CFFA3000

Compact Flash and USB Flash Interface for Apple II

Reference Manual

Contents

Disclaimer

Plain English Version:

Do not use this manual or the CFFA3000 Interface board for any mission-critical applications, or for any purpose in which a bug or failure could cause you a financial or material loss. This product was designed to enhance your Apple II computing experience, but may contain design flaws that could inhibit its proper operation, or result in a loss of the data recorded on the storage devices attached to it. When using this product you assume all risks associated with operation or data loss. If these terms are not acceptable, you may return the product for a refund with 30 days of receiving it.

Legalese Version:

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Warnings

You should avoid electrostatic discharge to the CFFA3000 Interface board. Like all electronics devices, static "shock" can destroy or shorten the life span of the CFFA3000 Interface board. Avoid touching the CFFA3000 Interface board after you have walked across the room, especially over carpet, and especially in dry weather.

You should safely discharge yourself before you handle the CFFA3000 Interface board. This can be done by momentarily coming into contact with a grounded piece of metal.

In all cases, please exercise common sense and observe all electrical warnings provided by the manufacturers of the equipment you are using.

Introduction to the CFFA3000

The Compact Flash for Apple (CFFA) 3000 is an Apple II expansion card that takes modern, solid-state USB and CompactFlash storage and makes it accessible to the Apple. This keeps you from needing a physical hard drive with spinning platters, or even floppy disks with delicate Mylar film. The CFFA3000 can take the place of both kinds of devices.

The CFFA3000 occupies one slot of your Apple II, Apple II+, Apple //e, or Apple IIGS. When configured to offer both SmartPort devices and Disk II devices, the CFFA3000 appears to the Apple II to be inserted in two separate slots: the physical slot it actually occupies, and the virtual Disk II slot you choose (typically slot 6). The slot you choose as a virtual Disk II card should not contain a real card. If using an Apple IIGS the virtual slot should be configured as "Your Card" under Slots menu of the Control Panel.

There are many ways the CFFA3000 can be useful. Some interesting scenarios:

- ***Acting as a hard drive***: ProDOS has the ability to use one or more hard drives up to 32 megabytes in size. Configuring the CFFA3000 with a hard drive image in the SmartPort will allow you to format it and copy files to it just like a real hard drive. Copying the files named PRODOS and BASIC.SYSTEM from any ProDOS system disk will make the CFFA3000 bootable in that slot.

- ***Acting as a disk II drive***: Floppy disk images that you create yourself or find on the Internet can be used on the CFFA3000, just the same way you might use them on an emulator—except you'll be running them on a real Apple II. Configure the CFFA3000 to host a virtual Disk II adapter in whatever slot is convenient (slot 6 is of course typical for a Disk II). The virtual Disk II adapter slot you choose can either be the same slot as the CFFA3000 is inserted into, which would disable the SmartPort capability - or it can be any other unoccupied slot in your Apple so you retain the SmartPort capability.

- ***Making backup copies of disks***: You can use your normal Disk II card in slot 6, and configure the CFFA3000 to act as a second Disk II controller in slot 7. You can then use any Disk II copying software to copy from slot 6 to slot 7. The resulting disk image files on the CFFA3000 will be backups of the physical disks. Many Apple II-based tools (i.e. COPYA, Copy II+, etc.) that can successfully copy a disk in the real world will be able to copy to a disk image hosted on the CFFA3000. The CFFA also has the ability to "capture" an image of any ProDOS or SmartPort drive (including physical Disk II drives) existing in the system.

- ***Speeding up disk access***: Disk operations can be sped up in two ways: by default, an RWTS "patch" is active (signified by a quick double-beep during startup) that speeds up Disk II operations significantly under the DOS operating system. Another speedup can be realized by assigning what would normally be used as a Disk II image as a SmartPort device, also realizing a significant speedup – this is especially useful for ProDOS disk images.

Quick Start Instructions

1. Discharge yourself of excess static charge and remove the CFFA3000 from the shielded anti-static bag. The bag is a zip-lock type so you do ***NOT*** need to cut it open.

2. Set DIP switches 4 and 7 according to your Apple model as shown in Table 1. All switches are set to the OFF position by default. The ON position is down toward the board.

Model	Switch 4	Switch 7
Apple II, II+, //e	OFF	OFF
Apple IIGS	OFF	ON
Apple ///	ON	ON

Table 1: Model-specific Switch Settings

3. Decide what CFFA functionality you would like to use. If you will be using only the CFFA hard drive (SmartPort) function or only the Disk II floppy emulation function, then you only need one empty slot in your Apple II for the CFFA3000. However, if you plan to use both the hard drive (SmartPort) and Disk II emulation you will need two empty slots in your Apple II for the CFFA3000. One slot for the CFFA3000 itself, and one empty slot for the Disk II emulated hardware.

   Note: If you are using an Apple IIGS, ensure that the slots the CFFA3000 uses are set to "Your Card" in the IIGS control panel.

4. Turn off your Apple II computer. Insert your CFFA3000 in the slot you have chosen. A popular choice is to use slot 7. Keep in mind if you are using both floppy emulation and hard drive features, hard drive features will always appear in the physical slot the CFFA is plugged into. The floppy emulation will always be in another slot. If you set the floppy emulation slot to be the same as the physical slot, you will disable the hard drive (SmartPort) feature.

5. Insert a Compact Flash card and/or a USB thumb drive loaded with disk images you are interested in mounting. You may also use a USB extension cable. The CF and USB media may be hot plugged. Please refrain from removing the storage media while disk access is occurring.

   Note: USB hubs are not supported by the CFFA3000.

6. Turn on your Apple and quickly press the 'M' key to enter the CFFA3000 menus.

7. If you are planning to use Disk II emulation, select a Disk II Slot number (make sure it is empty). Remember if you plan to NOT use the SmartPort hard drive feature then select the slot number that your CFFA is physically located in. If you want hard drive support for ProDOS or GS/OS, then select a different slot number than the CFFA is physically located in.

