



Using the Flash Disk

Product Numbers: MEM-I/O-FLD48M=, MEM-I/O-FLD64M=, MEM-I/O-FLD128M=, MEM-7100-FLD48M=, MEM-7100-FLD128M=, MEM-COMP-FLD64M=, MEM-COMP-FLD128M=, MEM-NPE-G1-FLD64=, MEM-NPE-G1-FLD128=, MEM-NPE-G1-FLD256=, MEM-RSP8-FLD48(=), MEM-RSP8-FLD128M(=)

Customer Order Number: DOC-785819=

Introduction

This configuration note is a standalone publication that provides instructions for installing, removing, and using Flash Disks in Cisco products that have PC Card slots—formerly called Personal Computer Memory Card International Association (PCMCIA) slots. This document also applies to the compact Flash Disk used on the Cisco 7401ASR router. (For a list of Cisco products that support the Flash Disk—and how they support it—see the [“Hardware Requirements” section on page 4](#)).

Flash Disks and the compact Flash Disk provide from 48 MB to 256 MB of storage space for your configuration files, Cisco IOS software images, and so forth. (For a more complete discussion of Flash Disk features, see the [“Product Description” section on page 9](#).)

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Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

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Related Documentation

Your Cisco router and the Cisco IOS software running on it contain extensive features and functionality, which are documented online and in the following resources:

- Cisco Documentation CD-ROM package (See the “[Documentation CD-ROM](#)” section on page 28.)
- Cisco.com (See the “[Cisco.com](#)” section on page 29.)
- Cisco IOS software configuration documentation contains Cisco IOS software configuration information and support. See the modular configuration and modular command reference publications in the set that correspond to the software release installed on your Cisco hardware. Access these documents at <http://www.cisco.com>.
- For information on ordering documentation, see the “[Ordering Documentation](#)” section on page 28.
- For information on providing documentation feedback, see the “[Documentation Feedback](#)” section on page 28.
- For information on contacting the Technical Assistance Center, see the “[Technical Assistance Center](#)” section on page 29.



Note

You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at <http://www.cisco.com>. Translated documentation is available at the following URL: http://www.cisco.com/public/countries_languages.shtml

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http://www.cisco.com/public/countries_languages.shtml

For hardware installation and maintenance information, refer to the following documents:

- Cisco 7100 series routers:
 - *Cisco 7100 Series VPN Router Installation and Configuration Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7100/hwicg/index.htm>.
- Cisco 7200 series routers:
 - *Cisco 7202 Installation and Configuration Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7202/7202icg/index.htm>
 - *Quick Reference for Cisco 7204 Installation* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7204/7204qrc/3641qrc4.htm>
 - *Cisco 7204 Installation and Configuration Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7204/7204ig/index.htm>
 - *Cisco 7206 Router Quick Start Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7206/12771q.htm>
 - *Cisco 7206 Installation and Configuration Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7206/7206ig/index.htm>
 - *Cisco 7200 VXR Quick Start Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7200vx/12769q.htm>
 - *Cisco 7200 VXR Installation and Configuration Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7200vx/72vxicg/index.htm>

- Cisco 7401ASR routers:
 - *Cisco 7401ASR Quick Start Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7401/12372q.htm>
 - *Cisco 7401ASR Router Installation and Configuration Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7401/7401icg/index.htm>
- Cisco 7500 series routers:
 - *Quick Start Guide Cisco 7505 Router* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/cis7505/qsg7505.htm>
 - *Quick Start Guide Cisco 7507 Router* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/cis7507/12949qsg.htm>
 - *Quick Start Guide Cisco 7513 and 7576 Routers* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/cis7513/12954qsg.htm>
 - *Cisco 7500 Installation and Configuration Guide* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/cis7505/cicg7500/index.htm>.
- For international agency compliance, safety, and statutory information for WAN interfaces:
 - *Site Preparation and Safety Guide* online at http://www.cisco.com/univercd/cc/td/doc/product/lan/cat4000/hw_doc/safety/index.htm
 - *Regulatory Compliance and Safety Information for 7100 Series VPN Routers* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7100/6345rc71.htm>
 - *Regulatory Compliance and Safety Information for Cisco 7200 Series Routers* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7206/3419pnc6.htm>
 - *Cisco 7401ASR Regulatory Compliance and Safety Information* online at <http://www.cisco.com/univercd/cc/td/doc/product/core/7401/12282r.htm>
 - *Regulatory Compliance and Safety Information for the Cisco 7500 Series Routers* at <http://www.cisco.com/univercd/cc/td/doc/product/core/cis7505/4194pc75.htm>

Installation Prerequisites

This section describes installation prerequisites you should observe before you can use the Flash Disk or compact Flash Disk in your system, and includes the following subsections:

- [Software Requirements, page 4](#)
- [Hardware Requirements, page 4](#)
- [Tools and Parts Required, page 5](#)
- [Compatibility Requirements, page 5](#)
- [System Memory and Software Image Functions and Interactions, page 6](#)
- [Boot Environment Variables, page 6](#)
- [Sample Upgrade Process, page 7](#)

Software Requirements

The Flash Disk provides file storage for the Cisco products listed in the section “[Hardware Requirements](#)” if these systems are running the applicable Cisco IOS release listed in [Table 1](#), [Table 2](#), or a later release.

Table 1 *Minimum Supported Cisco IOS Release for the Flash Disk*

Platform	Minimum Supported Cisco IOS Release or a Later Release
Cisco 7120 and Cisco 7140 routers	12.0(4)XE, 12.0(7)T, 12.1(1)E, 12.1(1)
Cisco 7200 series routers using the I/O controller	12.0(2)XE, 12.0(3)T, 12.0(5)S, 12.1(1)E, 12.1(1)T, 12.1(1), 12.2(1), 12.2(4)B
Cisco 7500 series routers using RSP8	12.0(5)T, 12.0(9)S, 12.1(0), 12.1(2)E

Table 2 *Minimum Supported IOS Release for the Compact Flash Disk*

Platform	Minimum Supported Cisco IOS Release or Later Release
Cisco 7200 VXR router with NPE-G1	12.2.(4)BX
Cisco 7401ASR router	12.2(1)DD, 12.2(1)DX, 12.2(4)B, 12.2(9)YE

Using the Flash Disk requires that you upgrade the boot image to Cisco IOS Release 12.0(2) or a later release of 12.0. Refer to the “[Sample Upgrade Process](#)” section on page 7 for upgrade instructions. (For additional information regarding boot image requirements, see the “[Compatibility Requirements](#)” section on page 5.)

Hardware Requirements

You can use the Flash Disk for file storage in the PC Card slots of the following Cisco products:

- Input/output (I/O) controller—Used in Cisco 7200 series systems (Cisco 7202, Cisco 7204, Cisco 7204VXR, Cisco 7206, and Cisco 7206VXR) and Cisco uBR7200 series universal broadband routers
- NPE-G1—Used in the Cisco 7200 VXR routers. You must use a compact Flash Disk for Cisco IOS software configuration file storage.



Note The 48-MB, 64-MB, and 128-MB Flash Disk are not supported with the NPE-100, NPE-150, or NPE-200 in a Cisco 7200 series system router or Cisco uBR7200 series universal broadband router.

