



FLOPPY EMU DISK EMULATOR

For vintage Apple II, Macintosh, and Lisa computers

Instruction Manual for [Floppy Emu Model B](#)

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1. INTRODUCTION

Thank you for purchasing a Floppy Emu disk emulator! Floppy Emu is a specialized floppy and hard disk emulator for classic Apple computers. It uses a removable SD memory card and custom hardware to mimic an Apple floppy disk and drive, or an Apple hard drive. The Emu behaves exactly like a real disk drive, requiring no special software or drivers on the computer. It's perfect for booting your favorite games, moving files between modern and vintage machines, and troubleshooting a computer without a working OS. Just plug in the Emu board, and you'll be up and running in seconds.

This instruction manual describes the Floppy Emu Model B. The Model B hardware can be identified by the text "Model B, Version 1.5" on the underside of the board. For the older Emu Model A, please see the separate instruction manual for that hardware.

2. COMPATIBILITY

Floppy Emu Model B is compatible with the entire Apple II line, without the need for a separate adapter. It's also compatible with vintage Macintosh computers from the original Mac 128K through the Mac II series and Power Mac, as well as the Lisa 2/5 and 2/10. The supported disk emulations are:

COMPUTER	DISK EMULATION MODES
Macintosh	
Macintosh 128K	✔ 3.5 inch 400K floppy
Macintosh 512K	✔ 3.5 inch 400K floppy, HD20 hard disk[1]
Macintosh 512Ke, Plus, SE	✔ 3.5 inch 400K/800K floppy, HD20 hard disk
SE FDHD, Classic, Classic II, Portable, IIfx, IIfx Plus	✔ 3.5 inch 400K/800K/1.4MB floppy, HD20 hard disk
SE/30, IIfx	✔ 3.5 inch 400K/800K/1.4MB floppy
LC	✔ 3.5 inch 400K/800K/1.4MB floppy, HD20 hard disk[2]
IIfx, IIfx Plus, IIfx Plus Plus, LC-II, LC-III, LC 5xx, Color Classic, Color Classic II, TV, Performa, Quadra, Centris, Power Mac	✔ 3.5 inch 400K/800K/1.4MB floppy[2]
Lisa	
Lisa 2/5 and 2/10	✔ 3.5 inch 400K/800K floppy
Apple II	
Apple II, II+, IIfx with standard disk controller	✔ 5.25 inch floppy
Apple II, II+, IIfx with Liron disk controller	✔ Smartport hard disk
Apple IIfx	✔ 5.25 inch floppy, Smartport hard disk[3]
Apple IIgs, IIfx+	✔ 5.25 inch floppy, 3.5 inch floppy, Smartport hard disk

[1] Mac 512K also requires boot floppy with HD20 Init

[2] uses internal disk connector

[3] requires IIfx ROM revision 0 or newer for Smartport mode



3. SD CARD

Floppy Emu Model B uses microSD size cards – the same size of SD cards commonly used with mobile phones. These cards can also be used with a modern Windows, Mac OSX, or Linux computer, with a full-sized SD adapter or USB-based SD card reader.

Each of your disk images will be stored on the SD card as a separate file. Think of the SD card as being like a giant box containing hundreds of floppy disks and/or hard disks, where each file on the SD card is a separate disk. Using the menu interface on the Emu, you can select which of those disks to insert or mount in your emulated disk drive.

You can use a modern computer to download more disk images from the internet, and add them to your SD card. With special software utility programs, it's also possible to peek inside a disk image on the SD card, see the individual Apple II or classic Mac files inside, and copy those files to/from your modern computer's disk. See the **Disk Images** section for further details.

Both standard SD and SDHC cards are supported. Smaller capacity cards typically provide slightly better write performance – use a 4GB or smaller card if possible. The card should be formatted as FAT32. Most new SD cards are already pre-formatted as FAT32, so you probably don't need to do anything.

The SD card can be removed and re-inserted while the Floppy Emu is powered on, without causing harm.



4. FIRMWARE

Floppy Emu can be used with an Apple II, Macintosh, or Lisa computer. It may be necessary to install new firmware on the Floppy Emu device, depending on the type of Apple computer being used. The Emu ships with Apple II compatible firmware pre-installed. For Macintosh and Lisa disk emulation, download and install the appropriate firmware from www.bigmessowires.com/floppy-emu

Firmware updates require copying two special files to the SD card, then inserting the SD card in the Emu board and pushing a few buttons while the power is turned on. Full instructions for installing firmware updates can be found in the *readme.txt* file included with the firmware download. Please note that firmware updates consist of two separate parts that must be installed one after the other. If you see a warning message about "wrong CPLD", it means you're not finished yet, and haven't installed both parts of the firmware.



5. EMULATION MODES

Each version of the firmware supports several different emulation modes, which emulate a specific type of disk. For example, the Apple II firmware has three separate emulation modes for 5.25 inch disks, 3.5 inch disks, and Smartport hard disks. The Mac/Lisa firmware has emulation modes for Macintosh 3.5 inch disks, Lisa 3.5 inch disks,

and HD20-type Macintosh hard disks. The current mode is briefly displayed on the Emu's LCD screen, whenever the device is powered-on or reset. Only one mode can be active at a time.

