
- ☐ Monitor resolution and dpi (dots per inch)
- ☐ Keyboard type

The Boot Monitor Setup menus provide a help menu and help text for each item.

The content of the Setup menus differs slightly depending on the Boot Monitor version you are using.

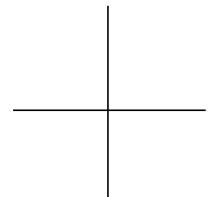
Parameters are saved to NVRAM when you exit the Setup menus unless you specify otherwise in the Done submenu.

Starting Boot Monitor Setup

To start Boot Monitor Setup from within the Boot Monitor (at the > prompt), press the Setup key or type the `se` command. The Boot Monitor Setup Menu bar and Help window appear.

The menu bar displays the names of the six submenus:

- ☐ Help—how to access the windows, move from item to item within the windows, and exit from Boot Monitor Setup
- ☐ Keyboard— keyboard type
- ☐ Monitor—monitor resolution, refresh rate, and dpi
- ☐ Network— IP and NCDnet addresses
- ☐ Boot—names and location of boot and configuration files and specify file transfer protocol preferences
- ☐ Done—save changes, reboot the terminal, return to the Boot Monitor, and restore original parameter settings



Navigating in Boot Monitor Setup

To move from one menu to the next, use the left and right arrow keys. The active menu name is highlighted, and the corresponding window or submenu appears.

Note If you are using a keyboard that does not have arrow keys, you can remap the movement functions to other keys. See “Programming Navigation Keys for Boot Monitor Setup Menus” on page 11-18.

To move from field to field in a window, use the up and down arrow keys. Below the window, a description of the current field is displayed.

If you enter an out-of-range value in a field, an error message appears. To delete a value in a field, use one of the following methods:

- ☐ The Delete key backspaces a character at a time.
- ☐ Ctrl-U deletes everything you typed in the current field.
- ☐ The Escape key erases everything that you typed and returns to the previous value.

Setting the Keyboard Type

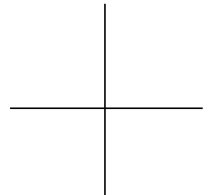
When you select the Keyboard menu, the Keyboard window displays a list of the keyboard types and languages supported by the keyboard group to which the keyboard belongs. The current type is highlighted when you display the window.

To select a keyboard other than the default (usually the US English language type), press the arrow key until you have highlighted the correct type.

Setting Monitor Resolution and Dots Per Inch

When a terminal is first turned on, the display appears at its default resolution (number of pixels in height and width) and refresh rate (in hertz). This setting may not accommodate the highest resolution or refresh rate that your monitor can support. For detailed information about monitor resolution and dpi, see your hardware documentation.

You can use the Monitor menu to select another resolution, refresh rate, or dpi for your monitor.



When you select the Monitor menu item, the two Monitor windows described below appear. Use the right and left arrow keys to move from one window to the other.

The Monitor Resolution Window



Selecting an unsupported screen refresh rate or resolution can damage the monitor. Always refer to your monitor installation booklet *and* test to be sure the refresh rate or resolution selection is supported by the monitor. Note that the test grid may appear even though a monitor is not rated to operate at the frequency selected.

The Monitor Resolution window lists the monitor resolutions (in pixels of height and width) and refresh rates (in hertz) that are supported by the video cable attached to your monitor.

To make sure that the resolution or refresh rate you select is supported on the terminal, press Shift-T.

If the resolution or refresh rate that you selected is supported, a grid test pattern appears, labelled with the selected resolution or refresh rate. If the value is not supported, the test grid might not appear.

The Dots Per Inch Window

To change dpi, backspace over the current setting and type the desired dpi.

Setting Network Parameters

Use the Network window to set the basic networking parameters. Table 11-3 lists the fields and how to change them.