- Cisco 7100 series systems—Cisco 7120 series routers and Cisco 7140 series routers
- Cisco 7401ASR router—Use the compact Flash Disk for Cisco IOS software and configuration file storage. Use the compact Flash Disk slot to install the compact Flash Disk.
- Route Switch Processor (RSP8)—Used in Cisco 7500 series systems (Cisco 7505, Cisco 7507, Cisco 7507-MX, Cisco 7513, Cisco 7513-MX, and Cisco 7576)

For convenience throughout this publication, the I/O controller, Route Switch Module (RSM), network processing engine (NPE), and RSP8 are referred to as the system processor. Specific differences are clearly noted.

Tools and Parts Required

You need some or all of the following tools and parts to install a Flash Disk:

- 3/16-inch flat-blade screwdriver—For Flash Disk installation in Cisco 7100 series systems only
- Antistatic wrist strap
- Access to a Trivial File Transfer Protocol (TFTP) server
- Linear Flash memory card
- One of the following Flash Disk or compact Flash Disk kits:
 - Cisco 7100 series systems—Flash Disk Product Numbers: MEM-7100-FLD48M= or MEM-7100-FLD128M= (See the “[Hardware Requirements](#)” section on page 4 for a system list.)
 - Cisco 7200 VXR routers with the NPE-G1—Compact Flash Disk Product Numbers: MEM-NPE-G1-FLD64=, MEM-NPE-G1-FLD128=, or MEM-NPE-G1-FLD256= (See the “[Hardware Requirements](#)” section on page 4 for a system list.)
 - Cisco 7200 series routers (I/O controller-based systems)—Flash Disk Product Numbers: MEM-I/O-FLD48M=, MEM-I/O-FLD64M=, or MEM-I/O-FLD128M= (See the “[Hardware Requirements](#)” section on page 4 for a system list.)
 - Cisco 7401ASR router—Compact Flash Disk Product Numbers: MEM-COMP-FLD64M= or MEM-COMP-FLD128M= (See the “[Hardware Requirements](#)” section on page 4.)
 - Cisco 7500 series routers—Flash Disk Product Numbers MEM-RSP8-FLD48= or MEM-RSP8-FLD128= for use with an RSP8 only (See the “[Hardware Requirements](#)” section on page 4 for a system list.)

Compatibility Requirements

This section discusses Flash Disk compatibility and use between supported systems.

In order to boot a Cisco IOS software image from the Flash Disk, when the system is executing from the ROM monitor software image, your ROM monitor software image and your boot image must be from one of the minimum Cisco IOS releases listed in [Table 1](#). Use the **show version** or **show hardware** commands to verify that your RSP8-based system is running these software images. The NPE-300 or later version installed in the Cisco 7204VXR and Cisco 7206VXR systems meets these requirements.

The **format** command places a processor-specific library on the Flash Disk so that the ROM monitor software can read the Flash memory media. If you plan to use the **boot** or **dir** commands at the ROM monitor prompt (`rommon>`), you might need to reformat your Flash Disk *if* it was not already formatted on a like system processor. To ensure Flash Disk system compatibility, observe the following guidelines:

- To use a Flash Disk from an I/O controller-based system in an RSP8-based system, first reformat the Flash Disk.
- To use a Flash Disk from an RSP8-based system in an I/O controller-based system, first reformat the Flash Disk.

- For simple file storage and retrieval functions, Flash Disks can be interchanged between and used in any system listed in the “[Hardware Requirements](#)” section on page 4.

**Note**

The Flash Disk is supported as the primary boot medium for the RSP8-, NPE-300-, and later-based systems *only*. In all other systems, you should use the Flash Disk side by side with a linear Flash memory card. In systems using a Flash Disk with a linear Flash memory card, it is possible to boot from a Flash Disk; however, you must maintain a bootable image on a linear Flash memory card to ensure that your system is bootable if the boot flash memory software image becomes corrupted.

System Memory and Software Image Functions and Interactions

The read-only memory (ROM) monitor image on your system performs important functions, such as running a brief set of system diagnostics, and initializing the hardware. This image gains control at reset or power on, or after a nonrecoverable event (such as a bus error). The ROM monitor software image has a rudimentary user interface that is recognizable by way of the ROM monitor prompt (`rommon>`). The ROM monitor software image has console drivers and trap handlers for parity and bus errors; however, the ROM monitor does not have any network interface code and it *cannot* boot an image over the network.

**Note**

The ROM monitor is *only* able to load an image from boot flash memory, linear Flash memory cards, or a Flash Disk (in RSP8-, NPE-300-, and later-based systems *only*).

By default, and as a result of a reset or power on, the ROM monitor loads the boot image from boot flash memory. If the ROM monitor cannot find a bootable image in boot flash memory, it searches the PC Card-based devices (such as linear Flash memory cards or Flash Disks) for the first bootable image. Normally, this would be the boot image (such as `rsp-boot-mz` or `c7200-boot-mz`).

The boot image, when loaded, looks in the boot environment variables—stored in nonvolatile random-access memory (NVRAM)—to determine the location of the Cisco IOS software image and the configuration to use. If boot environment variables are not defined, the system will boot the first image found on a Flash Disk, or if no such image is found, it will boot the first image found on a linear Flash memory card.

The operation of the boot environment variables is described in the “[Boot Environment Variables](#)” section, which follows.

Boot Environment Variables

The contents of the boot environment variables, which are stored in the configuration file in NVRAM, determine the actions your system takes on bootup. To see the current settings of these variables, use the **show bootvar** command as follows:

```
Router> show bootvar
BOOT variable =
CONFIG_FILE variable =
Current CONFIG_FILE variable =
BOOTLDR variable does not exist
Configuration register is 0x100
```

Following are explanations for each of these boot environment variables:

- **BOOT** variable—Points to the Cisco IOS software image that you want to boot; you set it in configuration mode. The default software image is the CISCOxxx image (where xxx is a filename assigned by the system, if you do not enter a specific filename). The system then looks for the first image on the Flash Disk in slot 0.

Enter configuration mode and specify a filename and PC Card slot from which to boot using the **configure terminal** and **boot system** commands as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot system flash disk0:rsp-p-mz.12-0
```

The result of this configuration file entry is that the BOOT variable is disk0:rsp-p-mz.12-0.

- **CONFIG_FILE** (configuration file) variable—Determines where the configuration is read from on bootup; you set it in configuration mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot config disk0:configfile
```

The result of this configuration file entry is that the CONFIG_FILE variable is disk0:configfile.

- **BOOTLDR** (boot loader) variable—Determines which image is used as the boot helper (boot image); you set it in configuration mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot bootldr bootflash:c7200-boot-mz
```

The result of this configuration file entry is that the BOOTLDR variable is bootflash:c7200-boot-mz.

- **Configuration register** variable—Instructs the system where to look for a bootable Cisco IOS software image; you set it as a hexadecimal value in configuration mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# config-register 0x102
```

The result of this configuration file entry is that the configuration register is set to hexadecimal 0x102. Please see the *Cisco 7200 VXR Installation and Configuration Guide* (Chapter 4, “Observing System Startup and Performing a Basic Configuration”) at <http://www.cisco.com/univercd/cc/td/doc/product/core/7200vx/72vxicg/configvx.htm> for more information about the configuration register.

