



# Harmony

A new way to experience the Atari 2600.  
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Second printing

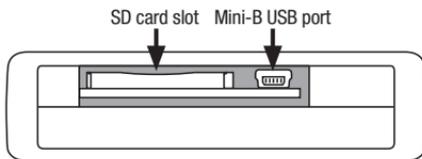
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# Introduction

The Harmony cartridge is a programmable add-on for the Atari 2600 console that allows you to load an entire library of games into a single cartridge and then select which title you want to play from a friendly, on-screen menu interface. It features an SD card interface, making it simple to access the large library of Atari 2600 software. The Harmony cartridge supports almost all of the titles that have been produced for the Atari 2600. It can also be used to run your own Atari 2600 game creations on a real console. The Harmony cartridge is flash-upgradeable, and will be updated to support future Atari 2600 developments.



Back edge of Harmony Cart

This guide tells you how to make the most of your Harmony cartridge. It should be read thoroughly before the cartridge is used for the first time. Your Harmony cartridge will provide you with many years of Atari 2600 enjoyment.

The following equipment is required to use the Harmony cartridge:

- 1) An Atari 2600, Atari 7800 or other Atari 2600-compatible console.
- 2) A Windows, Macintosh or Linux-based computer to transfer data onto the SD card.
- 3) An SD card adapter for your computer.
- 4) An SD or SDHC card up to 32GB capacity.
- 5) A Mini-B USB cable (only required for updating the Harmony firmware).

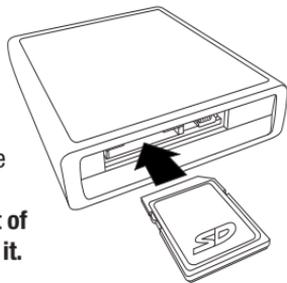
## Getting Started with Harmony

This section is a quick guide to using your Harmony cartridge. By following the steps below, you can use your Harmony cartridge to enjoy thousands of titles in the Atari 2600 software library:

- 1) **Connect an SD card to your computer.** This will normally require an SD card reader or adapter. Only SD (and SDHC) cards up to 32GB are supported. Older MMC cards and micro-SD cards (with an SD adapter) may not work reliably. A 1GB SD card is sufficient to hold every Atari 2600 title ever produced.



- 2) **Ensure that the SD card is FAT formatted** (FAT32 is best, but FAT16 or FAT12 will work). SD cards are normally supplied FAT formatted, but some new SD cards contain unnecessary files that may interfere with normal operation of Harmony, so it is best to start with a blank, freshly-formatted card. If you purchased a Deluxe Harmony cartridge, there is no need to format the included SD card as it is FAT32 formatted and ready to use.
- 3) **Locate the files that you want to copy onto the SD card.** These files should be raw Atari 2600 binary (.bin) files. Other file types (e.g. Supercharger .wav files) will need to be converted before they can be used. Binary files larger than 32KB, Supercharger multi-load files larger than 33KB, and Atari 5200 and 7800 files, will not work with the Harmony cartridge.
- 4) **Copy the Atari 2600 files that you want onto the SD card.** The Harmony cartridge supports file directories, so it is usually best to copy these files to your SD card in newly-created directories. The order the files are copied onto the SD card will be the order that they are displayed in the Harmony menu. On the Mac, it is necessary to copy and paste the files onto the SD card (rather than drag and drop) to preserve the file ordering. The Harmony menu will only display the first 24 characters of the filename (including the file extension). If the filename is longer, the full filename can still be displayed (see step 7) but will normally be truncated to 23 characters.
- 5) **The SD card can now be ejected from the computer system and placed into the Harmony cartridge.** This should be done before the Harmony cartridge is inserted into the console, or before the power is switched on. Note that the SD card slot on the Harmony is a push-push design - simply push gently and release to eject. **Never pull the SD card out of the Harmony cartridge without first pushing it in to eject it.**



- 6) **The Harmony cartridge with SD card inserted can now be inserted into the console, and the console powered on.** If everything is working, then you will see the menu system displayed on the screen after a few seconds. If weird patterns (garbage) appears on the screen, switch the console off, and then on again after a few seconds. If it fails to work after several attempts, try cleaning the cartridge edge connection.

- 7) **Navigate the menu system using a joystick in the left controller port.** Holding up or down on the joystick will move between menu entries, and holding left or right on the joystick will move between menu pages.



Use the fire button to open a directory (enclosed by [ ]), and to select a menu entry to be loaded. You can page faster by holding the fire button while moving the joystick left/right - this will skip forwards or backwards through the menu 10 pages at a time. You can display the full filename for a menu entry by holding down the fire button for more than a half second. The menu system can also be navigated with a paddle controller or driving controller in the left port. Sega Genesis controllers also work but are detected as paddles, but this detection may be circumvented by holding down button B. A similar method may also work for Sega Master System or Coleco Gemini controllers.