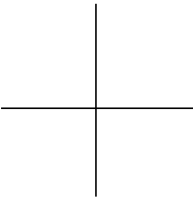


Table 11-3 Boot Monitor Setup Network Window

Window Item	Purpose and How to Set Value
<i>IP Parameters</i>	
Get IP Addresses From	Use the Space bar to toggle between the two permitted values: Network and NVRAM.
DHCP IP Addressing Order	Backspace through the existing value, then type 1, 2, or 3 to specify the preferred priority of this method.
BOOTP IP Addressing Order	Backspace through the existing value, then type 1, 2, or 3 to specify the preferred priority of this method.
RARP IP Addressing Order	Backspace through the existing value, then type 1, 2, or 3 to specify the preferred priority of this method.
Terminal IP Address	Backspace through the existing value, then type the terminal's IP address in decimal format; for example, 192.43.154.80.
First Boot Host IP Address (on versions prior to 2.7.1, this is "Boot Host IP Address")	Backspace through the existing value, then type the first boot host's IP address in decimal format; for example, 192.43.154.99.
Second Boot Host IP Address (Boot Monitor 2.7.1 or later)	Backspace through the existing value, then type the secondary boot host's IP address in decimal format.
Third Boot Host IP Address (Boot Monitor 2.7.1 or later)	Backspace through the existing value, then type the tertiary boot host's IP address in decimal format.
Gateway IP Address	Backspace through the existing value, then type the gateway's IP address in decimal format; for example, 192.43.112.32.
Subnet Mask	Backspace through the existing value, then type the network's subnet mask in decimal format; for example, 255.255.255.0.
Broadcast IP Address	Backspace through the existing value, then type the broadcast address for this subnet in decimal format; for example, 192.43.154.255.
<i>NCDnet Parameters</i>	
Terminal NCDnet Address:	Backspace through the existing value, then type the terminal's NCDnet address in the format area.node ; for example, 1.67. Areas range from 1 to 63; nodes, from 1 to 1023.

Table 11-3 Boot Monitor Setup Network Window (Continued)

Window Item	Purpose and How to Set Value
Host NCDnet Address	Backspace through the existing value, then type the host's NCDnet address, in the format area.node ; for example, 1.27 . Areas range from 1 to 63; nodes, from 1 to 1023.
Router NCDnet Address	Backspace through the existing value, then type the router's NCDnet address, in the format area.node ; for example, 1.59 . Areas range from 1 to 63; nodes, from 1 to 1023.
SNAP (802.2 LLC) Encapsulation (Boot Monitor 2.7.6 or later)	Use the space bar to toggle between Yes and No.

Setting Booting Parameters

Use the Boot window to set the filenames and directories used in booting. Table 11-4 lists the fields and how to set their values.

Table 11-4 Boot Monitor Setup Boot Window

Window Item	Purpose and How to Set Value
Boot File ¹	Backspace through the existing value, then type the name of the X server file; for example, xncdhmxx . Limited to 64 characters.
TFTP Boot Directory ¹	Backspace through the existing value, then type the name of the X server directory for TFTP booting; for example, /tftpboot/ . Limited to 64 characters.
NFS Boot Directory ¹	Backspace through the existing value, then type the name of the X server directory for NFS booting; for example, /tftpboot/ or /usr/tftpboot/ . Limited to 64 characters.
Config File ^{1 2}	Backspace through the existing value, then type the name of the remote configuration file; for example ncd_std . The length is limited to 64 characters.
UNIX Config Directory ²	Backspace through the existing value, then type the name of the directory containing the configuration file for use with UNIX hosts; for example, /usr/lib/x11/ncd/configs/ . The length is limited to 64 characters.

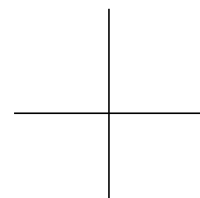


Table 11-4 Boot Monitor Setup Boot Window (Continued)

Window Item	Purpose and How to Set Value
NCDnet Config Directory ²	Backspace through the existing value, then type the name of the directory containing the configuration file for use with VMS hosts on DECnet; for example <code>NCD_ROOT:[CONFIGS]</code> . The length is limited to 64 characters.
TFTP Order	Backspace through the existing value, then type a number specifying the order in which the terminal should attempt file transfer protocols. (1 for first, 2 for second, 3 for third, 4 for fourth.) Type <code>D</code> if the transfer method is disabled. The default order is (1) TFTP, (2) MOP, (3) NFS, and (4) local. If a PCMCIA card is installed, the default order is (1) local, (2) TFTP, (3) MOP, and (4) NFS.
NFS Order	
MOP Order	
LOCAL Order	

¹ The Boot File, TFTP Boot Directory, and NFS Boot Directory items must have a combined length of 128 or fewer characters.

² The Config File, UNIX Config Directory, and NCDnet Config Directory items must have a combined length of 166 or fewer characters.