Sample Upgrade Process

This section applies to users who want to use Flash Disks for simple file storage.

-
- Step 1** Format your onboard Flash memory—called boot flash memory. (See the **format** command description in the “[Software Command Overview](#)” section on page 18.)
 - Step 2** Upgrade your onboard Flash memory by copying the Cisco IOS Release 12.x boot image (such as c7200-boot-mz) into onboard Flash memory. (See the “[Using the copy Command](#)” section on page 23.)

- Step 3** Copy the Release 12.x software image from onboard Flash memory to the linear Flash memory card in your system processor's PC Card slot. (See the [“Using the copy Command” section on page 23.](#))
- Step 4** Change the boot variables in your configuration file to point to the new Cisco IOS image in your linear Flash memory card. (See the preceding section, [“Boot Environment Variables,”](#) and the [“Making a Flash Disk-Based Software Image the Bootable Software Image” section on page 27.](#))
- Step 5** Reboot your system to load the Release 12.x software image from the linear Flash memory card in your system processor.
- Step 6** Insert a Flash Disk. (See the [“Installing a Flash Disk” section on page 10.](#))
- Step 7** With your system running Cisco IOS release 12.x, format the blank Flash Disk. (See the **format** command description in [Table 5 on page 19,](#) and the [“Using the format Command” section on page 22.](#))

You should now be able to store configuration files and Cisco IOS software images on your Flash Disk. If you have an NPE-300-based system (or a later processor), you should now be able to boot from any Cisco IOS software images you store on your Flash Disk.

**Note**

To boot from Cisco IOS software images stored on a Flash Disk in an NPE-300-based system (or a later processor), you must first copy the appropriate Cisco IOS software image to the Flash Disk. (See the [“Using the copy Command” section on page 23,](#) the [“Enabling Booting from a Flash Disk” section on page 26,](#) and the [“Making a Flash Disk-Based Software Image the Bootable Software Image” section on page 27.](#))

Safety Guidelines

Following are safety guidelines that you should follow when working with any equipment that connects to electrical power, or which might be sensitive to electrostatic discharge (ESD) damage.

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Electrostatic Discharge Prevention

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures.

Use the following guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact; connect the equipment end of the strap to an unfinished chassis surface.
- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components from ESD voltages on the body; ESD voltages on clothing can still cause damage.



Caution

For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megaohms (Mohms).

Product Description

Flash Disks are Flash memory-based devices that conform to the PC Card (formerly PCMCIA) standard and present an ATA (AT Attachment) interface to the system. This interface complies with the ANSI ATA Interface Document X3T13.1153 D Rev. 9 specification.

The Flash Disk is more flexible than linear Flash memory because the Flash Disk has controller circuitry that allows it to emulate a hard disk and automatically maps out bad blocks and performs automatic block erasure. Further, the Flash Disk provides the capability to allocate noncontiguous sectors, which eliminates the need for the **squeeze** command (previously required with linear Flash memory cards).

The Flash Disk provides increased Flash-based memory space—48 to 128 MB—for storage of system configuration files, Cisco IOS software images, and other types of system-related files. [Table 3](#) provides memory information for the Flash Disk and [Table 4](#) provides memory information for the vcompact Flash Disk.

Table 3 *Flash Disk Memory Options*

Memory Size	Product Number
48 MB	MEM-I/O-FLD48M, MEM-7100-FLD48M, MEM-RSP8-FLD48M ¹
64 MB	MEM-I/O-FLD64M
128 MB	MEM-I/O-FLD128M, MEM-7100-FLD128M, MEM-RSP8-FLD128M ¹

1. These products are also available as Flash Disk upgrades. To order an upgrade, add an equal sign (=) after the Product Number, for example, MEM-I/O-FLD128M=.

Table 4 *Compact Flash Disk Memory Options*

Memory Size	Product Number
64 MB	MEM-COMP-FLD64M=
64 MB	MEM-NPE-G1-FLD64=
128 MB	MEM-COMP-FLD128M=

Table 4 Compact Flash Disk Memory Options (continued)

Memory Size	Product Number
128 MB	MEM-NPE-G1-FLD128=
256 MB	MEM-NPE-G1-FLD256=

**Note**

The Flash Disk is only supported on systems with the Cisco IOS File System feature, and the Cisco IOS File System feature is supported in Cisco IOS Release 12.0(1) or later releases of 12.0. In general, Flash Disk functionality requires Cisco IOS Release 12.0(2) or a later release of 12.0.

The Cisco IOS File System feature provides a single interface to all file systems your system uses:

- Flash memory file systems—Flash Disks, onboard Flash memory, linear Flash memory cards
- Network file systems—File Transfer Protocol (FTP), Remote Copy Protocol (rcp), and TFTP
- Any other endpoint for reading or writing data—NVRAM, the running configuration, ROM, raw system memory, system bundled microcode, Xmodem, Flash load helper log, modems, and BRI MUX interfaces

**Note**

A complete discussion of the Cisco IOS File System feature is beyond the scope of this publication. For information about this feature, refer to the *Configuration Fundamentals Configuration Guide* and *Configuration Fundamentals Command Reference* publications for Cisco IOS Release 12.x. These publications are available on the Documentation CD-ROM and through Cisco.com. (To obtain the Documentation CD-ROM, see the “[Documentation CD-ROM](#)” section on page 28. For information on how to access Cisco.com, see the “[Cisco.com](#)” section on page 29.)

Installing a Flash Disk

The Flash Disk is a Type 2 PC Card device. This means that you can install up to two Flash Disks in system processors with two PC Card slots; there are no PC Card slot-height restrictions related to the Flash Disk. Further, the PC Card slots in which you install the Flash Disk are either vertically oriented or horizontally oriented, depending on the system you are using and the system processor installed in it; therefore, this section provides the following two Flash Disk installation procedures:

- [Installing and Removing a Flash Disk in Vertically Oriented Systems, page 11](#)
- [Installing and Removing a Flash Disk in Horizontally Oriented Systems, page 13](#)

Determine how your system is oriented, and then use the appropriate procedure.

Use the **show version** command to verify that a Flash Disk-compatible version of Cisco IOS software is running on your system:

```
System> show version
Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Released Version 12.0(2)
Copyright (c) 1986-1998 by cisco Systems, Inc.
```

(Additional displayed text omitted from this example.)

