APPENDIX B

Virtual Configuration Register

This appendix describes the router virtual configuration register, the factory default settings, and the procedures for changing those settings.

Virtual Configuration Register Settings

The router has a 16-bit virtual register, which is written into the nonvolatile memory (NVRAM). Use the processor configuration register information contained in this appendix to do the following:

- Set and display the configuration register value
- Force the system into the bootstrap program
- Select a boot source and default boot filename
- Enable or disable the Break function
- Control broadcast addresses
- Set the console terminal baud rate
- Load operating software from ROM
- Enable booting from TFTP server

Table B-1 lists the meaning of each of the virtual configuration memory bits, and Table B-2 defines the boot field names.

Table B-1 Virtual Configuration Bit Meanings

Bit No.	Hex	Meaning
00–03	0x0000–0x000F	Boot field (see Table B-2)
06	0x0040	Causes system software to ignore nonvolatile memory contents
07	0x0080	OEM bit enabled
08	0x0100	Break disabled
10	0x0400	IP broadcast with all zeros
11–12	0x0800–0x1000	Console line speed
13	0x2000	Boot default ROM software if network boot fails
14	0x4000	IP broadcasts do not have net numbers
15	0x8000	Enable diagnostic messages and ignore NVM contents

Table B-2 Explanation of Boot Field (Configuration Register Bits 00–03)

Boot Field	Meaning
00	Stays at the system bootstrap prompt (ROM Monitor)
01	Boots system image on EPROM
02-F	Specifies a default netboot filename Enables boot system commands that override default netboot filename[1]

1. Values of the boot field are 2–15 in the form *cisco<n>-processor_name*, where $2 \leq n \leq 15$.

Changing Configuration Register Settings

Some common reasons to modify the value of the virtual configuration register follow:

- Recover a lost password
- Change the console baud rate
- Enable or disable Break
- Allow you to manually boot the operating system using the **b** command at the bootstrap program (ROM monitor) prompt
- Force the router to boot automatically from the system bootstrap software (boot ROM image), its system image in Flash memory, or read any **boot system** commands that are stored in its configuration file in NVRAM

  If the router finds no **boot system** commands, it uses the configuration register value to form a filename from which to netboot a default system image stored on a network server. (See Table B-3.)

To change the configuration register while running the system software, follow these steps:

Step 1 Enter the **enable** command and your password to enter the privileged level, as follows:

```
router> enable
Password:
router#
```

Step 2 At the privileged level system prompt (router #), enter the command **configure terminal.** You will be prompted as shown in the following example:

```
router# configure term
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
```

Step 3 To set the contents of the configuration register, enter the **config-register** *value* configuration command where *value* is a hexadecimal number preceded by 0x (See Table B-3), as in the following:

```
config-register 0xvalue
```

(The virtual configuration register is stored in nonvolatile memory.)

Step 4 Exit the configuration mode by entering Ctrl-Z. The new value settings will be saved to memory; however, the new settings do not take effect until the system software is reloaded by rebooting the router.

Step 5 To display the configuration register value currently in effect and the value that will be used at the next reload, enter the **show version** EXEC command, and the value will be displayed on the last line of the screen display as in the example following:

```
Configuration register is 0x142 (will be 0x102 at next reload)
```

Step 6 Reboot the router. The new value takes effect. Configuration register changes take effect only when the server restarts: such as when you switch the power off and on or when you issue a **reload** command from the console.

The lowest four bits of the processor configuration register (bits 3, 2, 1, and 0) form the *boot field.* (See Table B-2.) The boot field specifies a number in binary. If you set the boot field value to 0, you must boot the operating system manually by entering the **b** command at the bootstrap prompt as follows:

```
> b [tftp] flash filename
```

Definitions of the various command options follow:

b—Boots the default system software from ROM

b flash—Boots the first file in Flash memory

b *filename* [*host*]—Netboots using TFTP

b flash [*filename*]—Boots the file (*filename*) from Flash memory

For more information about the **b** [**tftp**] **flash** *filename* command, see the *Router Products Configuration and Reference* publication.