To change the emulation mode, reset the Emu, and press the SELECT button while the Emu's version info is shown on the LCD screen. This will display a menu, from which you can select a new mode. The selected mode is stored in non-volatile memory, and will remain in effect permanently until changed.

After changing the emulation mode, you may need to turn the computer off, then on again in order for it to correctly recognize the new type of disk drive.



6. CONNECTION METHOD

The Floppy Emu board can be connected to the computer's external 19-pin disk port, or internal 20-pin port, as described further below.



Always plug the Floppy Emu board into your computer *before* turning it on. "Hot plugging" the Floppy Emu (plugging and unplugging when the computer is already on) may damage it.

6.1 External Connection

Connect the Floppy Emu to the 19-pin disk port on the rear of the computer. Most early Macintosh computers have this external 19-pin disk port, as do the Apple IIGS, IIc, and IIc+. The Apple 5.25 Drive controller card commonly used in the Apple II, II+, and IIe also has the same 19-pin port.

The Floppy Emu board has a 20-pin ribbon cable, with a detachable 20-to-19 pin adapter on one end. The cable makes it possible to place the Floppy Emu board somewhere on your desk where it's more convenient to access.

For Apple II computers, the Floppy Emu can also be connected to the end of a daisy chain of other disk drives, at the 19-pin disk port on the rear of an Apple 3.5 Drive, Apple 5.25 Drive, or other similar drive. The Floppy Emu board does not have a daisy chain output, and so it will always be the last drive in the chain. The Emu board must be placed at the correct position in the chain, given what type of drive it is currently emulating. 3.5 inch drives (if any) go first, then Smartport drives (if any), and finally 5.25 inch drives (if any).

The Lisa does not support daisy chaining, and Floppy Emu must be connected directly to the computer on this system.

The Macintosh generally does not support daisy chaining, and the Floppy Emu must normally be connected directly to the Mac. The only exception is when using a real Apple HD20 drive. In this case, Floppy Emu may optionally be attached to the disk connector on the back of the HD20.

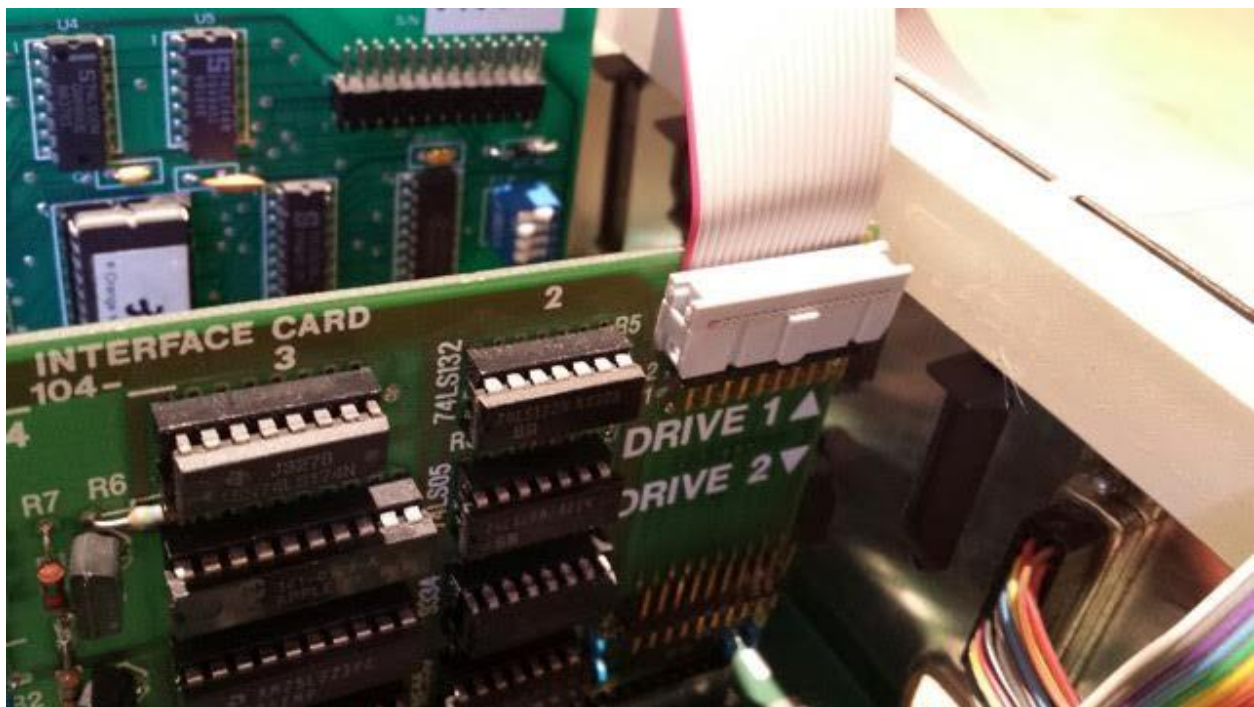
6.2 Internal Connection

The Lisa and some early Macintosh computers do not have an external 19-pin disk port, nor does an Apple II, II+, or IIe when equipped with an Apple Disk II controller card. In these cases, the Floppy Emu must be connected to a 20-pin internal disk port on the computer's logic board or disk controller card, using a 20-pin flat ribbon cable. This may necessitate disconnecting the internal floppy drive that's normally connected to this port.