Finishing the Boot Monitor Setup Session

To save parameter settings, restore old settings, reboot the terminal, or return to the Boot Monitor, use the Done menu item, which displays a Done window. The items in the Done window are described in Table 11-5.

Table 11-5 Boot Monitor Setup's Done Window

Window Item	Action
Reboot	Saves parameter settings to NVRAM and reboots after you press Return.
Exit	Saves parameter settings to NVRAM and exits to the Boot Monitor prompt (<code>></code>) after you press Return.
Undo	Restores the original parameters after you press Return.

Programming Navigation Keys for Boot Monitor Setup Menus

The Boot Monitor’s keymapper allows you to program menu navigation keys for unsupported keyboards that do not have defined arrow keys. You can, however, change the navigation keys for any keyboard.

Please read the following usage notes before you begin:

- ❑ As you assign keys, write down the key assigned to each navigation function in case you forget the new assignments after exiting from the keymapper. This is because the keymapper displays only the keycode, not the legend on the key. For supported keyboards, you can check the keycode against the keyboard maps. For unsupported keyboards, however, there may be no way to find out which key corresponds to a given key code.
- ❑ If you assign a number key to a navigation function, you can no longer use the number key for entering data in the Boot Monitor Setup menus or for entering data with other Boot Monitor commands.
- ❑ Mapping keys and then attaching a keyboard that has a different layout may cause problems if the assigned keys do not exist on the new keyboard.
- ❑ Do not assign one of the defaults to another keymapper function. For example, if you assign the default key for the *left* function to the *right* function but do not assign another key to the left function, pressing *left* causes the cursor to move right. There is now no way to move the cursor left. Be especially careful that you do not lose the *escape* or *setup* functions.

Follow these steps to map the navigation keys:

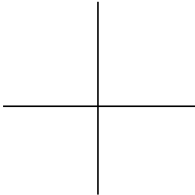
1. Enter the Boot Monitor and type the following command:

```
> km
```

The current keymap is displayed:

Current keymap:		
Key	Current	Customized

left	(default)	no
right	(default)	no
up	(default)	no
down	(default)	no
setup	(default)	no



```
escape      (default)      no
backspace   (default)      no
Change any items [y/n]?
```

2. To start changing the keymap, type **y** and follow the directions displayed:

```
Change any items [y/n]? y
Press one of the following keys:
<key>      Key to use for this item (must not be A-Z)
Return     Do not change this item
d          Restore default for this item
q          Quit without any changes
```

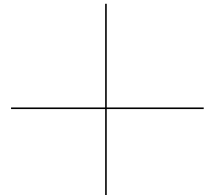
When you press a key, its code appears in the **New** column. In this example, the user has remapped all items but one:

Key	Current	New	Customized
left	(default)	0x6B	yes
right	(default)	0x74	yes
up	(default)	0x75	yes
down	(default)		no
setup	(default)	0x76	yes
escape	(default)	0x77	yes
backspace	(default)	0x7E	yes

```
Save new keymap in nvram [y/n]?
```

3. To save the new keymap, type **y**:

```
Save new keymap in nvram [y/n]? y
>
```



Using the NVRAM Utility to Configure Terminals

The NVRAM utility provides another method of configuring a subset of terminal parameters and provides access to some parameters that are not available through other configuration methods. The utility also allows you to set security levels for the optional security keyboard.

This section describes how to use the NVRAM utility and lists the contents of NVRAM.

Starting the NVRAM Utility

To start the NVRAM utility, type:

```
> nv
NVRAM Utility
C [add] - change location add
D - display contents
Q - return to monitor
L - load defaults
R - reload NVRAM values
S - save new values
->>
```

Type NVRAM utility commands after the ->> prompt, and follow all commands with a carriage return.

NVRAM Utility Commands

Table 11-6 lists NVRAM utility commands, options, syntax, and functions.

NVRAM commands modify a copy of NVRAM residing in RAM. The NVRAM utility does not write changes to NVRAM until you use the **s** (save) command.