8. Mount a disk image. The way you use them in a CFFA3000 is as follows:

   a. If the disk image you want to mount needs to be treated as if it were inserted in a virtual Disk II drive, then select "Disk II Assignments" from the main menu. If it can be treated as a SmartPort drive, then select "Smartport Assignments." Demonstrating how the Disk II works:

```
CFFA3000 v3.1                    Slot 7

USB: Ready
 CF: Ready

Disk II volumes (slot 6): 0
SmartPort volumes (slot 7): 0


     1 Disk II Slot: 6
     2 Disk II Assignments
     3 SmartPort Devices: 6
     4 SmartPort Assignments
     5 Import to Disk Image
     6 New Blank Disk Image
     7 Other Settings
     8 About
     9 Quit: Without Booting
```

Figure 1: Selecting "Disk II Assignments" from the menu.

b. When assigning Disk II images, pressing the '1' key will assign the highlighted image to drive 1. Pressing the '2' key will assign the highlighted image to drive 2:

```
CFFA3000 v3.1                    Slot 7

USB: USBSTICK        == Disk II S6,D1 ==
Items:               u> DISK01.DSK
 Folder1/
 Folder2/
 DISK01.DSK
 DISK02.DSK
 DISK03.DSK
 DISK04.DSK
 DISK05.DSK
 DISK06.DSK
 DISK07.DSK          == Disk II S6,D2 ==
 DISK08.DSK
 DISK09.DSK
 DISK10.DSK




DISK01.DSK
```

Figure 2: Pressing "1" to assign a disk image to Disk II drive 1.

Notes:

- If you have both a CF card and a USB drive inserted, pressing the space bar will alternate the left-hand column between CF and USB file listings.

- The Tab key will move the highlight-bar around the screen. Apple computers with no Tab key may use Ctrl-i instead.

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- The greater-than sign ("**>**") indicates the currently mounted disk in the drive in the right-hand column. You can select multiple disks for the drive, and rotate through them with the optional remote pushbutton attachment.

- The current disk mounted in the Disk II drive (as noted with the greater-than sign ("**>**") may also be selected by highlighting the desired image in the right-hand column and pressing the Return key.

- Depending on whether the disk images came from the USB or CF drive, there will be a letter '**u**' or '**c**' to signify the location of the image file.

- You cannot assign the same image to more than one drive at once.

c. When assigning an image to the SmartPort, pressing the Return key on the highlighted image will mount it:

```
CFFA3000 v3.1                          Slot 7

USB: USBSTICK         |SmartPort:
Items:                |u   DISK05.DSK
 Folder1/             |    ---
 Folder2/             |    ---
 DISK01.DSK           |    ---
 DISK02.DSK           |    ---
 DISK03.DSK           |    ---
 DISK04.DSK
 DISK05.DSK
 DISK06.DSK
 DISK07.DSK
 DISK08.DSK
 DISK09.DSK
 DISK10.DSK




DISK05.DSK
```

Figure 3: Pressing Return to assign a disk image to the SmartPort.

Notes:

- If you have both a CF card and a USB drive inserted, pressing the space bar will switch the left-hand column to alternately display CF and USB file listings.

- Depending on whether the disk images came from the USB or CF drive, there will be a letter 'u' or 'c' to signify the location of the image file.

- You cannot assign the same image to more than one drive at once.

9. To boot the Apple II using the disk images you have selected, press Ctrl-B from within the disk selection menu or select the "Boot (Reboot)" menu item at the bottom of the main menu.

Keyboarding in the CFFA3000 Menus

This section describes how to navigate in menus and file assignment screens.

The CFFA3000 menu system may be accessed in several ways:

1. Press the 'M' key immediately after turning on your Apple II.
   Note: You can only access the CFFA3000 menu if you are booting either its physical slot or its virtual Disk II slot. The CFFA defaults its virtual Disk II slot to OFF.
2. On an Apple IIGS, use the Classic Desk Accessory (CDA) menu by pressing the OpenApple-Control-Esc key sequence almost any time.
3. The menus may be accessed by using the appropriate slot specific entry point, as shown in Table 2.

CFFA3000 Slot	At the BASIC prompt:	At the Monitor prompt:
1	CALL -16080	C130G
2	CALL -15824	C230G
3	CALL -15568	C330G
4	CALL -15312	C430G
5	CALL -15056	C530G
6	CALL -14800	C630G
7	CALL -14544	C730G

Table 2: Menu invocation based on slot number

Moving among menu items or files:

1. Use the up/down arrow keys to move among items. If your Apple does not have up/down arrow keys, use A/Z (or Ctrl-K/Ctrl-J).

2. Use the numbers 1-9, or the first letter of an item, to select the next item starting with that character.

3. To navigate into a folder, highlight it and press the Return key.   Use left arrow or minus (-) to navigate back up one level.

Some menu items cycle through a list of options. These menu items show left or right arrows on the right side of the screen indicating other selections are possible. Press the <- and -> arrow keys change these settings.

Note: Any changes to a setting will be automatically saved when you move off that menu item.

Use the Tab key, or Ctrl-I (the letter "i") to move among columns/panes in the disk assignment screens.

Use the Delete key, the minus (-) key, or Ctrl-D to remove a disk image from the mounted list on the right-hand of the disk assignment screens.

Use Ctrl-B to boot the Apple II when in any of the drive assignmnet menus. This is useful for Apple II and Apple II+ computers that lack the Ctrl-OpenApple-Reset key sequence. After making drive assignments, you can easily reboot with Ctrl-B.

Many of the navigational keys used for the original Apple][and][+ computers are different, since the special keys don't exist on those keyboards. A view of the substitutions:

Figure 4: Menu navigation keys for the Apple][

Disk Image Formats Supported

The CFFA3000 recognizes the following types of disk images:

- .DSK, .DO, .PO 140K images (35 tracks x 4,096 bytes per track), can be used either as Disk II or Block devices. .PO is assumed to be in ProDOS sector order, .DO is assumed to be in DOS sector order, and .DSK sector ordering is auto-detected. If a .DSK fails to boot as you are expecting, renaming it to the correct sector ordering explicitly may help.

- .NIB nibble image files (35 tracks x 6,656 nibbles per track) can be used as a Disk II device only.