✿ 6.2.1 Apple II Disk II Controller Card



When connecting to a Disk II Controller Card, be very careful to orient the cable correctly. The red stripe on the cable should go to the pins marked "1" and "2" on the Disk II Controller Card. An incorrectly oriented cable may cause damage.



Pay careful attention to the cable orientation when connecting to a Disk II Controller Card in an Apple II computer. The Disk II connector lacks a polarity key, so it's easy to connect the cable backwards accidentally. This can result in damage to the Emu board or your computer. In the correct orientation, the red stripe on the cable will go to the pins marked "1" and "2" on the Disk II card, as shown in the photo. The cable will be sandwiched between the connector and the board.



7. LCD SCREEN ADJUSTMENT

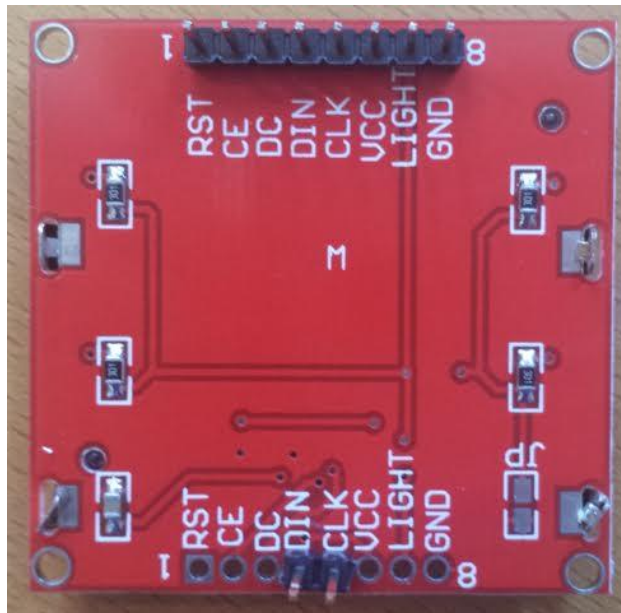
Contrast Setting

If the text on the LCD screen is too dark or too faint, you can adjust the contrast setting. Hold down the SELECT and NEXT buttons while Floppy Emu is initializing. After a few seconds you'll see the contrast adjustment screen. Use the PREV and NEXT buttons to change the contrast, and SELECT to save the new setting.

Contrast Instability or Blank Screen

If the LCD contrast fluctuates over time, or changes when you push your fingers on the edges of the LCD frame, or the LCD display is completely blank, then the LCD module may be loose. Unplug the LCD module and flip it over. You'll see four metal tabs sticking through the back of the red PCB. If you look closely, you'll notice that each metal tab has a small notch on its inner face. Use pliers to pull each tab further through the slot in the PCB, while also gently bending the tab inward towards the center of the PCB, until this notch clicks into place. This "click" holds the tab tight against the PCB, and is necessary to keep the LCD in the right position.

Once you have all four tabs clicked into place, you may need to readjust the contrast setting. If the current contrast setting is so low that the text is invisible, you'll need to perform the contrast adjustment "blind". Hold down the SELECT and NEXT buttons while the Floppy Emu is initializing. After about three seconds, the status LED will stop blinking, at which point you can release the buttons. Then press and release the NEXT button repeatedly to increase the setting and darken the contrast until the text becomes visible (or press PREV to lighten the contrast).



The photo above shows an example. The two tabs at the bottom are twisted out of the correct position. The tab at upper-left is straight, but its notch/clip isn't engaged. The tab at upper-right is correct, with the notch/clip engaged and overlapping the bare metal area of the red PCB. All four tabs need to look like the one at upper-right, in order to create even pressure on the LCD-to-PCB contacts, and get a consistent contrast on the LCD.



8. DISK IMAGES

Each of your disk images will be stored on the SD card as a separate file. Think of the SD card as being like a giant box containing hundreds of floppy disks and/or hard disks, where each file on the SD card is a separate disk. For example, a disk image of a Macintosh System 6.0.8 startup floppy might be stored on the SD card as the file *SYSTEM-608.DSK*, while side one of the Apple II game Oregon Trail might be stored on the card as the file *OREGON TRAIL 1.DO*. Using the menu interface on the Emu, you can select which of those disks to insert or mount in your emulated disk drive.

Hard disk images work similarly to floppy disk images. For hard disk emulation, the names of the disk image files are typically preset – see details in the machine-specific usage sections below. For example, an image of a bootable Apple II Smartport hard disk might be stored on the SD card as the file *SMARTO.PO*.

When you select a disk image from the Emu's menu, the computer behaves as if you had inserted a real disk with the same contents as the disk image. It can read the disk, or boot from it. If you write to the emulated disk, the contents of the disk image file on the SD card will be modified too.

