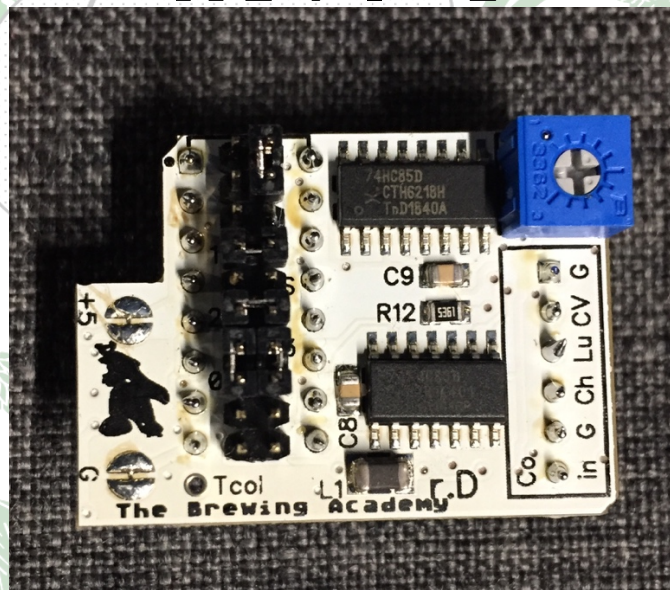


The Brewing Academy

presents

Bryan's
**Ultimate
Atari
Video**
Rev. D



Instruction Manual

Revision 1.4

11 July 2019

Video upgrade for Atari 800/XL/XE (A8), Atari
2600/5200/7800 and stock video equipment for
the 1088XEL & 1088XLD

Introduction:

Folks, in 2016, Bryan Edewaard created the Ultimate Atari Video board. It brought much sharper colors and pictures to Atari machines everywhere. In late 2016, he updated the UAV to revision D. It was a runaway hit. It got installed into just about every Atari console and 8-bit home computer known to humankind. It even got built into the 1088XEL and XLD computers invented by MyTekControls and produced by The Brewing Academy. In early 2019, Bryan agreed to sell the rights to the UAV rev. D. to The Brewing Academy and we started producing it for sale. This manual is a **beginning** at a collection of all of installation materials created by Bryan and many other AtariAge users over the years on how to install a UAV into an Atari 400/800/XL/XE/XEL/XLD machine (shortened hereafter as "A8 machines") or Atari 2600s, 5200s, & 7800s!

If you see an error, know of something that should be included or of a link that would be helpful, feel free to drop us a line at macrorie@thebrewingacademy.com or "PM" MacRorie via AtariAge. Enjoy!

Quick Start

We know there's a million upgrades out there, but the good ones are mostly based on tweaks to the original Atari circuit, and the bad ones are haphazardly designed.

1st, the real problems with the Atari circuit(s): The video circuits in most A8s are not sufficiently decoupled from the digital noise in the system. Video power and ground are often shared with very noisy components like DRAM and this causes vertical bars to appear in the picture. For example, you can often see the refresh cycles on the left side of the screen. Crude DACs like the one made from the CD4050 have no ability to reject power supply noise and will superimpose it on the picture. No tweaking of the video buffers will remove it. Atari actually put components in some XLs to blur the image in an attempt to clear up the lines.

That's not to say the buffers didn't need tweaking. They frequently deviated from the 75-ohm impedance standard that that meant the picture quality could be unreliable (shadows, smearing & ghosting), especially with longer cables. At video speeds, you only get maximum transfer when everything is the right impedance. In addition, some of the chroma circuits produced highly distorted sine-waves which contributed to noise in the image.

So, to solve these problems, The Ultimate Atari Video board:

1. Has an on-board regulator to create a clean video power source.
2. Has a 3-channel video amplifier designed for 75 ohm loads.
3. Has a pixel re-clocking circuit to remove skew and better align the 4 luminance signals into a perfect pixel edge.
4. Has a carefully designed chroma-shaping circuit which allows a ~40-45ns shift in the relative Chroma/Luma phase.
5. All inputs now have current limiting resistors. This reduced noise slightly and makes the board a bit more goof-proof.
6. The NCS2563 amp is intended for high-def purposes and doesn't have the 8MHz NTSC filter. All filtering is now done on the board and it looks a bit better. In our opinion, the composite output now approaches the look of S-Video on a good monitor.
7. There is a spare pad on the board for attaching the TIA input on the 7800 (Tcol).