- 8) **Select an entry from the menu and it will be loaded and should start after a few seconds.** The Harmony cart will automatically detect the type of the file. If weird patterns (garbage) appears on the screen, this normally means that the Harmony could not detect the file type. It can also indicate a corrupt or invalid file. It is possible to tell the Harmony what type of file is used by changing the file extension (the valid file extensions are listed in a section at the end of this document). Once you are done, the console can be powered off and then on to return to the Harmony menu. There is no way to return to the menu from a game without cycling power on the console.
- 9) **The console should not be switched off while the Harmony cartridge is loading a file. Under certain circumstances, this could corrupt the Harmony firmware (requiring it to be reprogrammed).** Also, the SD card should not be ejected from the Harmony cartridge while the console is powered, or the contents of the card may become corrupted. It is safe to switch off the console when it is displaying the menu screen, or after a file has loaded. It is only safe to remove the Harmony cartridge from the console when it has been powered off.

## Harmony Firmware Upgrading

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Harmony cartridges ship with the latest firmware (internal software), but new versions of the Harmony firmware may be released to improve the compatibility of the cartridge and to fix any issues that are discovered. It is a good idea to make sure that your Harmony cartridge is always using the latest firmware release.

To check your firmware version, select the [.] entry on the first page of the Harmony menu, then visit the Harmony cartridge website at <http://harmony.atariage.com> to see if a newer version of firmware is available. If the firmware is current, there is no need to upgrade the firmware unless you are having trouble with your Harmony cartridge, either due to firmware corruption or use of firmware for an incompatible television format. Harmony cartridges ship with firmware for the NTSC television format as this usually works worldwide, but sometimes it may not.

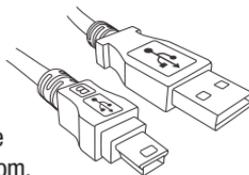
The Harmony firmware is too large to be loaded directly onto the Harmony cartridge. Therefore, a small loader program must first be downloaded onto the Harmony cartridge using a Mini-B

USB cable, and then the actual firmware will be loaded from an SD card. To simplify this process, a Harmony Programming Tool has been developed for Windows, Macintosh, and Linux-based computers.

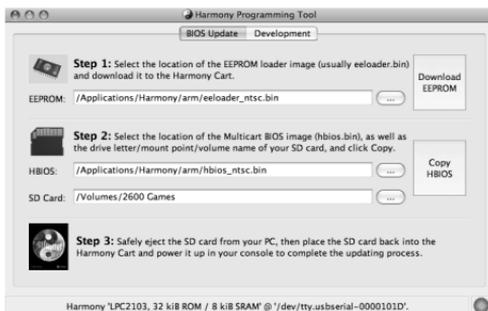


To upgrade the Harmony firmware using this tool, you should perform the following steps:

- 1) Download and install the latest version of the Harmony Programming Tool from <http://harmony.atariage.com>. Make sure that you download the correct version for your computer (Windows, Macintosh, or Linux).
- 2) Connect the Harmony Cartridge to your computer using a Mini-B USB cable. The Harmony cartridge should **not** be inserted into the Atari console at this point. Some operating systems may already have appropriate drivers to communicate with your Harmony cartridge, but if not, it may be necessary to install these drivers. These drivers may be found at <http://harmony.atariage.com>.
- 3) Insert an SD card into the SD card reader on your computer. Ensure that the SD card is FAT formatted, and can be accessed by your computer.
- 4) Start the Harmony Programming Tool. If everything is working correctly, a window should appear on the screen with a green light in the bottom right corner. If the window does not appear, or a red light is displayed, please consult the Frequently Asked Questions section at the end of this guide.



- 5) Make sure that the “BIOS Update” tab is selected inside the Harmony Programming Tool. The “Development” tab is provided for Homebrew game developers and is not covered in this guide.
- 6) The BIOS Update tab shows three steps that should be performed. These steps are described below:



**Step 1:** Select the EEPROM loader to download onto the Harmony cartridge. This is done by clicking on the EEPROM “...” button. You should select a loader that is suitable for your console (either NTSC, PAL50, or PAL60). If you are unsure, use the NTSC version (`eeloader_xxx_ntsc.bin`) if you are in Northern America, and the PAL50 version (`eeloader_xxx_pal50.bin`)

otherwise, where `xxx` is the firmware version. Once you have selected the correct version, click on the “Download EEPROM” button. The download to the Harmony cartridge should complete after a few seconds.

Step 2: Select the firmware image to be copied onto the SD card by clicking on the HBIOS “...” button. Your choice (NTSC, PAL50, or PAL60) should match your choice in Step 1. For example, if you used the `ee-loader_xxx_ntsc.bin` file in Step 1, you should select the `hbios_xxx_ntsc.bin` image here, where `xxx` is the firmware version. Once you have chosen the correct image, click on the SD Card “...” button and select the root directory of your SD card. Finally, click on the “Copy HBIOS” button and the firmware image will be copied onto the SD card.