If a disk image file on the SD card is marked "read only" in its Windows properties or its OS X file info, then the emulated disk will appear locked when it's used on the Macintosh, Apple II, or Lisa. If the write-protect tab on the SD card is set to the "lock" position, then all the emulated disks will appear locked when they are used.

8.1 Finding New Disk Images

Disk images of classic Apple II, Macintosh, and Lisa software can be found at many sites on the internet. Two excellent sources of vintage Macintosh games and applications are <http://macintoshgarden.org> and <http://www.macfixer.com/vintage-software>. Apple has retired their old FTP server of vintage Macintosh operating systems, but a mirror is available at [asa.max1zzz.co.uk/English-North American/Macintosh/System](http://asa.max1zzz.co.uk/English-North%20American/Macintosh/System).

For Apple II software, two good sources are the ASIMOV Apple II collection at <http://mirrors.apple2.org.za/ftp.apple.asimov.net/> and the Apple II and IIGS categories at <http://macgui.com/downloads/>.

Lisa disk images are harder to find – Google is your friend.

If you insert the SD card into a modern OS X or Windows computer, you will see all the disk image files that are stored on the card. You can copy your newly-downloaded disk images to the SD card by dragging and dropping, just as you would to copy any other kind of regular file to a USB drive or other device. Once copied to the SD card, these disk images will be available for emulation for your vintage Apple computer.

8.2 Disk Image Types

Disk images must be in one of the formats that Floppy Emu can recognize:

Macintosh:

- raw format (typically with a .DSK filename extension),
- DiskCopy 4.2 format (typically with a .IMG or .IMAGE filename extension).

Some Macintosh disk images with the .IMAGE filename extension may be in the less common DiskCopy 6.3 format. These cannot be used directly with the Floppy Emu, but can be converted. See section 8.2.2 for details.

Stuffit files (.SIT filename extension) and self-extracting archives (.SEA filename extension) are not disk images, and can't be used in place of a disk image. When possible, search for a version of your desired software that comes as a disk image rather than as an archive. See the following section for further details about working with archives.

Apple II:

- .DSK, .DO, .PO, .NIB, or .2MG formats for 5.25 inch disk images
- .DSK, .DO, .PO, or .2MG formats for 3.5 inch disk images
- .PO, .HDV, or .2MG formats for Smartport hard disk images

Lisa:

- DiskCopy 4.2 format (typically with a .IMG or .IMAGE filename extension).

Disk images should also be of a kind and size that's supported by your vintage Apple computer. For example, an Apple IIc will be unable to use 800K 3.5 inch disk images, because the IIc is designed for 140K 5.25 inch disks. Similarly, a Macintosh Plus can use 400K and 800K disk images, but not high-density 1.44MB disk images.



8.2.1 Special Note for DiskCopy 4.2 Images

Disk image files in Disk Copy 4.2 format contain an embedded checksum value, used to help determine if the file is corrupted. When using Floppy Emu to write to an emulated disk with a DC42 image file, the image file on the SD card will be modified but the checksum will not be recalculated. Instead, the checksum value will be set to 0 to indicate that it was not calculated. This may cause other disk utility programs to report that the disk image file is corrupt.

[dc42cksm](#) is a Windows command line program that can view the checksums in a DC42 disk image file, and optionally update the checksums if they're not correct.

✿ 8.2.2 Special Note for DiskCopy 6.3 Images

Floppy Emu does not directly support the less common Disk Copy 6.3 format for Macintosh, because DC63 disk images have separate data and resource forks with no equivalent in the FAT32 filesystem of the SD card. DC63 images can be converted to raw disk images from the command line on a modern OSX Macintosh:

```
hdiutil convert myDC63disk.img -format DC42 -o myDC42disk.img
```

```
dd ibs=1 skip=84 if=myDC42disk.img of=myrawdisk.dsk
```

Step 1 uses hdiutil to convert the DC63 disk image into DC42 format. However, there is a bug in hdiutil's DC42 implementation, and the "size" bytes in the header are written in the wrong byte order. It will report an error "convert failed - corrupt image", but don't worry. Step 2 strips off the entire 84-byte DC42 header, resulting in a finished raw disk image.

If you're not sure if a disk image file is in Disk Copy 6.3 format, hdiutil can also tell you that:

```
hdiutil imageinfo mydisk.img
```

Disk Copy 6.3 disk images are most often encountered with Apple's own operating system disk images for System 7.5 and later.

8.3 Working with the Contents of Disk Images from a Modern PC

To a modern computer, Apple II and vintage Macintosh disk image files have no special meaning. Windows and OSX will show you the disk image file, and let you copy it, but the OS doesn't know anything about what the disk image file is used for or how to interpret its contents. That means if you have a disk image containing all the MacWrite word processing docs from your old doctoral thesis, Windows and OSX won't let you retrieve them or even see their names.

To dig inside the disk images, you will need a disk image utility program on your modern computer. Ironically, all the best disk image utility programs for classic Apple disk images run on Windows. [HFVExplorer](#) will enable you to open vintage Macintosh and Lisa disk images, view a list of the files inside, and move individual files in and out of the disk image to the Windows computer's disk. [CiderPress](#) will do the same for Apple II disk images.