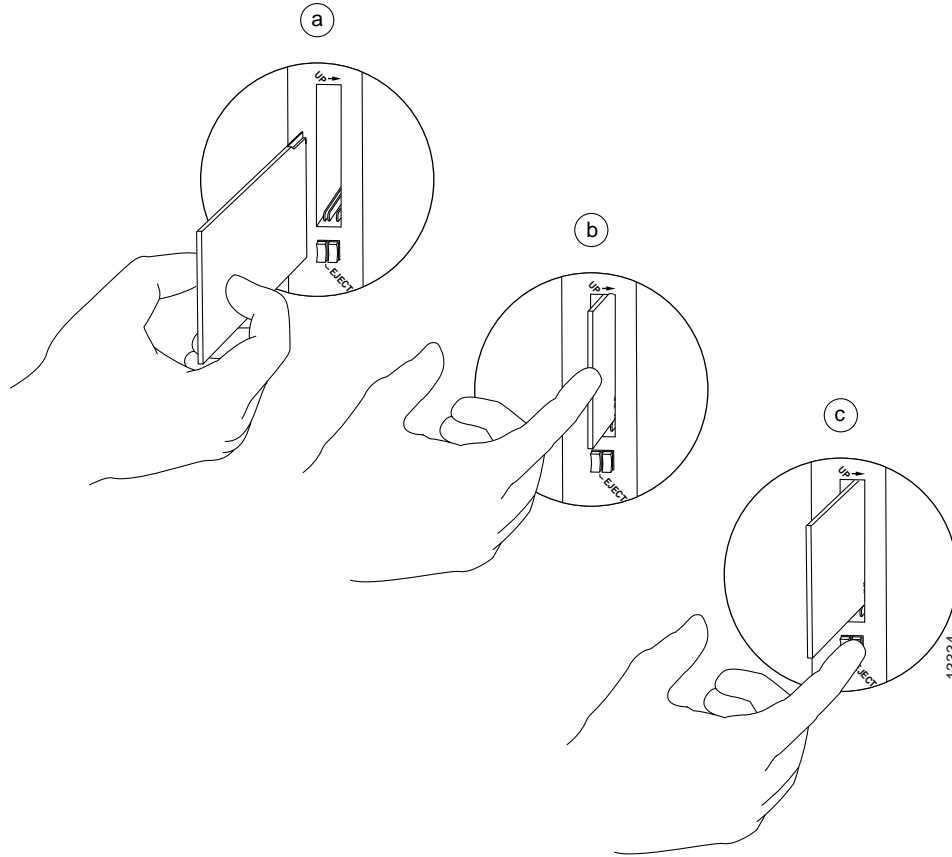
Installing and Removing a Flash Disk in Vertically Oriented Systems

The procedure in this section is for inserting and ejecting a Flash Disk in systems in which the PC Card slots are vertically oriented. The procedure is generic and can be used for a Flash Disk in either PC Card slot position (slot 0 or slot 1). You do not need to turn off system power for this procedure.

Use the following procedure to install and eject a Flash Disk in systems with vertically oriented PC Card slots:

-
- Step 1** Attach an ESD wrist or ankle strap, connecting the equipment end of the strap to an unfinished chassis surface.
- Step 2** Face the front panel of the system processor that has PC Card slots, which appear as shown in a of [Figure 1](#).
- Hold the Flash Disk with its connector end toward the PC Card slot and its front label facing to the right. The Flash Disk is keyed and cannot be seated the wrong way. The ejector button does not pop out if the Flash Disk is not completely inserted.
- Step 3** Insert the Flash Disk into the PC Card slot until the Flash Disk completely seats in the connector at the rear of the slot and the ejector button pops out toward you. (See b of [Figure 1](#).)
- The Flash Disk does not insert all the way inside the PC Card slot. A portion of the Flash Disk remains outside the slot. *Do not attempt to force the Flash Disk past this point.*

Figure 1 *Installing and Ejecting a Flash Disk in a Vertically Oriented System*



- Step 4** To eject a Flash Disk, press the ejector button—located below the slot—until the Flash Disk is free of the connector at the rear of the PC Card slot. (See c of [Figure 1](#).)
- Step 5** Remove the Flash Disk from the slot and place it in an antistatic bag.

This completes the procedure for installing and removing a Flash Disk in a vertically oriented system. Proceed to the [“Working with a Flash Disk”](#) section on page 17.

Installing and Removing a Flash Disk in Horizontally Oriented Systems

The procedures in this section describe how to insert and eject a Flash Disk in systems in which the PC Card slots are horizontally oriented. The following two procedures are discussed:

- [Installing and Removing a Flash Disk in Cisco 7100 Series Routers, page 13](#)

This procedure is specific to Cisco 7100 series routers. Use it for a Flash Disk in either horizontally oriented PC Card slot position (slot 0 or slot 1) on your Cisco 7100 series router.

- [Installing and Removing a Flash Disk in All Other Horizontally Oriented Systems, page 15](#)

This procedure is generic for all other horizontally oriented systems. Use it for a Flash Disk in either horizontally oriented PC Card slot on your system—PC Card slot 0 or slot 1.

Determine the system you have and use the appropriate procedure. (For a list of systems that support the Flash Disk, see the “[Hardware Requirements](#)” section on [page 4](#).) You do not need to turn off system power for these procedures.



Note

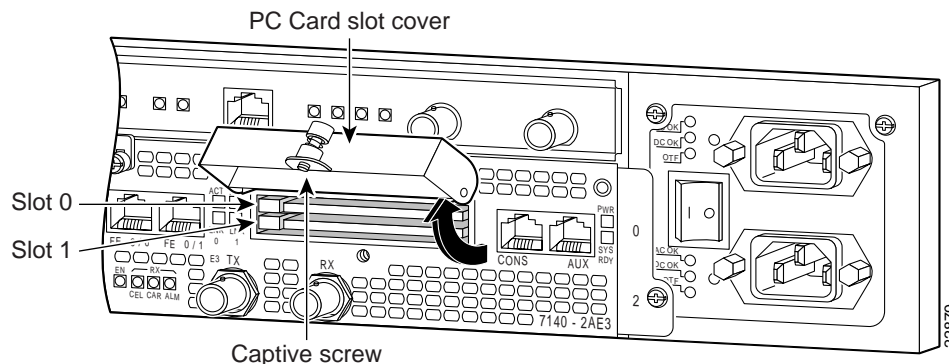
In Cisco 7100 series systems only, you must insert a Flash Disk with its back label facing up. (See a and b in [Figure 3](#).)

Installing and Removing a Flash Disk in Cisco 7100 Series Routers

Use the following procedure to install and eject a Flash Disk in a Cisco 7100 series router:

- Step 1** Attach an ESD wrist or ankle strap, connecting the equipment end of the strap to an unfinished chassis surface.
- Step 2** Locate the PC Card slot cover. (See [Figure 2](#).)
- To ensure protection from electromagnetic interference (EMI), the PC Card slots have a cover that is secured with a captive screw.

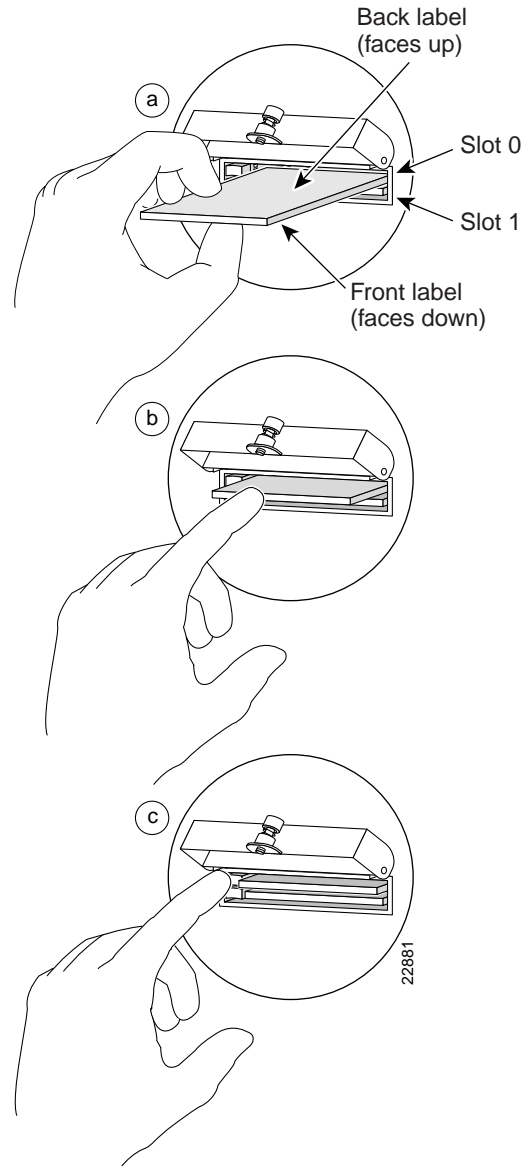
Figure 2 PC Card Slots on a Cisco 7100 Series Router—Partial Rear View of Router