- .2MG can contain a nibble image or a block image (same rules as above); when a 140K block image is used as a Disk II device, the volume number is respected.

- Any file at least 256K and an exact multiple of 512 bytes in size can be used as a Block device only.

Storage Devices

USB drives and Compact Flash cards store the data that your Apple II will see as virtual disks. You can insert and remove them any time, without turning anything off, and without necessarily rebooting the Apple II. Choices of which disk image files to use are stored in a file named CFFA.CFG in the root folder on the USB or CompactFlash media.

When formatting a Compact Flash or USB device, ensure that you format it with FAT16 or FAT32 and with a Master Boot Record (MBR)

Note: Media formatted FAT12 or NTFS will not work with the CFFA3000.

Memory storage devices generally come this way when new. The Mac Disk Utility may not put a MBR on your device by default if you format it yourself; so you need to click on options and choose it. See Figure 5 for an example.
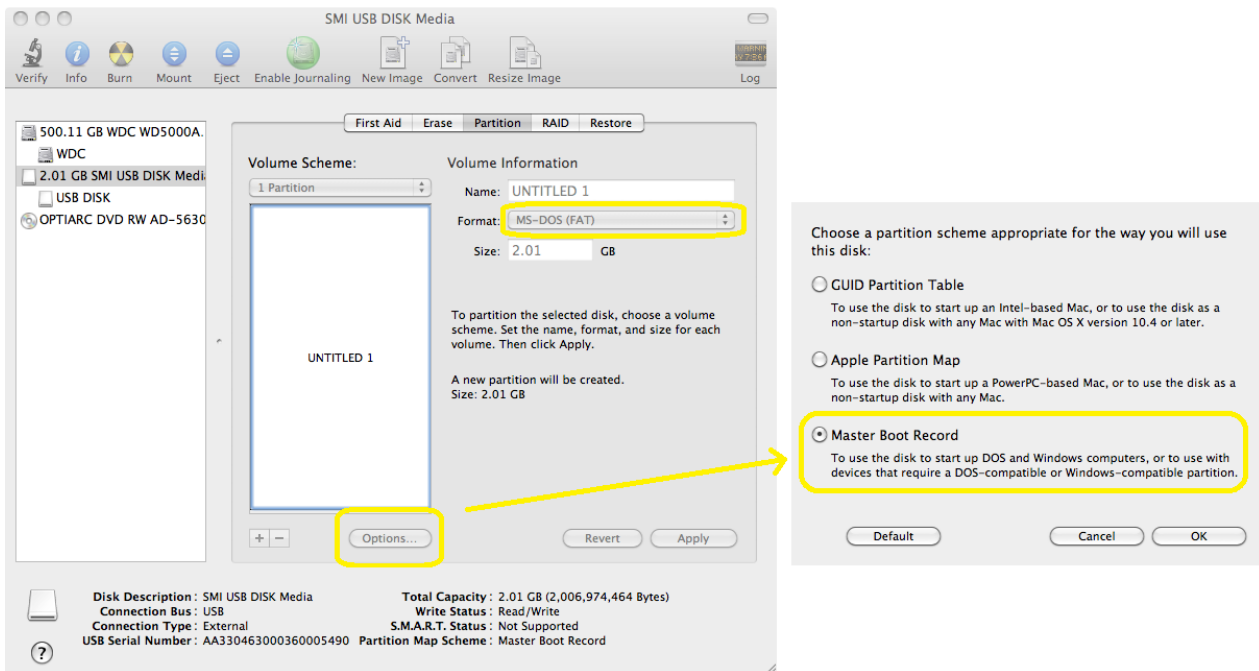

Figure 5: Partitioning and formatting with FAT16 or FAT32 and MBR required.

Partitioning Media

If a Compact Flash or USB device is formatted with more than one partition, only the first partition will be visible / available to the CFFA3000. All others will be untouched.

Compact Flash Cards

If you want old-style CFFA functionality - hard-coded drive partitions - your Compact Flash card will need to be zeroed out, or reformatted so that it doesn't have a Master Boot Record (MBR) at all. You can use tools like Disk Utility (Mac) or the CFFA3000 firmware to do that. See Figure 6 for an example.

```
CFFA3000 v3.1                          Slot 7


** For CF Card with no Partition Map **

        1 # 32MB partitions: 4
        2 Boot Partition: 1
        3 Erase CF For Raw Use
        4 Write New MBR to CF
        5 Back






Prepare the CF card for use as 32MB raw
partitions.
```
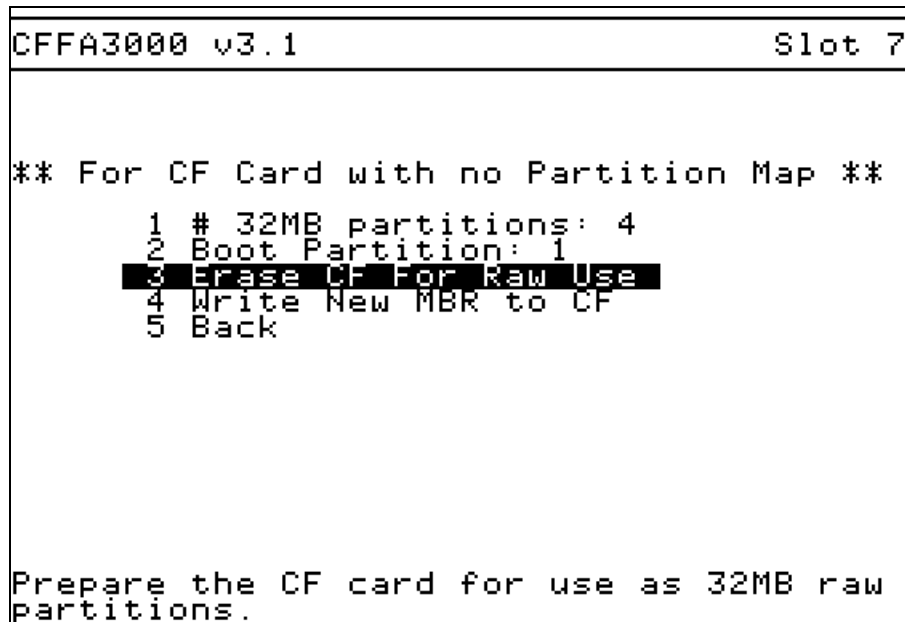
Figure 6: CFFA3000 menu, "Other Settings" > "Raw CF Card Settings"

Note that these old-style partitions can represent only block devices, not Disk II images. The only reason to use Compact Flash cards this way is for backwards compatibility with the original CFFA card - it is much more flexible to use the new disk image support.

