VidHD

HDMI Video for the Apple II

REQUIREMENTS

- 1080p 60Hz or 50Hz HD Display or TV with at least 1920 horizontal resolution, and an HDMI cable.
  (VidHD draws 1920 horizontal pixels and will not work with displays smaller than 1080p such as 640p, 720p, or 768p. VidHD is also compatible with larger 1200p, 1440p, 1600p, and 2160p TVs and monitors that support 1920x1080 or 1920x1200 resolution.)

- Apple II, II Plus, IIe, or IIGS computer.

FEATURES

- The VidHD card is unlike other video options for the Apple II because its all-digital HDMI 1080p output is upscaled directly from the byte values written into the Apple's video memory. Because VidHD is all-digital, it does not suffer the noise/crawl of analog converter boxes, or the color variance of VGA converters. VidHD has better clarity and color accuracy than composite, SCART, or even the original Apple IIGS RGB monitor.

- VidHD video modes (NTSC/PAL, IIGS RGB, HDTV, HDTV black & white) are available on all Apple II models. For example, IIGS 640x200 256-color Super Hi-Res can now be enabled on an Apple II, II Plus, and IIe.

- On the IIGS, VidHD can generate Hi-Res colors and NTSC artifact colors that were used in 8-bit Apple II games. Or, VidHD can be set to "IIGS" mode to use the GS's altered color palette as shown on the IIGS RGB monitor. When the GS is running at 1MHz, VidHD also correctly generates Page 2 Lo-Res and Text modes, correcting an Apple compatibility bug in the IIGS.

- Firmware is user-upgradeable via the microSD card slot.

- Future expansion options include 8x 5 volt GPIO pins, 8x 3.3 volt GPIO pins, a USB2 connector, and a Wi-Fi/Bluetooth antenna.
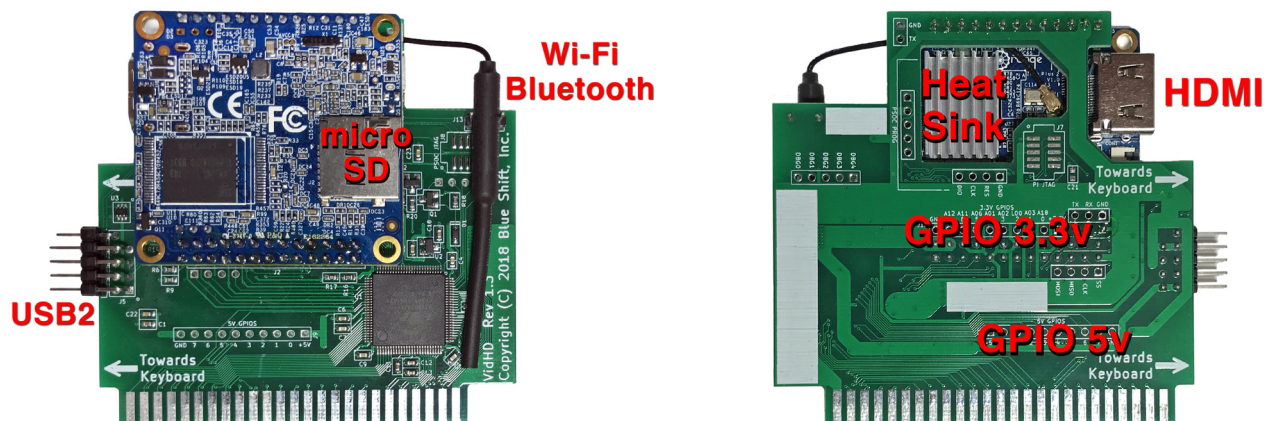
INSTALLATION

Display Settings

Verify your HD Display / TV is set to "Game Mode" if supported. Otherwise, fast-animating Apple II games will look blurry. The aspect ratio should be set to "Full-Screen" 16:9, not 4:3.

Slot Choice

|	
All Models:	Slot 3 is preferred
II, II Plus, IIe:	Slots 1 to 7 are compatible
IIGS (ROM0, ROM1):	Slot 3 is required
IIGS (ROM3):	Slots 1 to 6 are compatible

Card Orientation

HDMI cables are bulky, so the VidHD's HDMI connector must point toward the front / keyboard of your Apple II, as indicated by the "Towards Keyboard" arrows on the card.