- Step 3** Use a 3/16-inch flat-blade screwdriver to loosen the captive screw that secures the PC Card slot cover; lift the cover to reveal the PC Card slots. (See [Figure 2](#).)
- Step 4** Hold the Flash Disk with its connector end toward the PC Card slot and its back label facing up. (See a of [Figure 3](#).)

The Flash Disk is keyed and cannot be seated the wrong way. The ejector button does not pop out if the Flash Disk is not completely inserted.

Figure 3 Installing and Ejecting a Flash Disk in a Cisco 7100 Series Router



- Step 5** Insert the Flash Disk into the PC Card slot until the Flash Disk completely seats in the connector at the rear of the slot, and the ejector button pops out toward you. (See b of [Figure 3](#).)

The Flash Disk does not insert all the way inside the PC Card slot; a portion of the Flash Disk remains outside the slot. *Do not attempt to force the Flash Disk past this point.*

- Step 6** Close the PC Card slot cover and use a 3/16-inch flat-blade screwdriver to tighten the captive screw.
- Step 7** To eject a Flash Disk, lift the PC Card slot cover and press the ejector button—located to the left of the slot. (See c of [Figure 3](#).)
- Step 8** Remove the Flash Disk from the PC Card slot and place it in an antistatic bag.

- Step 9** Close the cover and use a 3/16-inch flat-blade screwdriver to tighten the captive screw.
-

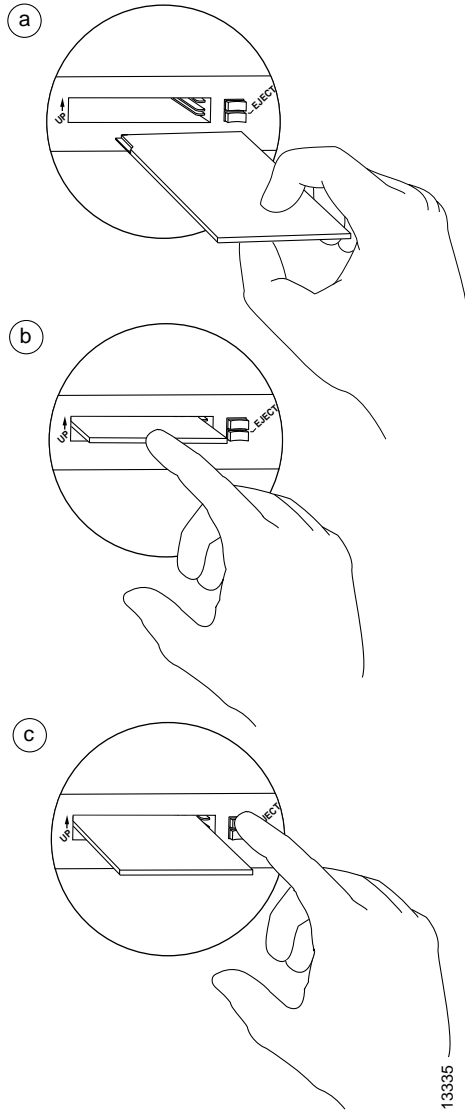
This completes the procedure for installing and removing a Flash Disk in a Cisco 7100 series router. Proceed to the [“Working with a Flash Disk” section on page 17](#).

Installing and Removing a Flash Disk in All Other Horizontally Oriented Systems

Use the following procedure to install and eject a Flash Disk in all other systems that have horizontally oriented PC Card slots:

-
- Step 1** Attach an ESD wrist or ankle strap, connecting the equipment end of the strap to an unfinished chassis surface.
- Step 2** Face the front panel of the system processor that has the PC Card slots, which appear as shown in a of [Figure 4](#).

Figure 4 Installing and Ejecting a Flash Disk in a Horizontally Oriented System



- Step 3** Hold the Flash Disk with its connector end toward the PC Card slot and its front label facing up. The Flash Disk is keyed and cannot be seated the wrong way. The ejector button does not pop out if the Flash Disk is not completely inserted.
- Step 4** Insert the Flash Disk into the PC Card slot until the Flash Disk completely seats in the connector at the rear of the slot, and the ejector button pops out toward you. (See b of [Figure 4](#)).
- The Flash Disk does not insert all the way inside the PC Card slot; a portion of the Flash Disk remains outside the slot. *Do not attempt to force the Flash Disk past this point.*
- Step 5** To eject a Flash Disk, press the appropriate ejector button—located to the right of the slot—until the Flash Disk is free of the connector at the rear of the PC Card slot. (See c of [Figure 4](#).)

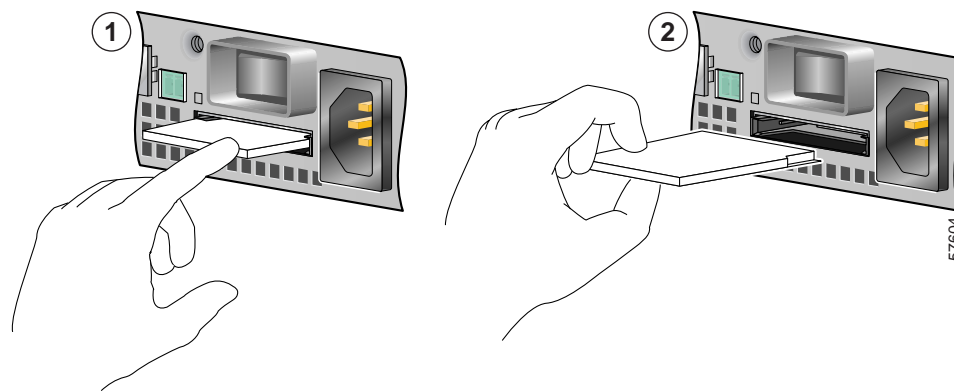
Step 6 Remove the Flash Disk from the PC Card slot and place it in an antistatic bag.

This completes the procedure for installing and removing a Flash Disk in a horizontally oriented system. Proceed to the [“Working with a Flash Disk” section on page 17](#).

Installing and Removing a Compact Flash Disk in the Cisco 7401ASR Router

The compact Flash Disk is a Type 2 device. Follow these instructions for installing and removing the compact Flash Disk in the Cisco 7401ASR router:

Figure 5 Inserting and Removing the Compact Flash Disk in a Cisco 7401ASR Router



- Insert the compact Flash Disk (see 1 in [Figure 5](#)) in the compact Flash Disk slot. It protrudes when completely seated.
- Grasp the compact Flash Disk (see 2 in [Figure 5](#)) and pull it from the chassis to remove the compact Flash Disk.