USB Memory

USB drives should be formatted with the FAT16 or FAT32 file system with a Master Boot Record. Most come this way ready to use right out of the box. If you have any trouble with them, use your operating system's native disk formatting capabilities to clean them off and start fresh.

Note: older SanDisk drives with "U3 Smart Drive" technology should be reformatted and the U3 software, which appears on a read-only partition, removed. See this SanDisk support statement:

http://u3.sandisk.com/launchpadremoval.htm

Capabilities and Details

Block Devices

Block devices use the ProDOS or SmartPort firmware interfaces. The maximum number of devices to be presented to the operating system is configurable via the menu. Devices without any disk image file associated with them will be "offline" from the perspective of ProDOS.

Disk II Emulation

The Disk][emulation built into the CFFA3000 is compatible with DOS 3.3 and many other Apple II operating systems. The emulation happens at the "nibble" level, even if the disk image is not stored as nibbles. The emulation is good enough for many purposes, but it does not attempt to simulate the real-time spinning of the floppy disk.

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Whenever Apple II software writes a nibble, the virtual disk advances by 1/6,656 of a rotation. Whenever Apple II software reads a nibble, it sees an alternating pattern of "no nibble yet" and a valid nibble from disk, and when it sees a valid nibble, the disk advances by 1/6,656 of a rotation. This means it is possible to read nibbles somewhat faster than from a real Disk II (where a valid nibble is ready every 32µs).

Generally when the Apple II does not read or write any nibbles, the virtual disk does not spin. The CFFA3000 virtual Disk II will not work with software that depends on:

- The disk spinning while nibbles are not being read and written

- The relative positions of data when seeking to another track

- Seeking to half-track or quarter-track positions.

The Disk II emulation keeps one track at a time in RAM on the CFFA3000 card. When seeking to another track, it writes the old track to the disk image if there have been any changes, and then it reads the new track. If necessary, it automatically converts the track between sectors and nibbles.

The CFFA3000 uses its own slot-ROM code when booting, and it implements the $Cn5C and related entry points for compatibility with the boot sequences of various operating systems.

Special Note: Formatting of Virtual Floppy Disks

Some aspects of the CFFA3000 Disk II support make it such that "formatting" of disks may not be successful, depending on several factors:

- Speed of the destination memory device

- Operating system of the software doing the formatting

- The formatting program itself

Several formatting scenarios have been tested with the CFFA3000, and the ones that have been shown to work well are:

- DOS 3.3's INIT command

- Whole-disk copies as performed by COPYA (on the DOS 3.3 System Master diskette), which performs a format operation before copying

- Whole-disk copies as performed by CopyII+, which performs a format operation before copying

- Disk format operations performed by ADTPro

Formatting scenarios that are known to NOT work are:

- Formatting performed by the ProDOS system utilities

- Formatting performed by the Apple Pascal Operating System

In general, all of these issues may be worked around by simply using a disk image that has been created elsewhere with programs like CiderPress or AppleCommander.

Importing Disk Images

The CFFA3000 has the ability to import virtual disk images directly from the physical disks and drives existing in the Apple II system. This makes it easy to digitize a stack of floppy disks or simply to back up an aging hard drive. From the main menu, select "Import to Disk Image" as shown in Figure 7:

```
CFFA3000 v3.1                    Slot 7

USB: Ready
 CF: Ready

Disk II volumes (slot 6): 2
SmartPort volumes (slot 7): 1

    1 Disk II Slot: 6
    2 Disk II Assignments
    3 SmartPort Devices: 6
    4 SmartPort Assignments
    5 Import to Disk Image
    6 New Blank Disk Image
    7 Other Settings
    8 About
    9 Quit: Without Booting


Make a new disk image from a real disk.
```

Figure 7: Importing Disk Images from Main Menu

In the next panel, any slot and drive that is recognized by the CFFA3000 as a viable import candidate may be selected for importing. The left and right arrow keys will scroll through the candidates:

```
CFFA3000 v3.1                    Slot 7

Import from slot:  6
       Drive (1-2):  1
```

Figure 8: Selecting slot and drive numbers for import

Once the drive and slot have been chosen, the file name that will be created is presented, and it can be modified to suit:

```
CFFA3000 v3.1                          Slot 7

Import from slot 6, drive 1

Import a new 140K disk image
USB or CF? (U/C) U

   --------
   DISK001_   .DSK
   --------
```

Figure 9: Modifying the imported file name

As the disk images are produced, they will be added to the root folder of the specified memory device. When importing multiple images, the numeric suffix will be incremented as each disk is imported. Next, if both USB and Compact Flash memory devices inserted, there will be a prompt to specify which device to write the new image to.

During the import operation, a progress bar will be displayed, along with any other status messages that are relevant to the import operation, as seen in Figure 10:

```
CFFA3000 v3.1                          Slot 7

Import from slot 6, drive 1

Import a new 140K disk image
USB or CF? (U/C) U

   --------
   DISK001_   .DSK
   --------

 |*****************                    |
```

Figure 10: Progress while importing a physical disk

Once the import operation is complete, there will be a prompt to import another disk, using the same parameters as before. This would be especially useful for importing a stack of floppy disks:

```
CFFA3000 v3.1                          Slot 7

Import from slot 6, drive 1

Import a new 140K disk image
USB or CF? (U/C) U

  --------
  DISK001   .DSK
  --------

 |*********************************|
Finished.

Import again from same drive? (Y/N) _
```

Figure 11: Opportunity to import again with the same parameters

Notes to Specific Apple Computer Models

The general operation of the CFFA3000 is the same on any Apple II model, but make note of the following differences.