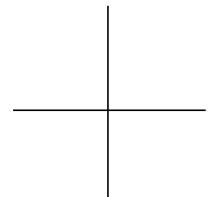


Table 11-6 General-Purpose NVRAM Utility (nv) Commands

Command	Function
c <i>address</i>	Changes the virtual contents of the location <i>address</i> . If you do not include an address, location 0 is used as the starting location. Press Return to continue to the next location. Press hyphen (-), then Return, to go to the previous location. All values shown and data entered are in hexadecimal notation. A non-hexadecimal value terminates the command.
d [<i>start</i>] [<i>end</i>]	Displays the virtual contents of NVRAM in hexadecimal.
l	Loads the terminal's factory defaults into the virtual NVRAM space.
q	Exits the NVRAM utility and displays the Boot Monitor's prompt.
r	Reads the entire NVRAM and places it into RAM space reserved for editing.
s	Saves the current values of NVRAM. Also calculates a new checksum before loading the values into NVRAM.

Sample NVRAM Utility Sessions

The following examples show how to use the NVRAM utility. In the NVRAM utility, you enter new values in hexadecimal notation. The symbols used in the examples are:

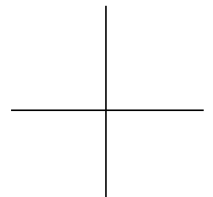
- > The prompt generated by the Boot Monitor
- >> The NVRAM utility prompt
- xx The previous values stored in NVRAM

Changing Contents Byte by Byte

In the following example of how to change NVRAM contents, the terminal's Ethernet address is re-entered after having been accidentally erased. The Ethernet address is 00 00 A7 10 24 14.

```
> nv
NVRAM Utility
C [add] - change location add
D - display contents
Q - return to monitor
L - load defaults
R - reload NVRAM values
S - save new values
->> l
->> c 04
004: xx ? 00
005: xx ? 00
006: xx ? A7
007: xx ? 10
008: xx ? 24
009: xx ? 14
00A: xx ? q
->> s
Are you sure ? y
->> q
> rs
```

1. Start the NVRAM utility and type **c 04** to start changing the Ethernet address (the Ethernet address starts at location 0x4).
2. Type the first pair of numbers of the Ethernet address and press Return.
3. In the same way, type the remaining pairs. At the prompt 009: xx ? you have typed the entire Ethernet address and you can type **q** to stop entering numbers.
4. Type **s** to save, and **y** after the question, Are you sure?
5. Type **q** to end the NVRAM utility session and resume using the Boot Monitor utility.
6. You can reboot the terminal by typing the **rs** (reset) command.

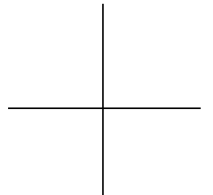


Changing Individual Bits in a Byte

In the following example, the first bit in byte 0x35 is changed. This bit enables the display of the NCD logo at boot time and is set to 1 by default.

```
> nv
NVRAM Utility
C [add] - change location add
D - display contents
Q - return to monitor
L - load defaults
R - reload NVRAM values
S - save new values
->> l
->> c 35
035: 8A ? 0A
036: A0 ? q
->> s
Are you sure ? y
->> q
> rs
```

1. Start the NVRAM utility and type `c 35` to start changing byte 0x35.
2. Compute the new value of the byte in binary and then convert it to hexadecimal. Assuming the other bits have their default values, the new value of the byte is 00001010, or 0A in hexadecimal. Enter the new value.
3. At the next `?` prompt, type `q` to stop entering numbers.
4. Type `s` to save, and `y` after the question, `Are you sure?`
5. Type `q` to end the NVRAM utility session and resume using the Boot Monitor utility.
6. You can reboot the terminal by typing the `rs` (reset) command.



NVRAM Contents

Table 11-7 lists the locations, descriptions, and permitted values for parameters stored in the shared portion of version 4 of the NVRAM layout, which is the current version. The corresponding remote configuration parameters (if any) are also listed.

NVRAM is divided into shared and server-only portions. The shared portion of NVRAM includes data used internally by the Boot Monitor and parameters set by both the Boot Monitor and the X server (that is X server defaults or the changes you make using the X server configuration methods described in Chapter 6, Terminal Configuration Methods). The server-only portion is used by X server configuration methods to write parameters that can be saved in NVRAM.

You should not attempt to change data set automatically by the Boot Monitor. You can change other parameters; see the following cautionary note.

If a remote configuration parameter is listed in the description column, you can set the parameter using the NVRAM utility or X server configuration utilities. A subset of the booting parameters can also be set using the Boot Monitor Setup menus described in “Using Boot Monitor Setup Menus to Configure Terminals” on page 11-12.