HDMI Cable Routing

Most HDMI cables will fit through one of the circular cutouts behind Slot 2. If your HDMI cable is too wide to fit through the Slot 2 circular cutout, you can:

1. Use a "Panel Mount" Male to Female HDMI extension cable. On the IIe and IIGS, using the cutouts near Slot 1 or Slot 7 can allow the extension cable to route around and avoid blocking cards. The best fit for the circular cutout is the 1-foot cable from AyaGroup.com. Additional choices are at CableLeader.com and eBay.com.

2. Leave off the Apple II cover.

3. Use a thin mini-HDMI cable and an HDMI converter/adapter.
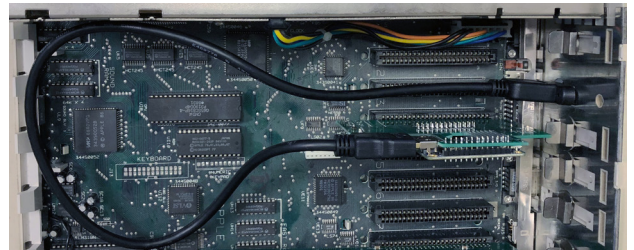
Power Up Sequence

Once the VidHD card is installed and connected to your 1080p display:

1. Turn on the Display first
2. Turn on your Apple II last

A few seconds after powering on your Apple II, the VidHD video daughtercard will start up, lighting a green and red LED near the SD card slot. The display will briefly show a blinking underscore at the top left of the screen. After about six seconds from power-on, your HDMI display shows the Apple II video output, indicating VidHD startup is complete. You can now use your Apple II.

On the Apple II and II Plus, VidHD pauses the computer until the display is ready, typically about six seconds. If no display is connected to VidHD, they remain paused until an HDMI cable is plugged into VidHD.

On the Apple IIe and IIGS, some storage devices may freeze during VidHD startup, requiring a `Ctrl-Reset` reboot. This can be avoided by holding `Ctrl-Reset` for about six seconds while powering on your Apple.

CONTROL PANEL

To change settings, access the VidHD
Control Panel by pressing:

Apple IIe, IIGS:	`Control-6`
Apple II, II Plus:	`Control-Shift-N`
Select:	`Up/Down Arrows`
	`A/Z` (for II, II Plus)
Change Setting:	`Left/Right Arrows`
Save Changes:	`RETURN`
Cancel:	`ESC`
Multiple ViDHDs:	`-ID=00000000`
controlled by:	`$C06E register`

```
┌VidHD Display: enh IIe Slot 3 ▬┐
│                                │
│ ✓ Monochrome: No               │
│ ✓ Video Mode: HDTV             │
│ ✓ Text Columns: 40             │
│ ✓ Show Scan-lines: Light       │
│                                │
│   -Screen Colors-              │
│ ✓ Text: White                  │
│ ✓ Background: Black             │
│ ✓ Border: Black                │
│ ✓ Wide Borders: Yes            │
│                                │
│   -International-              │
│ ✓ Language: U.S.A.   #@[\]`{|}~ │
│ ✓ Rate: 60 Hertz               │
│                                │
│ ✓ Standards: Yes               │
│                                │
│   -ID=00000000 v1.15 15-Feb-2019- │
│ Select:← → ↓Z ↑A  Cancel:Esc  Save:↵ │
└────────────────────────────────┘
```

Defaults are indicated by ✓. VidHD keeps its Control Panel settings only for the current session as the current firmware does not save settings to non-volatile memory. Retaining settings across power-off is a forthcoming feature. Currently, accessing the VidHD Control Panel will only work if the Apple CPU is periodically reading the keyboard.

BASIC receives the `Control-6` in addition to VidHD, so pressing `RETURN` in BASIC after using the Control Panel will result in a "`Syntax Error`". If you press `Control-6` from *Bitsy-Bye*, the IIGS Control Panel, or a program that ignores `Control-6` (most programs), then entering the VidHD Control Panel will not generate that error. After leaving the Control Panel from BASIC, it's a good idea to press `Control-X` so BASIC ignores the initial `Control-6` character in the keyboard buffer.

VidHD Display

Shows your Apple II model and slot number where VidHD is installed.