Apple II, Apple II+, Unenhanced Apple //e

To boot from CFFA3000 on power-up, you must go to "Other Settings" in the menu and set "Autoboot Older Apples" to Yes. (ProDOS 2.0 requires an enhanced //e or later, and the older versions of ProDOS do not use SmartPort.) Notes:

- ProDOS will be able to see at least the first two "SmartPort" drives. If the CFFA3000 is in slot 5 or 6, then two additional drives can appear in slot 1 or 2.

- On an Apple II and Apple II+ machines, use these keys in the menus:
    - A/Z or Ctrl-K/Ctrl-J to move up and down when navigating menus
    - Ctrl-I (the letter "i", not the number 1) is a substitute for the Tab key - it rotates through options on the disk assignment screens
    - Ctrl-D and the minus key (-) are substitute for the Delete key for removing/unmounting disk images on the disk assignment screens
    - Ctrl-B will boot the machine like Ctrl-OpenApple-Reset.

Apple IIGS

CFFA3000 DIP switch 7 should be set to ON/DOWN for operation in an Apple IIGS.

In order to have the CFFA3000 act as a virtual Disk II, be sure to set the Disk II slot to "Your card" in the IIGS control panel. The physical CFFA3000 card will also need to be in a slot that has that setting. Slot 7 is set to "Your card" by default; the rest are not.

There is a CDA for convenient access to the CFFA3000 menus. Use Ctrl-OpenApple-Esc and choose "`CFFA3000 (Slot N)`" from the list of CDAs. The CDA gets installed automatically when you boot from the CFFA3000, or when you boot from another slot and then access CFFA3000 block device (GS/OS and ProDOS 8 v1.9 and later does this at boot time). When you boot GS/OS, there is a time early in the boot process when the CDA is not available (GS/OS empties the CDA list, and CFFA3000 re-installs the CDA later in the boot sequence).

There is no need or use for a GS/OS loaded driver for the CFFA3000.

- The standard Disk II driver discovers the virtual Disk II and uses it.

- The standard "generated driver" discovers the CFFA3000's block devices and uses Extended SmartPort calls to read and write blocks.

Slot limitations: in an Apple IIGS, the virtual Disk II slot must be set to 4, 5, 6, 7, or None. The same restriction applies to a real Disk II card, because a GS monitors the Disk II motor-on soft switches only for those slots, and it automatically throttles to 1 MHz when a motor is on. The CFFA3000 itself can occupy slot 1 or 2 with no trouble.

Apple ///

CFFA3000 DIP switches 4 and 7 should be set to ON/DOWN for operation in an Apple ///.

The Apple /// can use the CFFA3000 either from within the emulated Apple][, or as a native SOS device. Under Apple][emulation, the /// can boot from a virtual floppy disk image on either the attached Compact Flash card or USB drive, provided it's formatted with a Master Boot Record and FAT16 or FAT32. To use a CFFA3000 as a native SOS device, refer to the Apple /// driver appendix on page 26.

CFFA3000 Hardware

CFFA3000 Remote

The optional CFFA3000 remote offers a way to change the currently mounted virtual diskette image in either of the virtual Disk II drives. Each push of a button mounts the next disk in the associated Disk II drive if more than one disk had been chosen on the Disk II assignment screen. The cable between the CFFA3000 and the remote must be oriented so that pin1 on the remote is connected to pin 1 on the CFFA3000 card. On the remote, pin 1 is the leftmost pin on the board, as viewed in Figure 12.

Note: Starting with run 2 of the CFFA3000 cards a 10 pin ribbon cable is being supplied with the optional remote accessory. Figure 12 below shows the proper orientation for this cable. The actual pins on the cable being used are pins 2, 4, 6, 8, and 10.
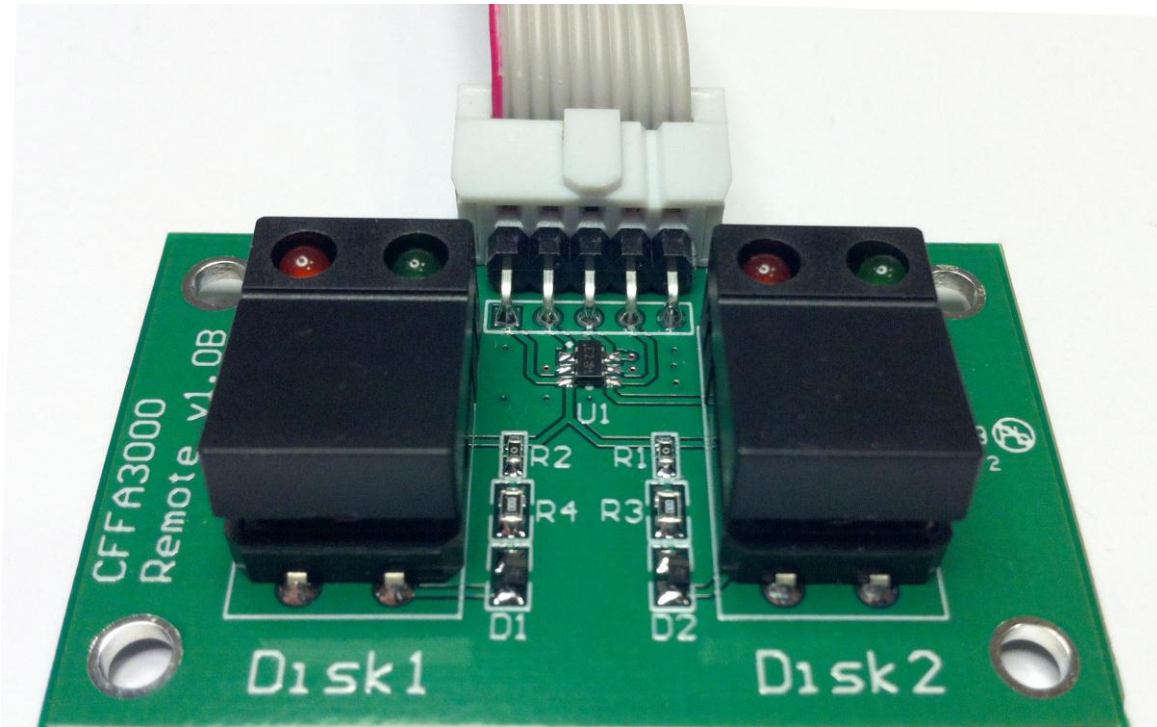