Do not change the contents of NVRAM using the NVRAM utility unless you know how your changes will affect the terminal. Incorrect NVRAM settings can seriously impair the terminal’s operation. Do not change settings in reserved areas or parameters set automatically by the Boot Monitor.

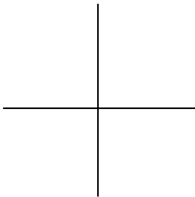


Table 11-7 Shared NVRAM Version 4

Location	Description	Size	Values (Default in Bold)
<i>Header Information</i>			
0x0	Version number of the NVRAM layout	1 byte	(set automatically by the Boot Monitor)
0x1	NVRAM checksum (calculated when you use the NVRAM utility; verified when the terminal is powered on)	1 byte	(set automatically by the Boot Monitor)
0x2	Reserved	2 bytes	
<i>Network Configuration</i>			
0x4	Factory-set Ethernet address, stored least-significant to most-significant byte. The first three bytes are the series allocated to NCD; the remaining bytes are terminal-specific.	6 bytes	00:00:A7:00.00.00
0xA	Terminal IP address ip-address-at-next-boot	4 bytes	0.0.0.0
0xE	Subnet mask ip-subnet-mask	4 bytes	255.255.255.000
0x12	Broadcast address ip-broadcast-address	4 bytes	255.255.255.255
0x16	Primary default gateway ip-initial-default-gateway-1	4 bytes	000.000.000.000
0x1A	Secondary default gateway ip-initial-default-gateway-2	4 bytes	000.000.000.000
0x1E	First boot host boot-tcpip-desired-server	4 bytes	000.000.000.000
0x22	Second boot host boot-tcpip-second-server	4 bytes	000.000.000.000

Table 11-7 Shared NVRAM Version 4 (Continued)

Location	Description	Size	Values (Default in Bold)
0x26	Third boot host boot-tcpip-third-server	4 bytes	000.000.000.000
0x2A	Terminal DECnet address (DEC byte ordering) ncdnet-address-at-next-boot	2 bytes	0.0
0x2C	DECnet router address (DEC byte ordering) ncdnet-default-router	2 bytes	0.0
0x2E	Default DECnet host	2 bytes	0.0
0x30	Try booting forever boot-persistent-loading	1 bit	1 Enabled 0 Disabled
	Turns off broadcast booting boot-tcpip-broadcast-boot-request	1 bit	1 Disabled 0 Enabled
	Turns off absolute product name booting boot-tcpip-product-name-with-path-file	1 bit	1 Enabled 0 Disabled
	Turns off absolute memory size booting boot-tcpip-product-name-and-memory-size-with-path-file	1 bit	1 Enabled 0 Disabled
	Turns off absolute hex IP address booting boot-tcpip-unit-address-with-path-file	1 bit	1 Enabled 0 Disabled
	Turns off relative product name booting boot-tcpip-product-name	1 bit	1 Enabled 0 Disabled
	Turns off relative memory size booting boot-tcpip-product-name-and-memory-size	1 bit	1 Enabled 0 Disabled
	Turns off relative hex IP address booting boot-tcpip-unit-address-file	1 bit	1 Enabled 0 Disabled

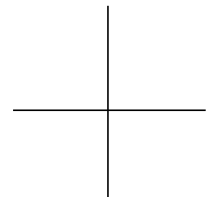


Table 11-7 Shared NVRAM Version 4 (Continued)

Location	Description	Size	Values (Default in Bold)
0x31	DEC auxiliary boot protocol	1 bit	0 TFTP 1 MOP
	Monitor power management override	1 bit	0 Disabled 1 Enabled
	Extra messages from booting	1 bit	0 Disabled 1 Enabled
	Use DDC data	1 bit	Hardware-dependent
	Absolute Ethernet address booting	1 bit	0 Enabled 1 Disabled
	Relative Ethernet address booting	1 bit	0 Enabled 1 Disabled
	Reserved	2 bits	
0x32	TFTP boot priority	upper 4 bits	1 Try TFTP first 2 Try TFTP second 3 Try TFTP third 4 Try TFTP last 15 Disable TFTP booting
	NFS boot priority	lower 4 bits	1 Try NFS first 2 Try NFS second 3 Try NFS third 4 Try NFS last 15 Disable NFS booting

Table 11-7 Shared NVRAM Version 4 (Continued)