If you set the boot field value to a value of *2* through *F*, and there is a valid system boot command stored in the configuration file, the router boots the system software as directed by that value. (See Table B-3.) If you set the boot field to any other bit pattern, the router uses the resulting number to form a default boot filename for netbooting.

In the following example, the virtual configuration register is set to boot the router automatically from Flash memory and to ignore Break at the next reboot of the router:

```
router# configure terminal
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
config-register 0x102
Ctrl-Z
router#
```

The server creates a default boot filename as part of the automatic configuration processes. To form the boot filename, the server starts with *cisco* and links the octal equivalent of the boot field number, a dash, and the processor-type name. Table B-3 lists the default boot filenames or actions for the processor.

Note A **boot system** configuration command in the router configuration in NVRAM overrides the default netboot filename.

Table B-3 Default Boot Filenames

Action/File Name	Bit 3	Bit 2	Bit 1	Bit 0
bootstrap mode	0	0	0	0
ROM software	0	0	0	1
cisco2-4000	0	0	1	0
cisco3-4000	0	0	1	1
cisco4-4000	0	1	0	0
cisco5-4000	0	1	0	1
cisco6-4000	0	1	1	0
cisco7-4000	0	1	1	1
cisco10-4000	1	0	0	0
cisco11-4000	1	0	0	1
cisco12-4000	1	0	1	0
cisco13-4000	1	0	1	1
cisco14-4000	1	1	0	0
cisco15-4000	1	1	0	1
cisco16-4000	1	1	1	0
cisco17-4000	1	1	1	1

Bit 8 controls the console Break key. Setting bit 8 (the factory default) causes the processor to ignore the console Break key. Clearing bit 8 causes the processor to interpret Break as a command to force the system into the bootstrap monitor, halting normal operation. A Break can be sent in the first 60 seconds while the system reboots, regardless of the configuration settings.

Bit 10 controls the host portion of the Internet broadcast address. Setting bit 10 causes the processor to use all zeros; clearing bit 10 (the factory default) causes the processor to use all ones. Bit 10 interacts with bit 14, which controls the network and subnet portions of the broadcast address. Table B-4 shows the combined effect of bits 10 and 14.

Table B-4 Configuration Register Settings for Broadcast Address Destination

Bit 14	Bit 10	Address (<net> <host>)
off	off	<ones> <ones>
off	on	<zeros> <zeros>
on	on	<net> <zeros>
on	off	<net> <ones>

Bit 13 determines the server response to a bootload failure. Setting bit 13 causes the server to load operating software from ROM after five unsuccessful attempts to load a boot file from the network. Clearing bit 13 causes the server to continue attempting to load a boot file from the network indefinitely. By factory default, bit 13 is cleared to 0.

Bits 11 and 12 in the configuration register determine the baud rate of the console terminal. Table B-5 shows the bit settings for the four available baud rates. (The factory-set default baud rate is 9600.)

Table B-5 System Console Terminal Baud Rate Settings

Baud	Bit 12	Bit 11
9600	0	0
4800	0	1
1200	1	0
2400	1	1

Enabling Booting From Flash

To enable booting from Flash, set bits 3, 2, 1, and 0 to a value between 2 through 15 in conjunction with the system software configuration command boot system flash filename.

To enter the configuration mode, while in the system software image, enter the configure command at the enable prompt as in the example following:

```
Gateway# configure
Configuring from terminal, memory, or network [terminal]? term
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
boot system flash filename
```

To disable break and enable the boot system flash command, enter the config-register command with a value as in the example following:

```
config-reg 0x102
CTRL/Z
Gateway#
```

If you set the configuration register value to 0x102, as in the example, it is not necessary to enter the **boot system flash** command unless there is more than one image in Flash.