Figure 12: CFFA3000 Remote connector pin 1 location

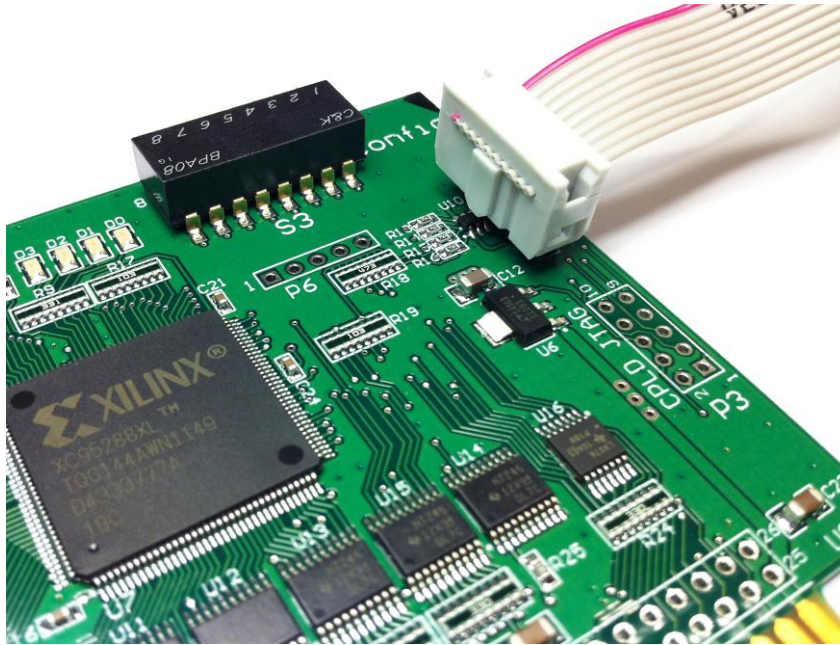The remote's ribbon cable should be oriented as shown in figures 13 and 14 below.

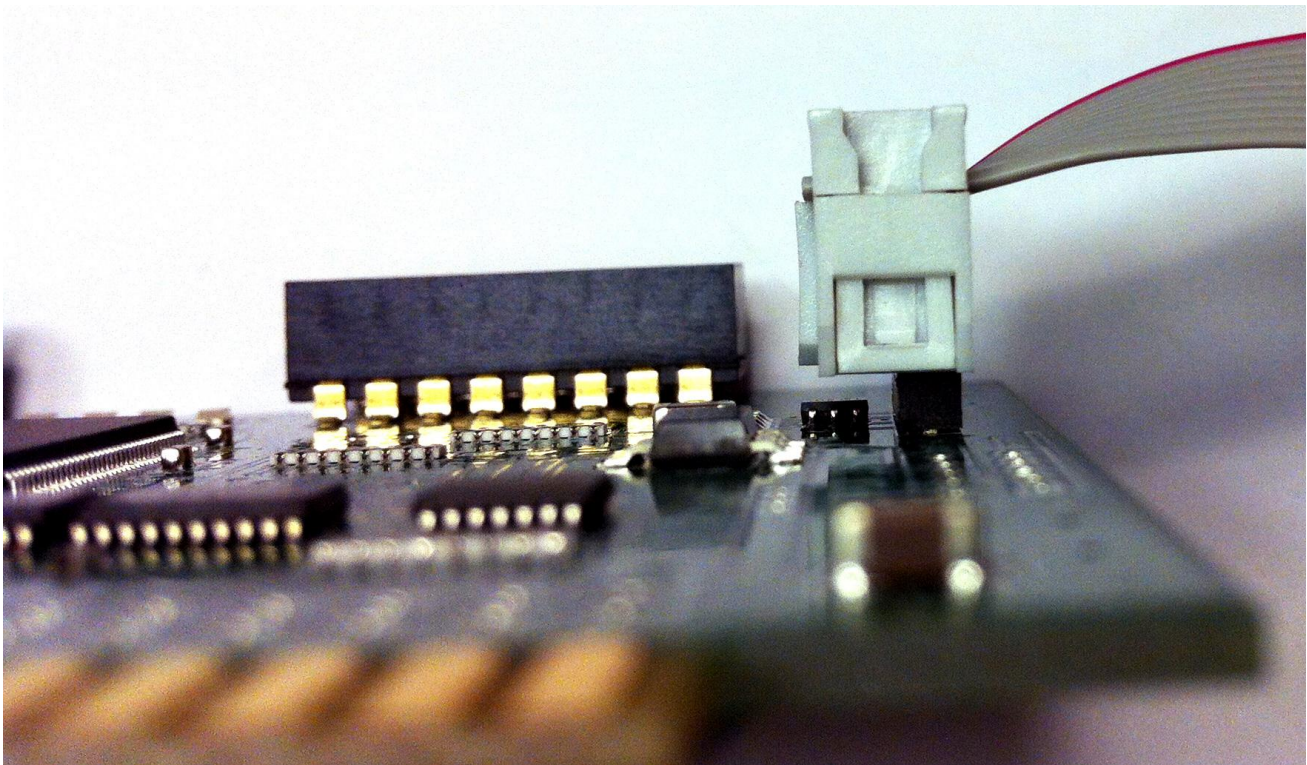**Figure 13: CFFA3000 P4 connector to remote, top view**

Figure 14: CFFA3000 P4 connector to remote, side view

DIP Switches – All OFF (UP) by default

- Switch 1 ON (DOWN) = On an Apple II/II+, use lowercase letters in CFFA3000 menus. Turn this switch on only if your II/II+ has a lowercase chip installed.