This completes the procedure for installing and removing a compact Flash Disk in the Cisco 7401ASR router.

Working with a Flash Disk

This section provides basic instructions for working with a Flash Disk in your system. Detailed descriptions of more complex Flash Disk options and the Cisco IOS File System feature are beyond the scope of this publication and can be found in the following Cisco IOS Release 12.x publications:

- *Configuration Fundamentals Configuration Guide*, in the chapter “File Management”
- *Configuration Fundamentals Command Reference*, in the chapter “File Management Commands”



Note

These and all publications are available online, on the Documentation CD-ROM, and on Cisco.com. To obtain the Documentation CD-ROM, see the [“Documentation CD-ROM” section on page 28](#). For information on how to access Cisco.com, see the [“Cisco.com” section on page 29](#).

This section includes the following subsections:

- [Software Command Overview, page 18](#)
- [Using Software Commands, page 20](#)
- [Enabling Booting from a Flash Disk, page 26](#)
- [Making a Flash Disk-Based Software Image the Bootable Software Image, page 27](#)

You can only boot from a Cisco IOS software image stored in a Flash Disk using the following systems: RSP8-based Cisco 7500 series systems, and NPE-300-based systems. (The NPE-300-based systems include the Cisco 7204VXR and the Cisco 7206VXR routers.)

In all other systems, booting from Flash Disk-based Cisco IOS software images is *not* supported. You can use Flash Disks for simple storage in all the systems listed in the “[Hardware Requirements](#)” section on page 4.



Note

Use the compact Flash Disk only in the Cisco 7401ASR router. Do not attempt to use it in another router or PC. You can boot from a Cisco IOS software image stored in a compact Flash Disk with the Cisco 7401ASR router.

Software Command Overview

This section lists some of the basic software commands you can use with the Flash Disk. Examples of these commands are included in the sections that follow.

The Flash Disk and other memory devices and locations in your system are defined as *file systems*, which are locations where you can store, use, or retrieve files and software images. (See the brief discussion about the Cisco IOS File System feature in the “[Product Description](#)” section on page 9.)

You can use Flash Disks in either one or both of the PC Card slots on your system processor, or you can use one Flash Disk in one PC Card slot and a linear Flash memory card in the adjacent PC Card slot. Flash Disks in PC Card slots 0 and 1 are referred to as *disk0:* and *disk1:*, respectively, whereas linear Flash memory cards in PC Card slots 0 and 1 are referred to as *slot0:* and *slot1:*, respectively.

The following partial output of the **show file systems** command shows a sample system with a Flash Disk—called *disk0:*—installed in PC Card slot 0 and a linear Flash memory card—called *slot1:*—installed in PC Card slot 1:

```
System# show file systems
File Systems:

      Size(b)      Free(b)      Type  Flags  Prefixes

(Additional displayed text omitted from this example.)

      48755200     48747008     flash   rw    disk0:
      7995392      4717276     flash   rw    slot1:
```

[Table 5](#) lists the software commands that you can use with the Flash Disk.



Note

You can use other arguments with some of the commands listed in [Table 5](#); however, in [Table 5](#) and throughout this document, command arguments are limited to those that apply to the Flash Disk and related file systems.

For a discussion of additional command arguments, refer to the *Configuration Fundamentals Command Reference* document, in the chapter “File Management Commands.”

Table 5 Flash Disk-Related Software Commands

Command and Arguments	Purpose
<code>cd [disk0: disk1:]directory-name</code>	Changes current directory. Allows you to move between directories on a Flash Disk, where <i>directory-name</i> is the directory to which you want to move.
<code>copy [disk0: disk1:]source-filename [disk0: disk1:]destination-filename</code>	Copies from one file to another. Allows you to make a copy of a file (<i>source-filename</i>) located on a source file system (disk0: , disk1: , and so forth) and place it with either the same filename or a different filename (<i>destination-filename</i>) on a destination file system. Along with disk0: and disk1: , the source and destination file system arguments include, but are not limited to: <ul style="list-style-type: none"> • bootflash: (onboard Flash memory) • nvr: (onboard nonvolatile random-access memory) • running-config (the running system configuration file) • startup-config (the startup system configuration file) • tftp: (a TFTP server to which you have access)
<code>delete [disk0: disk1:]filename</code>	Deletes a file. Allows you to delete any file you designate, where <i>filename</i> designates the name of the file.
<code>dir [/all disk0: disk1:]</code>	Lists files on a file system. Allows you to list the contents of the Flash Disks in PC Card slots 0 and 1. The /all argument lists all files on all file systems in your system.
<code>format [flash: bootflash: disk0: disk1:]</code>	Formats a file system. Allows you to format a linear Flash memory card (flash:), onboard Flash memory (bootflash:), or a new Flash Disk (disk0: or disk1:). This command also allows you to reformat a linear Flash memory card or Flash Disk that was formatted on another type of system. Note This command destroys all data currently in Flash memory; therefore, we strongly recommend that you use the format command with caution to prevent irretrievable loss of data.
<code>mkdir [disk0: disk1:]directory-name</code>	Creates a new directory. Allows you to create directories on a Flash Disk, where <i>directory-name</i> is the name you assign to this directory.
<code>pwd</code>	Displays current working directory. Allows you to display the name of the Flash Disk directory in which you are currently working.

Table 5 Flash Disk-Related Software Commands (continued)

Command and Arguments	Purpose
<code>rename [disk0: disk1:]filename [disk0: disk1:]filename</code>	Renames a file. Allows you to rename a file that is located on one Flash Disk and assign to that file another (or the same) file system path and filename. The first group of arguments defines the source (current) file system path and filename, and the second set of arguments defines the destination file system path and filename.
<code>rmdir [disk0: disk1:]directory-name</code>	Removes an existing directory. Allows you to remove a directory that currently exists on a Flash Disk, where <i>directory-name</i> is the name of the directory you want to remove.
<code>show [disk0: disk1:]</code>	Lists information about Flash Disk format and geometry.

Using Software Commands

This section provides examples of some of the basic software commands you can use with the Flash Disk. See [Table 5](#) for optional arguments you can use with some of the following commands:

- [Using the show Command, page 20](#)
- [Using the pwd Command, page 21](#)
- [Using the cd Command, page 21](#)
- [Using the dir Command, page 22](#)
- [Using the format Command, page 22](#)
- [Using the copy Command, page 23](#)
- [Using the mkdir Command, page 24](#)
- [Using the rmdir Command, page 25](#)
- [Using the delete Command, page 25](#)

Using the show Command

To display information about Flash Disk format and geometry, use the `show [disk0: | disk1:]` command:

```
System# show disk0:
***** ATA Flash Card Geometry/Format Info *****

ATA CARD GEOMETRY
  Number of Heads:      16
  Number of Cylinders   840
  Sectors per Cylinder  32
  Sector Size           512
  Total Sectors         430080

ATA CARD FORMAT
  Number of FAT Sectors 105
  Sectors Per Cluster   16
  Number of Clusters    26822
  Number of Data Sectors 429536
  Base Root Sector      338
  Base FAT Sector       128
```

```
Base Data Sector      370
```

```
Router#
```

In this example:

- Number of Heads is the number of heads on the Flash Disk.
- Number of Cylinders is the number of cylinders on the Flash Disk.
- Sectors per Cylinder is the number of sectors in each cylinder.
- Sector Size is the number of bytes in each sector.
- Total Sectors is the total number of sectors on the Flash Disk.
- Number of FAT Sectors is the number of sectors used to track allocation of clusters to files.
- Sectors Per Cluster is the number of sectors contained in each cluster. (Files grow by a minimum of one cluster.)
- Number of Clusters is the total number of clusters available for use by files.
- Number of Data Sectors is the number of sectors available for files.
- Base Root Sector is the logical address of the first sector of the root directory.
- Base FAT Sector is the first sector in the File Allocation Table (FAT).
- Base Data Sector is the first sector available for use by files.