In addition, there's an adjustable pot on the board which controls the phase between the chroma and luma signals. A nice side-effect of this that you can change the artifact colors. There's also a jumper to invert the chroma which swaps the positions of the artifact colors. The board plugs into the CD4050 socket for easy installation on most machines. It can be used in place of the original circuit or alongside it.

To use the UAV:

The UAV comes in three flavors:

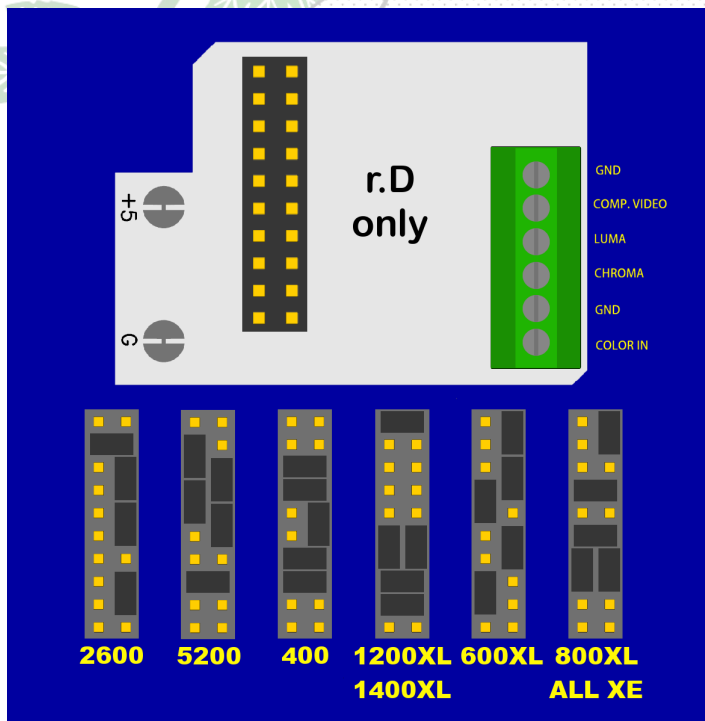
Plug-in: Jumpers are pre-configured with all headers and pins soldered in place. A socket is included for you to either solder on top of the existing CD4050 ****OR**** desolder the CD4050 and replace it with the socket. A wire for video input is included. There are plug-in versions for the A8, XLD, XEL, 2600, & 5200.

Basic: This is a board where you provide all of the wiring. Some wire is provided as well as a manual..

Kit: All headers are provided, but not soldered in place. Socket & wire is included. Jumpers provided, but not installed.