If you don't have a Windows computer, the next best solution is a software program that emulates an entire Apple II or vintage Macintosh computer. [Virtual \]\[](#) is a Mac OSX-hosted Apple II emulator. [Mini vMac](#) is a cross-platform emulator of vintage Macintosh hardware (be sure to get the [ImportFI and ExportFI extras](#) too). These programs can load the disk image, and you'll run an entire emulated Apple II or Mac computer system where you can see and manipulate the contents of the disk image. To copy individual files in or out to the modern computer's disk, follow the instructions for Virtual][or Mini vMac.

✿ 8.3.1 Retrieving Old Files

Let's assume you have some precious documents on an old 3.5 or 5.25 inch floppy disk, and you want to copy them to a modern computer where they can be preserved safely. From the Floppy Emu's menu interface, you

should select a disk image of a blank/empty disk (HFVExplorer and Ciderpress will make one for you, if needed). Insert the original disk containing your documents into a second drive. Then use the normal file copying methods of your vintage Mac (drag and drop) or Apple II (ProDOS utilities or other copy program) to copy the documents from the original floppy to the Emu's blank disk image.

After the documents have been copied to the blank disk image on the Emu's SD card, put the SD card into a modern Mac OSX or Windows computer. Use one of the utility programs or emulators described in the previous section to open the disk image, and copy the documents out to the modern computer's disk.

If your documents are plain text files, or simple images like GIFs, then modern editor and viewer programs should have no trouble opening them. But for many other types of files, migration of the old documents to a modern computer doesn't guarantee that any modern software will know what to do with them. If the old document is a MacDraw 1.0 vector drawing, for example, it's unlikely that any modern software will be able to open it.

Where possible, use the original application that created the document on your Apple II or Mac to re-save it in a more generic format, like RTF for word processing docs, CSV for spreadsheets, and GIF or TIFF for images. If that's not possible, then you'll need to search the internet for a conversion tool specific to your file type.

✿ 8.3.2 Stuffit, HQX, and other Archives

Occasionally you may find some classic software that's distributed as a compressed file archive, rather than as a disk image. Most often these are Stuffit archives of Macintosh software, or BinHex HQX-encoded archives, but the same concepts apply to other archive types. Because they are not disk images, these files can't be used directly with the Floppy Emu.

File archives are a headache, and it's best to avoid them by searching for the same software in a different format. Software on Macintosh Garden is often available in several different forms: as a Stuffit archive, as a set of disk images, etc. Check the list of download links, and try to find one that's a disk image.

If an archive is the only option, do *not* try to decompress the archive directly on your modern computer. This will likely cause problems, due to differences between the filesystems of your modern computer and the vintage filesystem.

The most direct strategy is to use the Windows utility programs HFVExplorer (for Macintosh disk images) or Ciderpress (for Apple II disk images) to create a new blank disk image, copy the archive into it, and use Floppy Emu on your vintage computer to mount the disk image containing the archive. Then run an un-archiver program directly on your vintage computer to decompress it. While this method is conceptually simple, it's only practical for vintage computers with a hard drive (real or emulated), and when you have a Windows computer available.

The most flexible strategy is to use a software emulator to run an un-archiver program, decompress the archive, and create a new disk image that contains the contents of the archive. This disk image is then copied to your SD card, where it can be used with the Floppy Emu.

For Stuffit and HQX archives, use the Mini vMac emulator (and its ImportFI extension) to import the .SIT file, and store it on the hard drive of the virtual Macintosh Plus that Mini vMac simulates. Next, from within Mini vMac, mount a disk image containing Stuffit Expander (or the full Stuffit program), and then mount a second disk image of a blank disk. Run Stuffit Expander, and use it to decompress the Stuffit archive, storing the decompressed files

on the blank disk image. Then quit Mini vMac. The formerly-blank disk image can now be copied to your SD card and used with the Floppy Emu.

There are many different versions of Stuffit, but no simple way to tell which version was used to create a given .SIT file. If Stuffit complains that your .SIT file is not valid or can't be decompressed, it's likely that the .SIT file is in a newer format than the version of Stuffit that you're running. Try a newer version of Stuffit instead, but watch out. The newest versions of Stuffit won't run properly on the simulated Mac Plus of Mini vMac, and require a Macintosh II and/or newer version of System software. If you encounter one of these new-format Stuffit archives, you'll need a different Mac emulator like [Basilisk II](#) in order to run the version of Stuffit required to decompress it.



9. MACINTOSH USAGE

Macintosh floppy disk and HD20 hard disk emulation is provided by the alternate firmware *hd20-xxx-xxx* (exact filename depends on the firmware version number). Download and install this firmware, following the procedure described in the *readme.txt* file that accompanies the firmware. This firmware is compatible with all Macintosh models, but not all disk emulation modes are available on every model.