Monochrome

Choose whether to force monochrome mode when displaying Hi-Res or Double Hi-Res graphics.

    `No`   `Hi-Res and DHGR`   `Double High-Res (DHGR)`

Video Mode

Graphics are displayed using one of four color modes:

`HDTV:`	A hybrid color mode that combines the appearance of Super Hi-Res graphics on an RGB monitor and non-Super Hi-Res graphics displayed on a composite monitor with most of the NTSC artifacts removed.
`HDTV Black & White:`	Grayscale like a crisp black and white CRT TV.
`NTSC/PAL:`	Models the appearance of graphics generated by an Apple II or IIe when displayed on a composite video monitor.
`IIGS:`	Models the appearance of graphics generated by an Apple IIGS when displayed on an RGB video monitor.

Text Columns

Choose between standard 40-column and 80-column text. High-resolution text modes with more columns and lines use an entire 1920x1080 display with a 16x9 aspect ratio.

```
40    80    80x45    120x67    240x135
```

VidHD's text firmware can be activated by typing "`PR#<slot>`". If VidHD is in Slot 3 of a IIe or IIGS, you may need to type "`POKE 49163,0`" first to disable the Apple's 80-column firmware. Once VidHD's text firmware is active, you can change resolutions:

`<ESC> 4`	40x24
`<ESC> 8`	80x24
`<ESC> 1`	80x45
`<ESC> 2`	120x67
`<ESC> 3`	240x135
`<ESC> Ctrl-Q`	Exit to Apple 40-column mode

Show Scan-Lines

How to display the separation of individual Apple II scan lines.

```
Light     Medium     Dark     No
```

–Screen Colors–   Text, Background, Border, Wide Borders

Select Text, Background and Border colors for text graphics modes, along with Wide Border options. The color selection also works on the Apple II and Apple IIe, even though those Apple II models don't normally allow color options for text modes. Text color choices are:

White	Green P31 Monitor II	Amber P3	Deep Red	Dark Blue
Purple	Dark Green	Dark Gray	Medium Blue	Light Blue
Brown	Orange	Light Gray	Pink	Light Green
Yellow	Aquamarine			

`Language:`	U.S.A., U.K., French, Danish, Spanish, Italian, German, Swedish
`Rate:`	60 or 50 Hertz

Standards

`Yes:`	Default ✓ settings
`No:`	Indicates a setting has been customized

ID

The unique identification number and firmware revision of your VidHD card.

ACCELERATORS AND DMA

CPU accelerators which plug into the CPU socket, such as Zip Chip, Zip GS and Transwarp GS should be 100% compatible with VidHD and DMA (Direct Memory Access).

The FastCHIP IIe and TransWarp IIe don't let other cards perform DMA which impacts the VidHD and RamFAST SCSI cards, among others. If those accelerators are running, VidHD is prevented from reading the current video modes and screen contents at startup, though VidHD's normal 1080p display will still work fine. For such accelerators, the following DMA-based VidHD features are automatically disabled at boot:

1. Auto-detect at startup of the VidHD slot, Apple II display mode and screen contents
2. VidHD firmware
3. Sync to Apple II video beam position at startup
4. Pausing the CPU while in VidHD's Control Panel screen

VidHD has support for DMA In and DMA Out pins for improved compatibility with other DMA interface cards. As long as DMA is not locked out by another interface card, VidHD will auto-detect the Apple II model and sync to the video beam position. This beam position feature is only noticeable for race-the-beam graphics demos from French Touch and others. When VidHD's Slot 3 firmware is enabled, VidHD uses DMA to greatly speed-up calls to `$C311 AUX_MOVE` and `$C314 AUX_XFER`.

If you have a FastCHIP IIe and press ESC at power-on to access the configuration screen, it will display before VidHD has started up and not be visible. To delay the FastCHIP IIe configuration screen, hold `Ctrl-Reset` down for seven seconds after turning on your Apple IIe, then release `Reset` and quickly press `ESC`.

FLOPPY DISK PRECAUTIONS:
Power Up and Menu Access During Disk Write

1. Do not have an unprotected disk in your 5.25" drive during power up, or data loss can result.
2. Avoid accessing the VidHD Control Panel during disk writes, or data loss can result.