Location	Description	Size	Values (Default in Bold)
0x33	MOP boot priority	upper 4 bits	1 Try MOP first 2 Try MOP second 3 Try MOP third 4 Try MOP last 15 Disable MOP booting
	Local boot priority (If a PCMCIA card is installed, NVRAM has default values, and the terminal has not booted from the network, the terminal first tries to boot from the PCMCIA card.)	lower 4 bits	1 Try local first 2 Try local second 3 Try local third 4 Try local last 15 Disable local booting
0x34	Reserved	8 bits	
<i>Boot Monitor Configuration</i>			
0x35	NCD logo enable	1 bit	0 Disabled 1 Enabled
	Use standard NCD path for X server files and directories or a special OEM path.	1 bit	0 NCD path 1 OEM path
	Test RAM at boot boot-test-ram	1 bit	0 Enabled 1 Disabled
	Boot source 1	1 bit	0 Network 1 Local file system
	Screen saver	1 bit	0 Off 1 On
	Background	1 bit	0 Black 1 White
	Auto boot after reset or display Boot Monitor prompt boot-automatically	1 bit	0 Boot Monitor 1 Auto boot
	MOP boot boot-mop	1 bit	0 Enabled 1 Disabled

Table 11-7 Shared NVRAM Version 4 (Continued)

Location	Description	Size	Values (Default in Bold)
0x36	Discover IP address from the network or from NVRAM ip-use-address-discovery	2 bits	0 NVRAM 1 DHCP/BOOTP/RARP
	Default settings	1 bit	(set by the Boot Monitor)
	Use ICMP to determine subnet mask boot-send-broadcast-icmp-for-subnet-mask	1 bit	0 Enabled 1 Disabled
	Boot via MOP with filename boot-mop-with-file-name	1 bit	0 Disabled 1 Enabled
	Reserved	3 bits	
0x37	Reserved	1 byte	
<i>Device Configuration</i>			
0x38	Type of keyboard attached to the terminal xserver-keyboard-type	1 byte	See Table 11-8.
0x39	IBM/PS2 or Windows 95-compatible keyboard (this is the default keyboard and the default for the N-101/N-102 keyboard group)	1 bit	0 Other keyboard 1 IBM keyboard
	Token-Ring speed valid	1 bit	(set by the Boot Monitor)
	Token-Ring speed ¹	1 bit	0 4 Mbit ring 1 16 Mbit ring
	Synchronize monitor on green (HMX and older terminals only)	1 bit	Hardware-dependent
	Use monitor timing	1 bit	Hardware-dependent
	Default keyboard LEDs	1 bit	(set by the Boot Monitor)
	Reserved	2 bits	

Table 11-7 Shared NVRAM Version 4 (Continued)

Location	Description	Size	Values (Default in Bold)
0x3A	Monitor type	1 byte	Use the Boot Monitor Setup menus to set this parameter.
0x3B	Monitor dots-per-inch	1 byte	Use the Boot Monitor Setup menus to set this parameter.
Platform-Specific Monitor Timing			
0x3C - 0x50	Reserved	24 bytes	
Tagged Strings			
0x51	Boot Monitor tagged strings	128 bytes	Automatically set by the X server. See Table 11-9 for the names of the parameters saved in this area.
0xD1	Tagged strings 1	38 bytes	
0xF7	Tagged strings 2	128 bytes	
Keymapper for Boot Monitor Setup Menus			
0x177	Keymap for programmable Setup menu navigation keys	10 bytes	(Automatically set by the Boot Monitor)
Platform-Specific Monitor Timing			
0x181 - 0x191	Reserved	15 bytes	

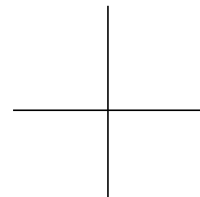


Table 11-7 Shared NVRAM Version 4 (Continued)

Location	Description	Size	Values (Default in Bold)
<i>Miscellaneous</i>			
0x192	NFS read size	2 bytes	Block size set by the Boot Monitor nf command
0x194	RARP address discovery priority	upper 4 bits	1 Try RARP first 2 Try RARP second 3 Try RARP last 15 Disable RARP
	BOOTP address discovery priority	lower 4 bits	1 Try BOOTP first 2 Try BOOTP second 3 Try BOOTP last 15 Disable BOOTP
0x195	DHCP address discovery priority	upper 4 bits	1 Try DHCP first 2 Try DHCP second 3 Try DHCP last 15 Disable DHCP
	Reserved	4 bits	
0x196	Reserved	1 byte	

¹ In Boot Monitor versions earlier than 2.8.2, the default is 4 MBit.