9.1 Floppy Disk Emulation for Macintosh

Floppy disk emulation supports 400K, 800K, and 1.4 MB floppy disks. The type of disk is automatically determined by the size of the disk image file that's selected. The disk image files can be in "raw" format, which typically has a .DSK filename extension, or DiskCopy 4.2 format, which typically has a .IMG or .IMAGE filename extension. Raw .DSK format images will provide somewhat better performance, and their use is preferred.

Use the PREV and NEXT buttons to navigate through the list of image files on the SD card. Press the SELECT button to choose an image to insert into the drive.

To eject a floppy disk and insert another, drag the disk's icon onto the trash can, or select "Eject" from the Finder's menu.

Avoid pressing the Emu's reset button while in floppy mode. The Macintosh won't recognize that the emulated floppy disk has been removed, causing it to become confused and behave incorrectly.

Macintosh floppy mode works with any classic Macintosh from the original Mac 128K to the Mac II and Power Macintosh series. The very oldest Mac models aren't designed to use 800K and 1.4MB disks, and will be limited to using 800K or 400K disk images.



9.2 Hard Disk Emulation for Macintosh

Hard disk emulation mode is compatible with the Mac 512K (requires HD20 Init), Mac 512Ke, Plus, SE, Classic, Classic II, Portable, IIci, IIsi, LC-I. The Mac 128K is also compatible if it has a 512K RAM expansion. Other Macintosh models are not compatible with this mode. In hard disk mode, the Floppy Emu emulates an HD20-compatible external hard drive – an Apple-brand hard drive from 1985 that predated SCSI and connected to the external floppy disk port.

To choose between 3.5 inch floppy and HD20 hard disk emulation modes, press the SELECT button while the Emu's version info is displayed on the LCD screen. See the previous sections on Firmware and Emulation Modes for details.

In hard disk mode, the Floppy Emu requires a disk image in “raw” format with a .dsk filename extension. For a suitable file, use an existing hard disk image file from a software-based Mac emulator like Mini vMac, or create an empty disk image by using a tool like *HFVExplorer*. Or download a prebuilt blank disk image from [Gryphel](#), which includes various size blanks up to 224 MB. Hard disk emulation supports Macintosh disk image files up to 2 GB.

The Mac 512K cannot boot directly from an HD20-compatible hard disk. Instead, you must first insert a floppy disk containing a System folder with Apple's [HD20 INIT](#). The computer will load the HD20 INIT, then switch over to the Floppy Emu hard drive and continue booting from there. The Mac 512Ke, Plus, SE, Classic, Classic II, Portable, IIci, IIsi, and LC-I have HD20 support built into ROM and do not require the HD20 INIT.

Accelerator add-ons for compact Macs like the Plus and SE appear to be incompatible with HD20 disks. It's not clear why, although some people have found success by disabling the instruction cache in their accelerator's control panel. For best results, it's recommended to disable or remove any accelerator from your compact Mac if you plan to use HD20 hard disk mode.



10. APPLE II USAGE

The Floppy Emu ships with Apple II compatible firmware pre-installed. You may wish to visit the Floppy Emu web site to see if a newer firmware version is available.

The Floppy Emu must be set to the desired emulation mode. To choose between 5.25 inch, 3.5 inch, and Smartport hard disk emulation, press the SELECT button while the Emu's version info is displayed on the LCD screen.

10.1 Boot Disk Requirements

If your Floppy Emu is drive 1 of its assigned slot, then the Apple II can boot from it. Apple II systems can't boot from drive 2 in any slot, although drive 2 can be used after the computer has already booted. This is a normal result of the Apple II's design, and is true for real disk drives as well as the Floppy Emu.

It may not always be obvious which slot the Floppy Emu is assigned to, or whether it's drive 1 or 2, depending on how it's connected to your Apple II. The slot and drive number can also change when the Emu's current emulation mode is changed, because different types of disks are auto-assigned to different slots by some Apple II models. If it's uncertain, use ProDOS file utilities to list all attached drives along with their slot and drive numbers.

If the Floppy Emu is running in 5.25 inch emulation mode and is connected to an Apple IIc, the internal 5.25 inch drive will be S6D1 and the Emu will be S6D2 and will not be bootable. Similarly, if the Emu is running in 3.5 inch emulation mode and is connected to an Apple IIc+, the internal 3.5 inch drive will be S5D1 and the Emu will be S5D2 and will not be bootable. Daisy chain configurations involving other external drives can also result in the Emu becoming a non-bootable drive 2.

Apple IIc Note: On the Apple IIc with ROM version 255, it's possible to boot from slot 6, drive 2 by typing PR#7 at the BASIC prompt. However, most software is hard-coded to expect loading from drive 1, and won't run correctly using this method, so the PR#7 trick has limited usefulness.

Many types of external drives can be connected in a daisy chain. The Apple II design requires 3.5 inch drives (if any) to be first in the chain, then Smartport drives (if any), and finally 5.25 inch drives (if any). This means the Floppy Emu may need to be moved to a different position in the chain, depending on its currently selected emulation mode.

When the Emu is part of a daisy chain, other disks ahead of it in the chain may be treated as drive 1 of its slot. The Apple IIc, IIc+, and IIgs will assign 5.25 inch drives to slot 6, and assign 3.5 inch and Smartport drives to slot 5.