- Switch 2 ON (DOWN) = Disable the use of MouseText characters in CFFA3000 menus even on machines where they are available.

- Switch 3 ON (DOWN) = Detailed debug logging.

- Switch 4 ON (DOWN) = Host machine is an Apple ///. Since the Apple /// also requires switch 7 to be on/down, switch 4 on/down tells the CFFA3000 to use the 6502 firmware instead of the 65816 firmware.

- Switch 6 ON (DOWN) = Power-on self tests: Blink the LEDs in sequence, test 128K SRAM and 8K DPRAM. Then it either blinks an error code on the red LED, or it lights a green LED and waits for you to turn the switch off before proceeding.

- Switch 7 ON (DOWN) = Host machine is a IIGS or an Apple ///; OFF/UP is not

- Switch 8 ON (DOWN) = At power on initiates firmware upgrade (looks for CFFA.bin and/or CFFA.xsv file on FAT-formatted/MBR CF card only).

Diagnostic LEDs

Big Green LED

- On when reading or writing data to USB or CF

Four Small Green LEDs

LED	Meaning
D0	Blinks when reading or writing virtual Disk II controller. Also blinks while the virtual motor is on.
D1	Blinks when writing to a FAT formatted device.
D2	Blinks when reading or writing the USB flash device.
D3	Blinks when reading or writing the CF card.

There are also patterns that you will see on these LEDs that have special meaning:

- `*-*- / -*-*` Even/Odd animation at power-up (longer dance if the AVR restarts for some other reason, like after a firmware upgrade)

- `*--* / -**-` In/Out animation while the Apple II is being in Reset

- Repeated left-to-right animation while waiting for a USB device to be ready

Remote Pushbutton LEDs

The left button and LEDs apply to Disk II drive 1, and the right button and LEDs apply to Disk II drive 2. Press a button once to advance to the next disk in the list. Press and hold a button to have it blink a number of times corresponding to the index number of the disk in the drive.
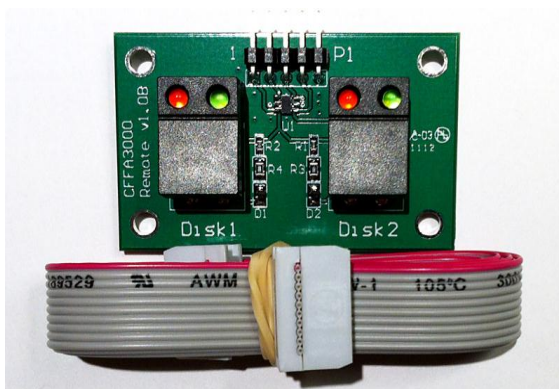

Figure 15: Remote pushbutton board.

LED	Meaning
Red (fast blink)	Disk switch was not allowed, or there is no disk in the virtual drive.
Red (slow blink)	Blinks once for disk image 1, twice for disk image 2, and so on. Disk images are assigned in the "Disk II Assignments" menu.
Green on	The virtual disk II motor is on.
Red on	Data is being written to the virtual disk II image.

Small Bright Red LED D5

Blinks at power-up and also communicates important information, usually by blinking a 2-number code. Many of the codes can repeat forever. The (2, x) codes are from the bootloader, which always runs at power-on and provides the opportunity to replace the main firmware (DIP Switch 8 on), even if there is no firmware present and/or the CPLD is not in a good state:

- (2, 4) = please insert CF card containing CFFA.BIN
- (2, 5) = the CF card is not formatted as MBR + FAT16/FAT32
- (2, 6) = could not find CFFA.bin
- (2, 7) = firmware upgrade complete
- (2, 8) = the CFFA.bin file is too large (>120K)

- (2, 9) = failed to read from CFFA.bin file
- (2, 10) = no main AVR firmware is present: must install a CFFA.bin

The (3, x) blink codes come from the main firmware, when it tries to program the CPLD from a CFFA.xsv file on the CF card. This can be done "blindly" by powering up with DIP Switch 8 turned on:

- (3, 4) = Upgrade CPLD failed (power off and try again)
- (3, 7) = Upgrade CPLD complete (must power off and back on now)

Upgrading the Firmware

There are two programmable chips on the CFFA3000, both upgradable by the user. Firmware upgrades from the web site consist of one or both of these files:

- CFFA.bin - firmware for the AVR microcontroller

- CFFA.xsv - logic for the CPLD

When upgrading either of these chips, these files must be placed on a Compact Flash memory device, not a USB memory device.

Upgrading When the CFFA3000 is Working Normally

To update the main firmware:

1. Enter the CFFA's main menu on the Apple II.

2. Put CFFA.bin onto the CF card, and insert the CF card into the CFFA3000.

3. The CFFA3000 automatically asks if you would like to install the update, if the version of CFFA.bin is different than the currently running version. Press Y for Yes to update.

4. The CFFA3000 will go through several sequences of flashing LEDs; when it is complete, the main menu will re-appear with an updated version number visible. The expected red LED blink code is 2, 7. See Diagnostic LED section for details on other blink codes.

To update the CPLD:

1. Put CFFA.xsv onto the CF card, and insert the CF card into the CFFA3000.

2. The CFFA3000 automatically asks if you would like to install the update, if the version of CFFA.xsv is different than the currently running version. Press Y for Yes to update.

3. Wait about 30 seconds for the expected red LED blink code of 3, 7. You will need to power the Apple II off and back on once complete.

Upgrading When the CFFA3000 is Not Working

To perform an update (even if the CFFA3000 is not working normally because of incorrect or incomplete firmware):

1. Power off the Apple II.

2. Use your PC or Mac to copy one or both of CFFA.bin and CFFA.xsv onto a CF card, and insert the CF card into the CFFA3000.

3. Set DIP Switch #8 to ON and power on the Apple II.

4. Watch the blinking LED on the CFFA3000. After a minute or two it will settle down.

   - If only a CFFA.bin is installed, the CFFA3000 will start operating normally (after the 4 green LEDs D3-D0 blink in an alternating pattern).
   - If a CFFA.xsv installed, the final blink pattern will be (3, 7).