Most users do not encounter the first problem as they boot to a menu, or boot from a hard drive or other mass storage in the first six seconds, so the 5.25" floppy drive is not active during the VidHD DMA. If the boot disk is write-protected, the startup DMA may cause an I/O error, but it will not write to the floppy disk.

If booting an unprotected floppy disk, workarounds include:

1. Press `Ctrl-Reset` at startup to turn off the drive, or
2. Hold `Ctrl-Reset` for six seconds while powering on the Apple II
   (delaying floppy boot until after VidHD DMA).

Technical Background:

VidHD's bus chip scans the slots about six seconds after power up, when the video daughtercard is DMA'ing the contents of VRAM. If a 5.25" drive is spinning at that time, the slot scan inadvertently enables writing – damaging the current track.

If VidHD starts up, or the VidHD Control Panel is entered, while the 6502 is writing a sector to a disk, the effect of DMA pausing the 6502 results in the current track being overwritten. CPU timing is critical for floppy writes, and DMA (Direct Memory Access) interferes with that timing. The problem is in VidHD's bus bridge chip and/or inherent in doing DMA independently of the 6502 CPU (i.e. while the 6502 is doing critically-timed floppy access), so it is unfortunately not patchable with a VidHD firmware update.

In these two situations, it may be possible for data loss to occur on an Apple IIGS with a 3.5" drive, but no problems have been reported to Blue Shift Inc.

DISPLAY REGISTERS

VidHD enables many IIGS display registers on the Apple II, II Plus, and IIe:

```
$C000-$C005: Controls whether bytes are written into VidHD's main or aux video memory
$C00C/D:     Clear/Set 80-column video mode (new for II, II Plus)
$C00E/F:     Clear/Set MouseText characters (new for II, II Plus)
$C021:       Monochrome display mode
$C022:       Text Foreground/Background Color
$C029:       SHR display modes and DHGR Monochrome mode
$C02B:       Language select and 50/60 Hz control
$C034:       Border Color
$C05E/F:     Annunciator 3 controls Double Lo-Res and Double Hi-Res
$C068:       Controls Page 1 & 2 display and Main/Aux video memory write enable
$C06E:       Pause VidHD in Slots 1-7. One bit per slot with bit 0 always set
```

FIRMWARE UPDATES

Firmware will be updated over time as bugs are fixed and new features are added. The process requires a microSD card between 256MB and 32GB for storing the 128MB firmware image. Once you have downloaded the latest firmware:

1. Unzip the file on a Mac, PC, or Linux.

2. Write the resulting ".img" file to your microSD card using your preferred imager, or *Etcher* available at: https://www.balena.io/etcher

3. Power off your Apple II.

4. Insert your microSD card into the VidHD.

5. Power on your Apple II.

The firmware will be installed onto the VidHD card if it is a different version from what was previously installed. About 10 seconds later the display will come on. You can check the VidHD Control Panel to verify the firmware version and expected revision date.

Then power off your Apple II and remove the microSD card to run VidHD off the internal flash memory, or leave the microSD card inserted and run from it since microSD boots slightly faster.

FIRMWARE HISTORY

1.15   Feb 15, 2019

1. Fixed sync on 1440p, 1600p, and 2160p displays as long as they also support 1920x1080 or 1920x1200. Displays smaller than 1920 horizontal resolution *will not work* with firmware 1.15.

2. OS fixes: Linux 4.20.8 and uBoot 2019.01 loader.

3. MouseText: fixes incorrect inverse-checkmark font.

4. Fixed a bug which caused `Ctrl-Reset` on PAL machines to incorrectly switch VidHD to 60 Hz mode.

5. VidHD PASCAL extended text firmware:
   a. CR now stays on the same line (does not include LF)
   b. `Ctrl-_` now correctly moves up one line (also fixed in BASIC)

6. Improved BASIC text firmware:
   a. `ESC A,B,C,D` are now supported.
   b. Fixed a bug where the VidHD mistakenly thought `HOME` was called and incorrectly cleared the screen.
   c. Turning off 80-column hardware at `$C00C` now exits VidHD text firmware.
   d. PR#3 now does `POKE 33,40` to prevent `HOME` from corrupting BASIC at `$8xx`.
   e. Fixed a few bugs turning MouseText on and off via control characters.

1.14   Jan 23, 2019 – First Release

CREDITS

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