Step 3: Close the Harmony Programming Tool and disconnect the Harmony cartridge from your computer by unplugging the USB cable. You should also safely eject the SD card from your computer (do not just pull it out of the SD card reader). Insert the SD card into the Harmony cartridge, and then insert the Harmony cartridge into your Atari console before turning on the power to the console. If everything has worked correctly you should see a spinning symbol on the screen, followed a few seconds later by a message saying that the BIOS update has been successful. If weird patterns (garbage) appear on the screen, turn off the console power for a few seconds and then back on again.

- 7) At this point the firmware in your Harmony cartridge should have been successfully updated. You can continue using your Harmony cartridge as normal until the next firmware update is available. If you encountered any problems upgrading the firmware, consult the Frequently Asked Questions section.

## Frequently Asked Questions

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### Q) I am having a problem with my Harmony Cartridge - where can I get help?

- A) <http://harmony.atariage.com> has a link to the Harmony cartridge forum on the AtariAge website. This is good place to ask questions about the Harmony cartridge. However, it is a good idea to check if your question has already been answered before posting a query.

### Q) Why are my files all jumbled up in the Harmony menu?

- A) The files are shown unsorted, in the order that they appear on the SD card. If you are using a Macintosh computer, make sure to use copy and paste, rather than simply dragging the files onto the SD card. There are also utilities (e.g. DriveSort) that can reorder the files on an SD card.

**Q) My Harmony cartridge just displays a spinning logo on the screen, and nothing else happens - what am I doing wrong?**

- A) This means that the SD card is not supported, or has not been properly FAT formatted. Try reformatting the card (make sure to backup the contents first). If this does not work, then you will need to use another SD card. Unfortunately, not all SD cards are created equally - there are many counterfeit branded cards out there, and many do not support the full SD card protocol.

**Q) My Harmony cartridge has stopped working - it used to work fine, but now it just shows weird patterns on the screen - what do I do?**

- A) Try cleaning the cartridge edge connector, and re-seating the cartridge. If this does not help then the firmware probably needs to be reprogrammed using the Mini-B USB port.

**Q) How do I clean the edge connector on my Harmony cartridge?**

- A) Open the cartridge dust flap by gently inserting a screwdriver into one of the holes on the bottom of the cartridge and pressing lightly on the flap. The contacts can be then be cleaned with a contact cleaning solution or rubbing alcohol, and a Q-tip. Conductive liquids, such as water, must never be used to clean the cartridge contacts.

**Q) Why does my computer say that the SD card is full, even though there appears to be plenty of free space on the card?**

- A) Your SD card is probably formatted with FAT12 or FAT16. You can solve this by reformatting your card as FAT32 (make sure to backup the contents first), or by splitting the contents into more sub-directories.

**Q) What games do not work with the Harmony cartridge?**

- A) All of the original Atari 2600 titles should work, apart from the 64KB MegaBoy cartridge. There are also some homebrew titles over 32KB that will not work, e.g. Stella's Stocking.

**Q) Why does a ROM that does not work with the Harmony cartridge, work fine with the Stella emulator?**

- A) If the ROM is over 32KB then it will not work. If it is 32KB or smaller, you can try forcing the file type by changing the file extension. The supported file types are listed at the end of this document. If the ROM still does not work, please let us know.

**Q) My Supercharger multiload game crashes after the first part - is there any way to make it work properly?**

- A) Supercharger multiloads are supported on the Harmony cartridge, but only if they are made into a single binary file. You need to join all of the separate parts together using a utility, or obtain a file that has already been joined together.

**Q) Why does my TV screen roll after loading certain games, or the picture appear in black and white?**

A) You are probably trying to play an NTSC game on a PAL console, or a PAL game on an NTSC console. Try to find a version of the game that matches your console type.

**Q) Will my Harmony cartridge be “bricked” (permanently damaged) if I switch it off during loading, or if a firmware update fails?**

A) The Harmony cartridge cannot be “bricked” as the firmware loader for the Harmony is permanently stored in ROM. If the Harmony firmware gets corrupted then it can simply be reprogrammed using the Mini-B USB port.

**Q) How do I check which version of the firmware is on my Harmony cartridge?**

A) The firmware version is displayed at the top of the “credits” screen on the Harmony cartridge. Simply start the Harmony cartridge with an SD card inserted and select the [.] entry on the first page.

**Q) Why can the Harmony Programming Tool not find my Harmony cartridge?**

A) You probably need to install the Virtual COM port drivers for the FT232R device available from: <http://www.ftdichip.com/Drivers/VCP.htm> You should reboot your computer after these drivers have been installed.