Keyboard Type Settings

Table 11-8 lists the keyboard-type values for byte 0x38. The default keyboard for the N-101/N-102 keyboard group is the IBM/PS2 or Windows 95-compatible keyboard (byte 0x39). This is also the default keyboard if the terminal cannot sense the type of the attached keyboard.

Table 11-8 Keyboard Type Settings in NVRAM

Keyboard	NVRAM Value
N-101	0
VT220 VMS	1
VT220 ULTRIX	2
N-97	3
N-102 German	4
N-102 French	5
N-102 Belgian UK	6
N-102 Swiss German	7
N-102 Spanish	8
N-102 English UK	9
N-102 Italian	10
N-102 Canadian	11
N-102 Norwegian	12
N-102 Finnish	13
N-102 Portuguese	14
N-102 Danish	15
N-102 Flemish	16
N-102 Norwegian/Tandberg	17

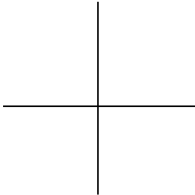


Table 11-8 Keyboard Type Settings in NVRAM (Continued)

Keyboard	NVRAM Value
N-108 Nokia	18
N-108LK	19
N-Kana	20
VT220 Danish	21
VT220 Norwegian	22
VT220 German	23
VT220 Swedish	24
VT220 Spanish	25
VT220 Flemish	26
VT220 Portuguese	27
VT220 French	28
VT220 Swiss German	29
VT220 Swiss French	30
VT220 Italian	31
VT220 Dutch	32
VT220 Finnish	33
VT220 Canadian	34
VT220 Hebrew	35
reserved	36 - 39
VT220 UK	40
reserved	41
N-122 Nokia	42

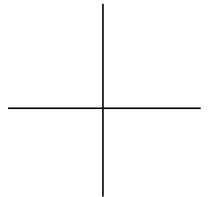


Table 11-8 Keyboard Type Settings in NVRAM (Continued)

Keyboard	NVRAM Value
N-102 French Canadian	43
N-102 Belgian French	44
N-102 French Canadian CSA 1992	45
N-102 Swiss French	46
N-102 OADG Kana	47
N-107 Sun Type 4 Compatible	48
Hitachi Kana	49
N-108 UK	50
N-108 Flemish	51
N-108 Canadian English	52
N-108 Canadian French	53
N-108 Danish	54
N-108 Finnish	55
N-108 French	56
N-108 German	57
N-108 Netherlands	58
N-108 Italian	59
N-108 Norwegian	60
N-108 Portuguese	61
N-108 Spanish	62
N-108 Swedish	63
N-108 Swiss French	64

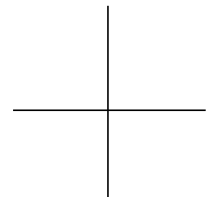


Table 11-8 Keyboard Type Settings in NVRAM (Continued)

Keyboard	NVRAM Value
N-108 Swiss German	65
Nokia 108 UK	66
Nokia 108 Flemish	67
Nokia 108 Canadian English	68
Nokia 108 Canadian French	69
Nokia 108 Danish	70
Nokia 108 Finnish	71
Nokia 108 French	72
Nokia 108 German	73
Nokia 108 Netherlands	74
Nokia 108 Italian	75
Nokia 108 Norwegian	76
Nokia 108 Portuguese	77
Nokia 108 Spanish	78
Nokia 108 Swedish	79
Nokia 108 Swiss French	80
Nokia 108 Swiss German	81
unused	82 - 91
IBM 3270 US	92
N-123 NA US	93
N-123 UNIX	94
N-123 UK	95

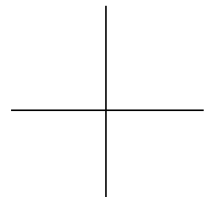
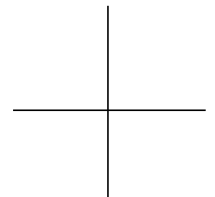


Table 11-8 Keyboard Type Settings in NVRAM (Continued)