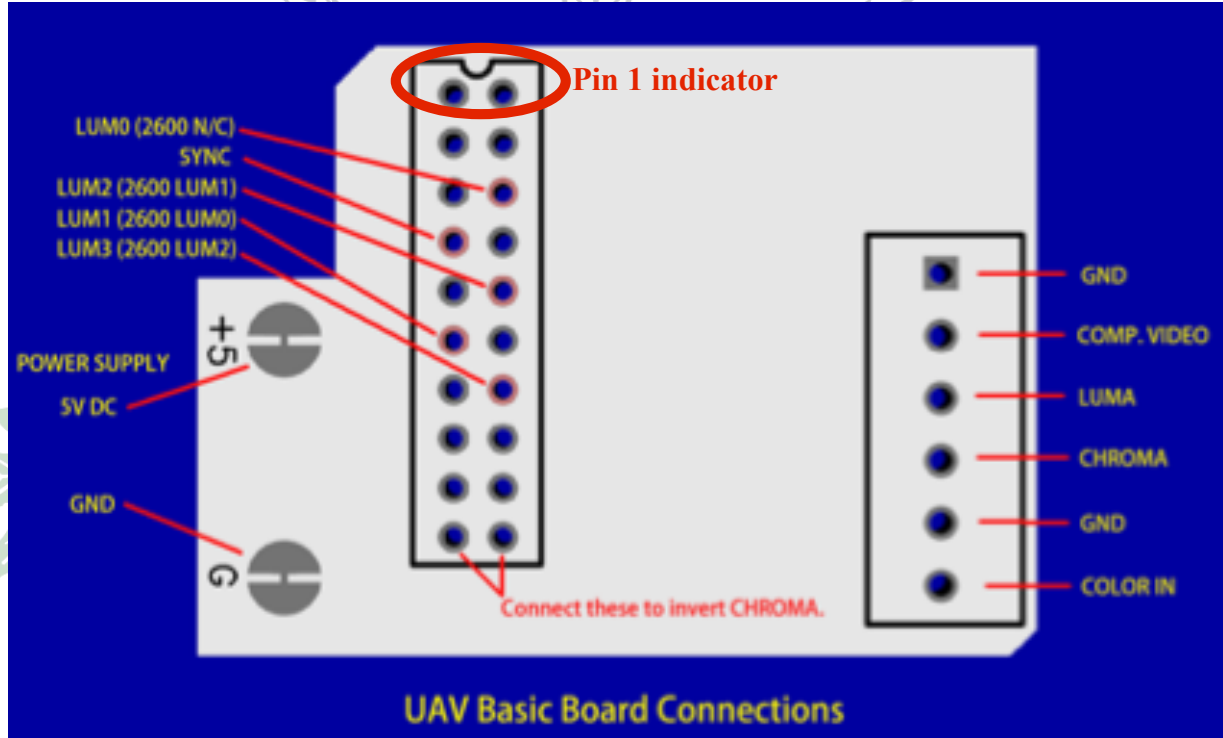
Installation will vary according to the flavor of UAV you purchased and the machine you are installing it in. We have tried to provide pictures and instructions, but your situation may vary. **REMEMBER:** UAV is static-sensitive (as are all electronics) and should be handled with care. If you have questions, please feel free to email @ macrorie@thebrewingacademy.com

Jumper Settings

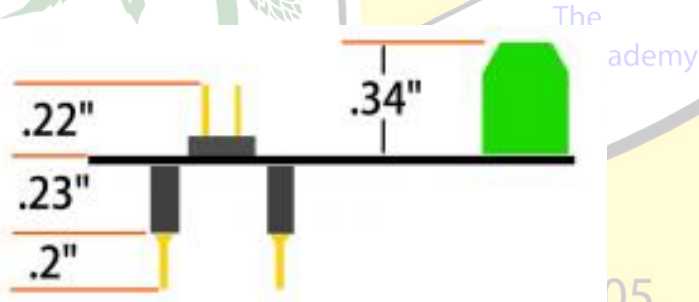


UAV Board Specifications

PLEASE NOTE ORIENTATION for insertion into socket! The Pin 1 indicator should align with the same indicator on the machine you are installing



Rev. C Look @ Board silkscreen for D a

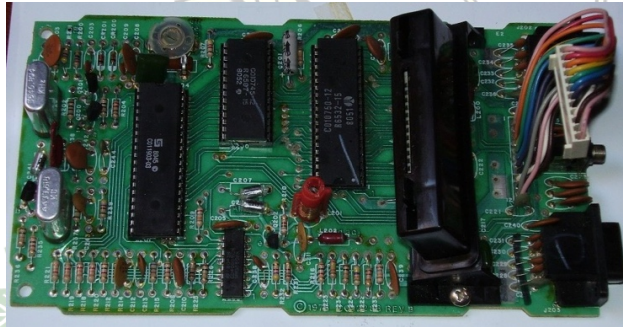


UAV installation:

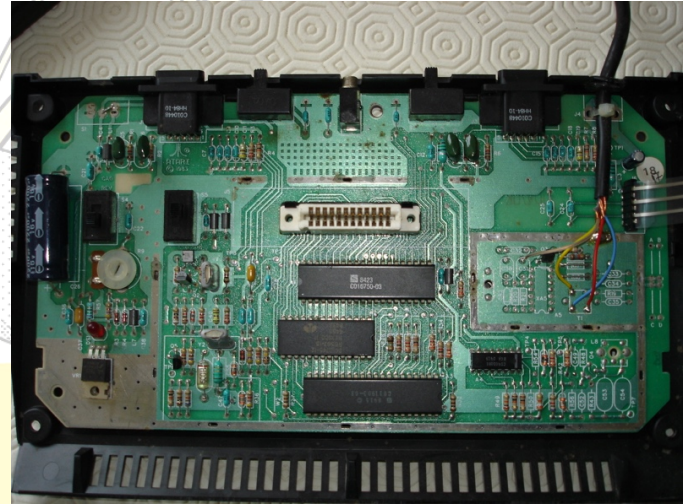
2600 installation

Some quick notes about 2600s...