Also make sure you are using a proper Mini-B USB cable. Some cables are designed for power-only, such as those for USB speakers, lights, chargers, or other passive devices. Other cables might have a poor connection or sensitivity to RF interference, so it is best to use a quality cable with a ferrite bead attached.

**Q) How do I use the Harmony Programming Tool with Linux?**

A) The USB FTDI Single Port Serial Driver module (ftdi\_sio) needs to be loaded into your kernel. This module has been included with the Linux kernel since 2.4.30 (and all 2.6.x kernels). You should also make sure that the qt4 library (libqt4) has been installed from your Linux distribution.

**Q) Should I use the NTSC, PAL50, or PAL60 version of the firmware?**

A) The choice depends on the kind of Atari console that you have, and your TV set. If you are in an NTSC region (USA, Canada, Mexico, Japan, etc.) you should use the NTSC version. If you are in a PAL region (Europe, Africa, Russia, Australia, etc.) then you should use the PAL50 version. If you are in a PAL-M region such as Brazil, or in a PAL region but have a TV that can display a 60Hz picture, then you can try the PAL60 version. You can always update the firmware to a different version if necessary. If you select the wrong version, the colors in the Harmony menu will be wrong, and the TV picture may “roll” on the screen.

**Q) What if my Harmony cartridge starts acting weirdly after upgrading the firmware?**

A) If your Harmony cartridge does not work properly after the firmware upgrade then you should repeat the upgrade process. If it still does not work, then you should ensure you are installing a compatible firmware image. Some Harmony carts will not work properly with firmware versions before v1.03. If you are sure that you are installing a compatible firmware version, and it still does not work, consult the AtariAge forums for known issues.

**Q) When I connect my Harmony Cartridge to my computer, why doesn't it appear as a drive letter or volume like my camera or MP3 player?**

A) The Harmony Cartridge is not designed to do that. The USB port on the Harmony is intended for firmware upgrades or game development only. Use a separate card reader to manage the contents of your SD card.

**Q) The Harmony menu is very difficult to read on my TV set - how can I fix it?**

A) The Harmony menu is optimized for CRT TVs and may not display perfectly on newer LCD TVs. You may find the picture is clearer if you disable color cycling (set the Color/B&W switch to Color). It is also important to properly calibrate your TV so that darker colors are clearly visible. There are a number of home theater calibration DVDs and Blu-Ray discs that can help with this. Lastly, installing a video mod into your Atari console that provides composite or S-video output may display a clearer picture.

## Harmony File Extensions

The Harmony cartridge supports many different types of Atari 2600 software. The type of the software is automatically detected when the file is loaded. However, this auto-detection process can sometimes fail, resulting in weird patterns (garbage) being displayed on the screen. This is completely harmless, but can often be avoided by telling the Harmony cartridge explicitly what is the type of the file. In technical terms, the type of the file is the kind of bankswitching that was originally used by the cartridge.

It is possible to tell the Harmony cartridge directly what type of file is used by renaming the file extension. Atari 2600 software normally has a binary (.bin) file extension. This extension can be changed to one of the following to tell the Harmony what kind of bankswitching to use:

Extension	Bankswitch type
.2K	Atari 2K
.4K	Atari 4K (default)
.F8	Atari F8

Extension	Bankswitch type
.F8S	Atari F8 with Superchip
.F6	Atari F6
.F6S	Atari F6 with Superchip

Extension	Bankswitch type
.F4	Atari F4
.F4S	Atari F4 with Superchip
.FA	CBS RAM +
.FE	Activision FE
.3F	Tigervision 3F
.3E	3E (3F with up to 4K RAM)
.E0	Parker Brothers E0

Extension	Bankswitch type
.E7	M-Network E7
.CV	CommaVid
.UA	UA Limited
.AR	Arcadia Supercharger
.DPC	DPC (Pitfall 2)
.084	0840 Econobanking
.CU	Custom *

For example, to tell the Harmony cartridge to use F4 bankswitching with Superchip support you would rename the file `cavein.bin` to `cavein.f4s` (the extension is not case-sensitive).

\* Custom bankswitching is not a specific format but rather a stub that allows new bankswitching schemes to be added to the .bin files themselves, so future BIOS updates are not necessary to support them.

## Harmony Cartridge Technical Specifications

Processor:	NXP 70MHz ARM7TDMI-S microcontroller
Memory:	8KB SRAM, 32KB Flash, and 512KB EEPROM
SD Card Interface:	7MHz SPI bus controller
USB:	FTD232 serial interface
Filesystems supported:	FAT32/16/12 with Windows Long Filenames (LFN)
Bankswitching types supported:	2K, 4K, F8, F8SC, F6, F6SC, F4, F4SC, FA, FE, 3E, 3F, E0, E7, CV, UA, Supercharger, DPC, 0840, Custom

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