To force the Floppy Emu to become drive 1 and make it bootable, you can:

- attach the Emu closer to the front of the daisy chain
- change its emulation mode, so it's different from the drives earlier in the chain
- connect it internally on the computer's logic board, in place of the original internal drive



10.2 5.25 Inch Disk Emulation for Apple II

5.25 inch disk mode supports 140K Apple II floppy disks, and is compatible with all models of Apple II computers. The disk image files can be in .DSK, .DO, .PO, .NIB, or .2MG formats. DSK, DO, and PO will provide somewhat better performance than .2MG, and their use is preferred. NIB image files will appear as locked read-only disks to the computer.

Use the PREV and NEXT buttons to navigate through the list of image files on the SD card. Press the SELECT button to choose an image to insert into the drive. After inserting a disk image, press NEXT to remove it and select a different one.

✿ 10.2.1 Copying 5.25 Inch Disks

To copy a 5.25 inch disk image from the Floppy Emu onto a real floppy disk, you can use any standard disk copy program such as Copy II+ or Locksmith.

To copy a real 5.25 inch floppy disk onto a Floppy Emu disk image, special attention is needed. Most disk copy programs perform a simultaneous format-and-write of the destination disk, which creates problems because Floppy Emu doesn't handle formatting the same way as a real disk drive. If possible, configure your disk copy program to disable formatting of the destination and to copy sectors one at a time.

An alternative is to use the venerable COPYA program on the DOS3.3 system master disk, after modifying line 250. Boot from DOS3.3 system master, then type:

```
LOAD COPYA
250 FT=1
RUN
```

You can then remove the DOS3.3 system master, and then follow the program prompts for disk copying. Use a blank DOS3.3 disk image on the Floppy Emu as the destination disk.



10.3 3.5 Inch Disk Emulation for Apple II

3.5 inch disk mode supports 800K Apple II floppy disks, and is compatible with the Apple IIgs and Apple IIc. Disk image files can be in .DSK, .DO, .PO, or .2MG formats. DSK, DO, and PO will provide somewhat better performance than .2MG, and their use is preferred.

Use the PREV and NEXT buttons to navigate through the list of image files on the SD card. Press the SELECT button to choose an image to insert into the drive.

The Apple IIgs will not wait for you to insert a 3.5 inch disk at startup. It will check only once for a suitable boot disk, and if none is found, it will display an error message and halt. Because it takes some seconds to select the desired disk image file from the Floppy Emu's menus, at startup the IIgs will give up and display an error message before you can select and insert a virtual disk. If this happens, reset the computer by pressing CTRL + Apple + RESET to force it to re-scan for a startup disk.



10.4 Smartport Hard Disk Emulation for Apple II

Smartport hard disk mode for Apple II can emulate up to four simultaneous Smartport hard drives. It is compatible with the Apple IIgs, the Apple IIc+, and the Apple IIc with ROM version 0 or later (anything other than ROM version 255). Check the IIc ROM revision by typing PRINT PEEK(64447) at the BASIC prompt. Smartport also works on the Apple II+ and IIe when using a Liron disk controller card.

Although the Smartport protocol supports drive sizes up to 8 GB, the maximum size of a ProDOS volume is 32 MB, which means Apple II hard disk images normally can't be any larger than this. On the Apple IIgs under GS/OS 6.0.1, however, it's possible to boot from a 32 MB ProDOS volume, and then mount additional HFS volumes. HFS

supports volume sizes up to 2 GB, and is the filesystem normally used on vintage Macintosh computers. Apple2Online has some [blank HFS disk images of various sizes](#) in their CFFA3000 area, which are perfect for Apple II usage.

The hard disk image files can be in .PO, .HDV, or .2MG formats. The four disk image files should be named SMART0.*, SMART1.*, SMART2.*, and SMART3.*, where * is either PO, HDV, or 2MG. If you have fewer than four disk images, number them beginning with 0 and don't use SMART3.



11. LISA USAGE

Lisa floppy disk emulation is provided by the alternate firmware *hd20-xxx-xxx* (exact filename depends on the firmware version number). Download and install this firmware, following the procedure described in the *readme.txt* file that accompanies the firmware. Lisa floppy mode works with the Lisa 2/5 and 2/10 for emulation of 400K and 800K floppy disks.

After installing the new firmware, the Floppy Emu must be set to Lisa Floppy mode. To set the emulation mode, press the SELECT button while the Emu's version info is displayed on the LCD screen.

Native Lisa floppy disk images should be stored on the SD card in Disk Copy 4.2 format, in order to preserve the sector tag bytes needed by the Lisa. Floppy Emu can also emulate Macintosh disks while the Lisa is running the MacWorks environment, using either DC42 disk images or raw disk images. Keep the Emu in "Lisa floppy" mode, even when operating under MacWorks.

Use the PREV and NEXT buttons to navigate through the list of image files on the SD card. Press the SELECT button to choose an image to insert into the drive. The Lisa OS handles disk ejection.