Using the pwd Command

To determine which PC Card slot you are accessing, use the **pwd** command:

```
System# pwd
disk0:/
System#
```

The preceding example indicates that you are currently in the working directory called *disk0:*, which is the Flash Disk in PC Card slot 0.

Using the cd Command

To move back and forth between installed Flash Disks, use the **cd** command by defining a specific path name. Then to verify your working directory, use the **pwd** command:

```
System# cd disk1:
System# pwd
disk1:/
System# cd disk0:
System# pwd
disk0:/
```

You can also move up (or back) one level in the Flash Disk directory hierarchy using the **cd ..** command, and then verify your working directory with the **pwd** command:

```
System# pwd
disk1:daily_dir/
System# cd ..
System# pwd
disk1:/
System#
```

Using the dir Command

To list the directory structure and contents of the Flash Disk from which you are currently working, use the **dir** command with no arguments:

```
System# dir
Directory of disk1:/

 1 drw-          0   Jul 25 1998 10:23:11  daily_dir
 2 drw-          0   Jul 25 1998 10:28:37  access_lists

48755200 bytes total (48742912 bytes free)
System#
```

Note that the size of the Flash Disk is shown in the output of the **dir** command. (A 48-MB Flash Disk is shown in this example.) You can also view the contents of other directories and file systems using specific optional arguments with the **dir** command. (See [Table 4](#).)

Using the format Command

To format a new Flash Disk, use the **format [disk0: | disk1:]** command.



Note

You must format a new Flash Disk before you can use it. If you plan to use a Flash Disk that was formatted and used on another type of system, see the “[Compatibility Requirements](#)” section on page 5 to determine if you need to reformat the Flash Disk first.



Caution

The formatting procedure erases all information on the Flash Disk. To prevent the loss of important data that might be stored on a Flash Disk, proceed carefully. If you want to save data that is currently on your Flash Disk, copy the data to a TFTP server or to another Flash Disk *before* you format the new Flash Disk. A Flash Disk that was shipped as part of a configured system contains a Flash Disk-compatible Cisco IOS software image; therefore, you do not need to format it to use it in the system in which it was shipped.



Note

A spare Flash Disk is shipped blank; therefore, you must format it before you can use it.

Use the following procedure to format a new Flash Disk using the **format** command. (The procedure assumes you have already booted your system.)

Step 1 Insert the Flash Disk into PC Card slot 0 using the procedures in the “[Installing and Removing a Flash Disk in Vertically Oriented Systems](#)” section on page 11, or in the “[Installing and Removing a Flash Disk in Horizontally Oriented Systems](#)” section on page 13.

If slot 0 is not available, use slot 1, but in the following step use the **format disk1:** command, not the **format disk0:** command, or you will format the Flash Disk that is being used in slot 0.

Step 2 Use the **format disk0:** command to format the Flash Disk in PC Card slot 0 as follows:

```
System# format disk0:
Format operation may take a while. Continue? [confirm]
Format operation will destroy all data in 'disk0:'. Continue? [confirm]
Format:Drive communication & 1st Sector Write OK...
Writing Monlib
```

```
sectors.....
.....
Monlib write complete

Format:All system sectors written. OK...

Format:Total sectors in formatted partition:81760
Format:Total bytes in formatted partition:49861120
Format:Operation completed successfully.

Format of disk0:complete
```



Note A 48-MB Flash Disk was formatted in this example.

The new Flash Disk is now formatted and ready to use in the system on which you formatted it. (For specific formatting and compatibility requirements, see the [“Compatibility Requirements” section on page 5.](#))

Using the copy Command

To copy an image from a Flash Disk to another file system or from another file system to the Flash Disk, use the **copy** command:

```
copy [tftp: | bootflash: | disk0: | disk1:]source-filename [tftp: | bootflash: | disk0: | disk1:]destination-filename
```

In this example:

- The file you want to copy is located in a file system (**tftp:**, **bootflash:**, and so forth).
- The variable *source-filename* is the name of the file you want to copy to another file system (**tftp:**, **bootflash:**, and so forth).
- The variable *destination-filename* is the name you want to apply to this file after it is copied.

You do not need to change the filename; this is an option.

The following assumptions are made for this command:

- You have a system processor with a Flash Disk-compatible Cisco IOS software image in the onboard Flash memory—called *boot flash memory*—so you can start the system.
- Your system is running Cisco IOS Release 12.0(2) or later.
- The bootable image you want to copy to the Flash Disk exists in another file system or on a TFTP server to which you have access (meaning you know its name and have connectivity to it), and at least one interface is available over which you can access this server through Telnet. To ensure access to a TFTP server, you need to configure at least one interface. To configure an interface, you can use the **setup** command or use the configuration editor.

An Ethernet interface is used in the examples that follow.

- You know the filename of the image you want to copy to the Flash Disk.



Note See [Table 5](#) for a list of destination file system arguments.

**Note**

You might need to copy a new image to a Flash Disk whenever a new Cisco IOS software release or a new Cisco IOS software maintenance release becomes available. You can use the **copy** command for this purpose.

Use the following procedure to copy a file (called *new.image* in this example) located on a Flash Disk—called *disk1*:—in PC Card slot 1 to the Flash Disk—called *disk0*:—in PC Card slot 0:

Step 1 If the Flash Disk is unformatted or has been formatted on another, possibly incompatible system, format it now using the procedure in the “Using the format Command” section on page 22, as appropriate.

Step 2 To copy the image *new.image* to Flash Disk *disk0*:, use the following series of commands:

```
System> enable
Password:
System# copy disk1:new.image disk0:new.image
3393 bytes copied in 0.548 secs#
System#
```

In the preceding example, the 3393-byte file *new.image* was copied to the Flash Disk in PC Card slot 0 in approximately one-half second.

Step 3 Verify that the file *new.image* is now on the Flash Disk in PC Card slot 0:

```
System# pwd
disk0:/
System# dir
Directory of disk0:/

 1  -rw-          3393   Jul 26 1998 17:44:47 new.image

48755200 bytes total (48747008 bytes free)
System#
```

Using the mkdir Command

To create a directory on the Flash Disk, use the **mkdir** command. The following example shows how to create a directory called *daily_dir* on the Flash Disk in PC Card slot 1, and then verify that it was created:

```
System# mkdir disk1:daily_dir
Created dir disk1:daily_dir
System# dir
Directory of disk1:/

 1  drw-          0   Jul 25 1998 10:15:43  daily_dir

48755200 bytes total (48751104 bytes free)
System#
```

**Note**

If you create a directory and place a file in it that you plan to access or use later on, be sure to define the entire directory path to the file as you enter the appropriate software commands.