5. Turn DIP Switch 8 back off, to avoid potentially trying to apply automatic updates every time you turn on the Apple II. If the switch is still on, the main menu will remind you to turn it off.

6. If you wish, remove the CFFA.bin and/or CFFA.xsv from the CF card.

Appendix A: Native SOS Apple /// Driver

The CFFA3000 driver for the Apple /// computer takes many of the virtual resources of the CFFA3000 card and makes them available to SOS and the many languages and environments that SOS supports. The driver has the capacity for up to eight virtual drives hosted by the CFFA3000 card as SmartPort devices. Disk][emulation (including the optional remote switch module) is not available under SOS and should not be enabled.

Unlike ProDOS, most of the environments under SOS are unable to use or correctly recognize more than 32,767 blocks of data on any given block device (approximately 16 megabytes). This is not a limitation of the CFFA3000 card; this is a limitation of SOS environments like Pascal, BASIC, and the Apple /// System Utilities. When creating virtual disks for the Apple ///, remember to make them of 32,767 blocks or fewer in size.

DIP switches 4 and 7 should be set ON/DOWN in an Apple ///.

Configuration

Using the System Configuration Program (SCP), part of the SOS System Utilities disk, you can copy the CFFA3000 driver to any boot disk you choose just like any other Apple /// driver. The only configurable parameter the slot the card is in: 1-4. Ensure the slot parameter number matches which slot the card is actually plugged in.

The driver is distributed on a copy of the SOS System Utilities disk both integrated into the `SOS.DRIVER` file as well as in a stand-alone `CFFA3000.DRIVER` file. The eight supported device names are `.CFFA3000D1` through `.CFFA3000D8`.

Compatibility with Earlier CFFA Compact Flash Cards

The CFFA3000 driver will recognize "native" partitions (i.e. original CFFA CompactFlash cards). However, they generally won't be suitable for the Apple /// since they will be 32 megabytes in size, which will not be represented correctly by most SOS-based environments. They will be usable, but block sizes will be inaccurately reported. Pascal and the SOS Utilities Disk in particular will be unable to display the catalog of partitions greater than 32,767 blocks in size (16 megabytes).

Partitions as created by Dale Jackson's excellent Apple /// driver for the original CFFA card are not compatible with this new driver since they could be variably sized. In order to use the information in those partitions with the CFFA3000, plug the CompactFlash card into a card reader and use the CiderPress utility on Windows to extract ProDOS-order disk images of the native SOS partitions. Then, simply copy those disk image files to a new CompactFlash card for use in the CFFA3000. After configuring the CFFA3000 to host the images as SmartPort drives, they will be available to SOS just as they were before.

Firmware Configuration

When a CFFA3000 card is running in an Apple][, it is simple to call upon the firmware to manage disk images. However, the user interface - the configuration system - can't run natively on an Apple ///. There are at least two ways to accomplish the same goal:

1. Plug the CFFA3000 into any Apple][and bring up the firmware menu system on it, saving whatever configuration of drives you wish on a CompactFlash card (or on a USB stick if it is extremely small - there is very limited space for a USB adapter in the /// case).

2. Boot the Apple /// with the Apple][emulation diskette, press the Return key to boot an Apple][floppy, press the reset button, then invoke the firmware menus from the Apple][emulation according to this table:

CFFA3000 Apple /// Slot	BASIC Invocation	Monitor (i.e. CALL-151) invocation
1	CALL -16080	C130G
2	CALL -15824	C230G
3	CALL -15568	C330G
4	CALL -15312	C430G

Table 3: Menu invocation in Apple /// slots

Once a memory device has disk images configured on it, they can be left alone and used in the CFFA3000 in the Apple /// without further intervention from the menus. Memory devices can also be swapped, and as long as they have SmartPort configuration information saved on them (the CFFA.CFG file written by the firmware menus) they will be recognized and used by SOS.

Hot-Plugging Memory Devices

The Apple /// driver supports hot-plugging USB or CompactFlash memory devices. As long as each device has been pre-configured with drive selections, they will be made available to the operating system. Different operating environments behave differently when disks are swapped. In most cases, asking for a catalog based on the device name will be enough to make the system aware of a new drive, and subsequent access via the volume name will be possible.

From within Business BASIC, for example, after inserting a new CompactFlash card, issuing the CATALOG command and specifying the device name: CATALOG .CFFA3000D1 will re-attach the virtual drive to the system, and then the volume name (as opposed to the device name) can be used to interact with the drive contents.

ADTPro's Volume screen generally needs to be refreshed once or twice with the R key in order to re-scan the new set of available devices.

USB Memory Devices in the Apple ///

Both USB and CompactFlash memory devices will work fine with the Apple /// driver. However, due to the proximity of the USB port to the physical wall of the Apple ///'s case, it may be difficult to insert a USB memory stick or a USB extension cord. Only the smallest or most flexible of USB solutions will likely fit. The vast majority will not.

Appendix B: Copyright Notices

Copyright © 2009-2013 R&D Automation, LLC.

The CFFA3000 USB support uses components from the LUFA Library:

```
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(dean [at] fourwalledcubicle [dot] com)
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consequential damages or any damages whatsoever resulting from loss
of use, data or profits, whether in an action of contract,
negligence or other tortious action, arising out of or in connection
with the use or performance of this software.
```

Appendix C: Warranty and Return Information

You may return the CFFA3000 Interface board for any reason within 30 days of receiving it. This should allow you enough time to evaluate the compatibility with your system. I guarantee your CFFA3000 Interface board to be free of defects under normal usage for a period of one year from the date you receive the product. This means that if the board fails, and you have treated it properly, I will repair, replace, or refund your money at my discretion, to be determined by me on a case-by-case basis.

If you want to return the product under warranty, please contact me via E-mail at rich@dreher.net to discuss return arrangements. Include your name and the serial number from the sticker on the back of the board. It is your responsibility to get the product you are returning back to my door. I will not be responsible for lost shipments. Please choose the shipping method and insurance that you deem necessary.

Appendix D: Acknowledgements

I would like to extend my gratitude to the following people who helped make the CFFA3000 project a reality:

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2011 Kfest attendees