Keyboard	NVRAM Value
N-123 German	96
N-123 French	97
N-123 Spanish	98
N-123 Swiss German	99
N-123 Swiss French	100
N-123 Swedish	101
N-123 Danish	102
N-123 Italian	103
N-123 Dutch	104
N-123 Norwegian	105
N-123 Portuguese	106
reserved	107
N-102 Siemens German	108
N-102 Spanish Latin American	109
N-102 Dutch	110
N-102 Icelandic	111



Parameters Saved in the Tagged Strings Area

Table 11-9 lists all of the strings saved in the tagged string area of NVRAM. Terminals in the HMX and Explora series have 166 bytes available for storing these strings. If you are storing many of these strings in NVRAM, you should keep them short to avoid running out of space. Strings stored in the tagged string space use one byte per character plus two bytes of overhead for each string. For example, a 10-character password uses 12 bytes.

Table 11-9 Parameters in NVRAM Optional String Space

Parameter Name	Description
config-console-display-password	Password for displaying the Console
config-custom-file	Custom configuration filename
config-pref-read-only-password	Password for read-only access to user preference information
config-pref-read-write-password	Password for read/write access to user preference information
config-read-only-password	Password for read-only access to all configuration data
config-read-write-password	Password for read/write access to all configuration data
config-unix-directory	Custom configuration file directory for UNIX
config-vms-directory	Custom configuration file directory for VMS
file-manager-password	Password for access to the Local File Manager
login-xdm-authentication-key	Key for authenticating clients trying to connect to the terminal
snmp-read-only-community snmp-read-only-community-alt	Community names for read-only access to configuration data through SNMP
snmp-read-write-community snmp-read-write-community-alt	Community names for read/write access to configuration data through SNMP
unit-global-password	Global password for read/write access to configuration data and the Local File Manager

Remote Configuration Parameters Saved in NVRAM

Table 11-10 is an alphabetical listing all of the remote configuration parameters that can be saved in NVRAM, in both the shared and the X server-only areas of NVRAM. For more information about remote configuration parameters, see the *Remote Configuration Parameter Quick Reference*.

Table 11-10 Remote Configuration Parameters Saved in NVRAM

Group	Parameter Name	
boot	boot-automatically boot-custom-file boot-default-server-when-prom-booting boot-desired-source boot-monitor-inverse-video boot-mop boot-mop-with-file-name boot-nfs-directory boot-persistent-loading boot-second-source boot-send-broadcast-icmp-for-subnet-mask boot-tcpip-broadcast-boot-request boot-tcpip-desired-server	boot-tcpip-product-name-and-memory-size-file boot-tcpip-product-name-and-memory-size-with-path-file boot-tcpip-product-name-file boot-tcpip-product-name-with-path-file boot-tcpip-second-server boot-tcpip-third-server boot-tcpip-unit-address-file boot-tcpip-unit-address-with-path-file boot-test-ram boot-tftp-directory boot-third-source
config	config-add-domain-to-unit-name-as-filename config-console-display-password config-custom-file config-generic-file config-load-initial-file config-persistent-loading config-pref-read-only-password config-pref-read-write-password config-read-only-password	config-read-write-password config-unit-ethernet-address-file config-unit-ip-address-file config-unit-name-file config-unit-ncdnet-address-file config-unix-directory config-use-decimal-ip-address-notation-as-filename config-vms-directory
file	file-extended-diagnostics file-initial-protocol-1 file-initial-protocol-2 file-initial-server-1	file-initial-server-2 file-manager-password file-name-type-for-initial-tftp-servers

Table 11-10 Remote Configuration Parameters Saved in NVRAM (Continued)

Group	Parameter Name
ip	ip-address-at-next-boot ip-broadcast-address ip-initial-default-gateway-1 ip-initial-default-gateway-2 ip-subnet-mask ip-use-address-discovery ip-use-proxy-arp ip-use-router-discovery ip-use-router-solicit
login	login-xdm-authentication-key
ncdnet	ncdnet-address-at-next-boot ncdnet-default-router
net	net-ethernet-snap-encapsulation net-token-ring-speed
serial	serial-interfaces-table
snmp	snmp-read-only-community snmp-read-only-community-alt snmp-read-write-community snmp-read-write-community-alt
tcpip	tcpip-name-server-protocol tcpip-name-servers
unit	unit-global-password unit-license-key unit-query-for-name-at-boot
xserver	xserver-keyboard-type xserver-touchscreen-calibration-limits