For example, if you placed the file *itsa.file* into the directory *daily_dir* on the Flash Disk in PC Card slot 1, you must designate the entire directory path as follows: *disk1:daily_dir/itsa.file*. Otherwise, the system might not be able to locate this file.

Using the rmdir Command

To remove a directory from the Flash Disk, use the **rmdir** command. The following example shows how to remove the directory *daily_dir* from the Flash Disk in PC Card slot 1, and then verify that it was removed:

```
System# rmdir disk1:daily_dir
Delete disk1:daily_dir? [confirm] y
Removed dir disk1:daily_dir
System# dir
Directory of disk1:/

    No files in directory.

48755200 bytes total (48751104 bytes free)
System#
```

Using the delete Command

To delete a file from a Flash Disk, use the **delete** command. Use the **dir** command to find the file you want to delete, and then use the **delete** command to delete it.

The following example shows how to find a file (called *fun1*) on the Flash Disk in PC Card slot 0, delete the file, and then verify that it is deleted:

Step 1 Find the file you want to delete:

```
System# dir
Directory of disk0:/

    1  drw-          0   May 10 1998 09:54:53 fun1

48755200 bytes total (48742912 bytes free)
```

Step 2 Delete the file *fun1*:

```
System# delete disk0:fun1
```

Step 3 Verify that the file *fun1* is deleted:

```
System# dir
Directory of disk0:/

    No files in directory.

48755200 bytes total (48742912 bytes free)
System#
```

Enabling Booting from a Flash Disk

This section explains how to enable booting from a Flash Disk.

To enable booting from a Flash Disk, set configuration register bits 3, 2, 1, and 0 to a value between 2 and 15 in conjunction with the **boot system [disk0: | disk1:]filename** configuration command. This section includes only descriptions of **boot** commands specific to the Flash Disk. (You can use either the **slotn:** argument or the **diskn:** argument for **boot** commands.)

Following are definitions of the various Flash Disk-related **boot** commands:

- **boot system flash disk0:** or **boot system slot0:**—Boots the first file in the Flash Disk in slot 0.
- **boot system flash disk1:** or **boot system slot1:**—Boots the first file in the Flash Disk in slot 1.
- **boot system flash disk0:herfile** or **boot system slot0:herfile**—Boots the file named *herfile* from the Flash Disk in slot 0.
- **boot system flash disk1:hisfile** or **boot system slot1:hisfile**—Boots the file named *hisfile* from the Flash Disk in slot 1.



Note

As you enter **boot** commands, pay attention to how you use the Spacebar, which influences the way your system interprets the commands. Also, ensure that you define the entire path to a file as you enter the **boot** commands; otherwise, the system might not be able to find the file.

For example, notice the difference in the following correct and incorrect commands:

```
System(config)# boot flash system disk0:myfile
```

Based on the preceding correct command, the system boots the file specified (*myfile*).

```
System(config)# boot flash system disk0: myfile
```

Based on the preceding incorrect command, the system finds the *filename* field blank because there is a space after **disk0:**. In this case, the system ignores the filename argument and boots the first file on the Flash Disk, which might not be the file called *myfile*.

Use the following procedure to enable booting the file *myfile* from a Flash Disk:

- Step 1** Enter configuration mode and specify an image filename in the PC Card slot from which to boot by using the **configure terminal** command, as follows:

```
System# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot system flash disk0:myfile
```

- Step 2** Enable the **boot system flash disk0:myfile** command using the **config-register** command with the hexadecimal value shown in the following example:

```
System(config)# config-reg 0x2102
```

This command, with the hexadecimal value 0x2102, results in the following:

- Enables the system to boot the default boot ROM software if the Flash Disk-based image fails to boot—hexadecimal value 0x2000
- Disables Break—hexadecimal value 0x0100
- Enables the image *myfile* as the default boot image—hexadecimal value 0x0002

Step 3 Press **Ctrl-Z** to exit configuration mode:

```
System(config)#
Ctrl-Z
System#
```

Step 4 Save the new configuration to NVRAM by using the **copy system:running-config nvram:startup-config** command as follows:

```
System# copy system:running-config nvram:startup-config
```

Making a Flash Disk-Based Software Image the Bootable Software Image

This section explains how to make a Flash Disk-based Cisco IOS software image a bootable image.

After you copy a software image to the Flash Disk, use the following series of commands to make the image bootable (the file named *new.image* in this example). The software image in this example is located on the Flash Disk in PC Card slot 0. Note that the **config-register** command is also a part of this command sequence because you must set the configuration register to 0x2102 to enable loading an image from the Flash Disk.

```
System# config terminal
System(config)# no boot system
System(config)# boot system flash disk0:new.image
System(config)# config-register 0x2102
Ctrl-Z
System# copy system:running-config nvram:startup-config
System# reload
```

When the system reloads, it boots the image *new.image* from the Flash Disk in slot 0.

Ordering Printed Documentation

Cisco is phasing out the automatic shipment of printed manuals with many of its products. To order a printed document, go to the following URL and follow the instructions on the page:

[Product Doc Comprehensive Instructions: Comprehensive Instructions for Ordering Cisco Product Documentation](http://www.cisco.com/univercd/cc/td/doc/es_inpk/cdocomp.htm) at: http://www.cisco.com/univercd/cc/td/doc/es_inpk/cdocomp.htm

Obtaining Documentation

These sections explain how to obtain documentation from Cisco Systems.

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You can access the most current Cisco documentation on the World Wide Web at this URL:

<http://www.cisco.com>

Translated documentation is available at this URL:

http://www.cisco.com/public/countries_languages.shtml

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Technical Assistance Center

The Cisco Technical Assistance Center (TAC) is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two levels of support are available: the Cisco TAC Web Site and the Cisco TAC Escalation Center.

Cisco TAC inquiries are categorized according to the urgency of the issue:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration.
- Priority level 3 (P3)—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- Priority level 2 (P2)—Your production network is severely degraded, affecting significant aspects of business operations. No workaround is available.
- Priority level 1 (P1)—Your production network is down, and a critical impact to business operations will occur if service is not restored quickly. No workaround is available.

The Cisco TAC resource that you choose is based on the priority of the problem and the conditions of service contracts, when applicable.

Cisco TAC Web Site

You can use the Cisco TAC Web Site to resolve P3 and P4 issues yourself, saving both cost and time. The site provides around-the-clock access to online tools, knowledge bases, and software. To access the Cisco TAC Web Site, go to this URL:

<http://www.cisco.com/tac>

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC Web Site. The Cisco TAC Web Site requires a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

<http://www.cisco.com/register/>

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC Web Site, you can open a case online by using the TAC Case Open tool at this URL:

<http://www.cisco.com/tac/caseopen>

If you have Internet access, we recommend that you open P3 and P4 cases through the Cisco TAC Web Site.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

<http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml>

Before calling, please check with your network operations center to determine the level of Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

This document is to be used in conjunction with the appropriate documents available for use with your router.

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