12. Error Messages

Disk image type is not supported in the current Emu mode

A variety of disk image types can be used with Floppy Emu, depending on which firmware is installed and what emulation mode is currently selected. You'll see the "image type is not supported" error if you choose a disk image that the Floppy Emu can't use with the present firmware and emulation mode. Often this is because you need to change the firmware or emulation mode to the ones appropriate for that type of disk image. This error may also appear if you chose a type of disk image that Floppy Emu doesn't know how to read. Some examples:

- You selected a Macintosh disk image, but the Emu has the Apple II firmware installed, or vice versa. See section 4 for instructions for installing the appropriate firmware.
- You selected a floppy disk image, but the Emu is set to hard disk emulation mode, or vice versa. See section 5 for instructions for changing the emulation mode.

- You selected a 5.25 inch Apple II disk image, but the Emu is set to 3.5 inch disk emulation mode, or vice versa. See section 5 for instructions for changing the emulation mode.
- You selected a DiskCopy 6.3 disk image. See section 8.2.2 for instructions for converting the image.
- You selected something that isn't a disk image, such as an archive or an individual file. See section 8.3.2 for instructions for working with archives.
- The Emu is set to hard disk emulation mode, but the selected disk image is smaller than 2 MB.
- The Emu is set to Macintosh hard disk emulation mode, but the selected disk image isn't in raw format with a .dsk filename extension. Use a disk image utility program to convert it.
- The Emu is set to Macintosh or Lisa floppy emulation mode, but the selected disk image is not a raw image precisely 400K, 800K, or 1440K, nor is it a DiskCopy 4.2 image of a disk less than or equal to 1440K size. Verify that the disk image is actually a floppy-sized image. If necessary, use a disk image utility program to convert it.
- The Emu is set to Apple II 5.25 inch emulation mode, but the selected disk image is not precisely 140K (for .po and .do images), nor is it 227.5K (232960 bytes, for .nib images), nor is it a .2mg image of a 140K disk. Verify that the disk image is actually a floppy-sized image. If necessary, use a disk image utility program to convert it.
- The Emu is set to Apple II 3.5 inch emulation mode, but the selected disk image is not a raw image precisely 800K, nor is it a .2mg image of an 800K disk, nor is it a DiskCopy 4.2 image of an 800K disk. Verify that the disk image is actually a floppy-sized image. If necessary, use a disk image utility program to convert it.

File not contiguous

For optimal performance with Floppy Emu, disk images must be stored on the SD card in a contiguous span of sectors. Normally this happens automatically, but if the SD card becomes fragmented, you may see this error message, and will need to defragment the SD card.

The easiest way to defragment the SD card is to insert it into a modern computer, copy everything from the SD card into a temp directory, delete all the files on the SD card (including any hidden files that may exist), and then copy everything back to the SD card. An alternative method is to reformat the SD card, or use a disk defragmenting utility program.

SD read error

SD write error

SD writestop fail

These errors indicate a problem transferring data between the SD card and the Floppy Emu's on-board microcontroller. Typically they appear intermittently, and if you simply try again, it will succeed.

The error may be caused by a flakey SD card, although this is rare. You can try substituting a different SD card to rule out this possibility.

Most often this error is caused by out-of-spec voltages, or electrical noise of some kind. Typically this is due to a degraded power supply or failing capacitors in a 20+ year old computer. It can also be caused by bad cables or connectors. On certain Macintosh models, the Bourns filters on the logic board can become degraded and cause trouble. To help find the cause, try using the Floppy Emu on a different computer and see if the error persists. Then try substituting parts one at a time to isolate the problematic hardware.

13. FAQ

Does this require a special driver or INIT?

No software is required for floppy emulation on any system. For Macintosh HD20 hard disk emulation, most supported Mac models require no software, though the Mac 512K requires Apple's HD20 Init.

Can I format the emulated disk?

Yes for hard disk emulation, no for floppy emulation. Floppy Emu emulates standard sector-by-sector floppy writing, as occurs with normal I/O operations such as copying files or saving data from within a program. Instead of formatting a blank disk, use one of the provided blank disk images.

Can I back-up old floppies using tools like Disk Copy 4.2 or Copy II Plus?

Yes, with some conditions. Many disk copy programs perform a simultaneous format-and-write of the destination floppy, which creates problems (see previous answer about formatting). For the Mac, direct floppy-to-floppy copies are possible using Copy II Mac with its "Sector Copy no Format" option. For Apple II, see the section titled Copying 5.25 Inch Disks.

Can the Emu work with copy-protected disks?

The hardware is designed to work with unprotected disks using standard sector and disk formats. Some copy-protection schemes may work, including some Apple II .NIB disk images, but this isn't a cracking tool.

Can I emulate multiple floppies at once?

Floppy Emu can store as many disk image files as your SD card will hold, but only one can be "inserted" in the drive at any given time.

Can I connect two Floppy Emus to the same computer?

Yes, if they are connected to separate disk ports. For the Apple II, a Floppy Emu board can also be placed at the end of a daisy chain of other disk drives. The Emu doesn't have a daisy-chain output port, and can't be daisy-chained on the Lisa or Macintosh.