If you have this sixer board:



or this 2600 Jr. board:



...you should be able to use the plug-in board.

4-switch units typically eliminate the CD4050. I had to lift the chroma mixing cap in my 4-switch because the heavy load on this signal distorted the signal too much (UAV needs chroma as a decent looking square wave). I'm sure there's a way to preserve the RF signal though, even if we just send UAV's output into the modulator.

For reference, here's the typical 4-switch board:



Some rev's of the 2600 have saturation boosting circuits and some don't. The saturation boosting circuit causes problems but it can be modified or disabled. If your 2600 has a trace from pin 6 to a 820 ohm resistor, you have the saturation boost. This circuit reduces the level of the colorburst so the TV sets the color gain higher. It also makes the color waveform too distorted for UAV. Lifting pin 6 (if TIA is socketed) or one end of the resistor will eliminate the problem.

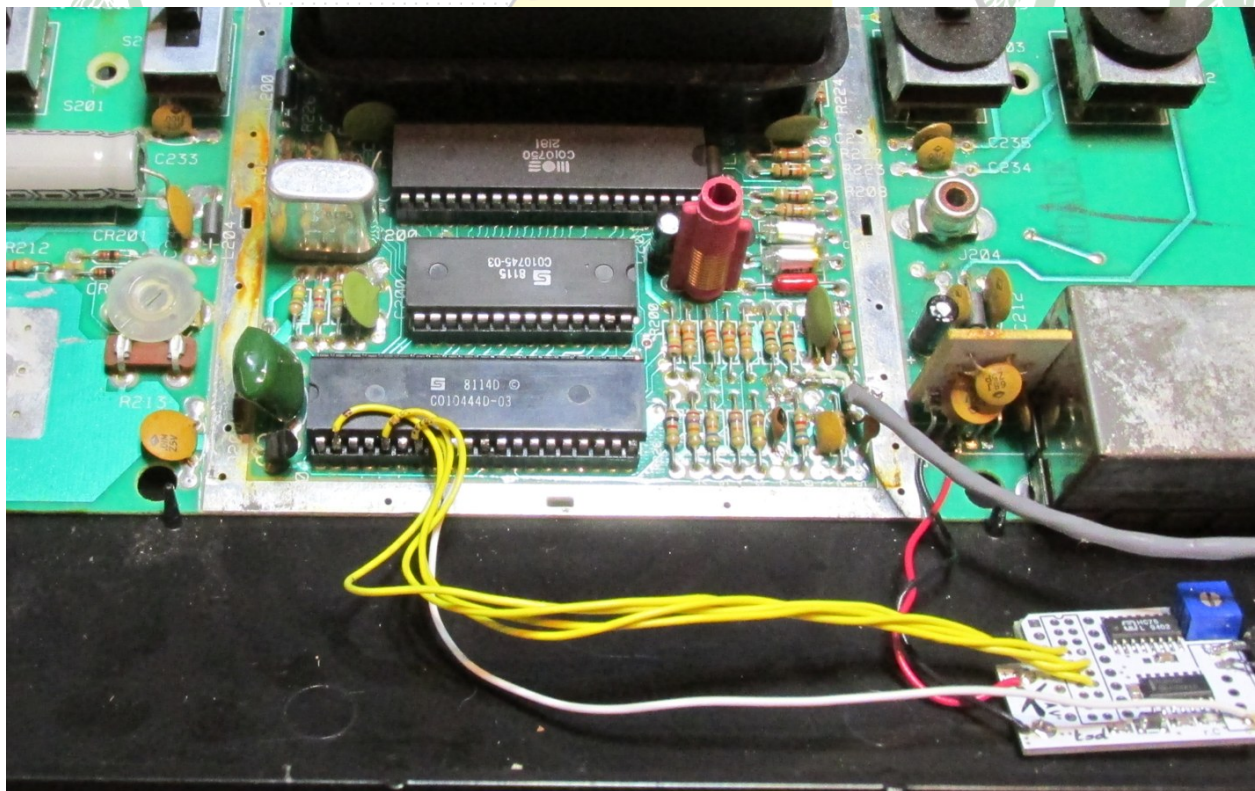
Saturation boost:

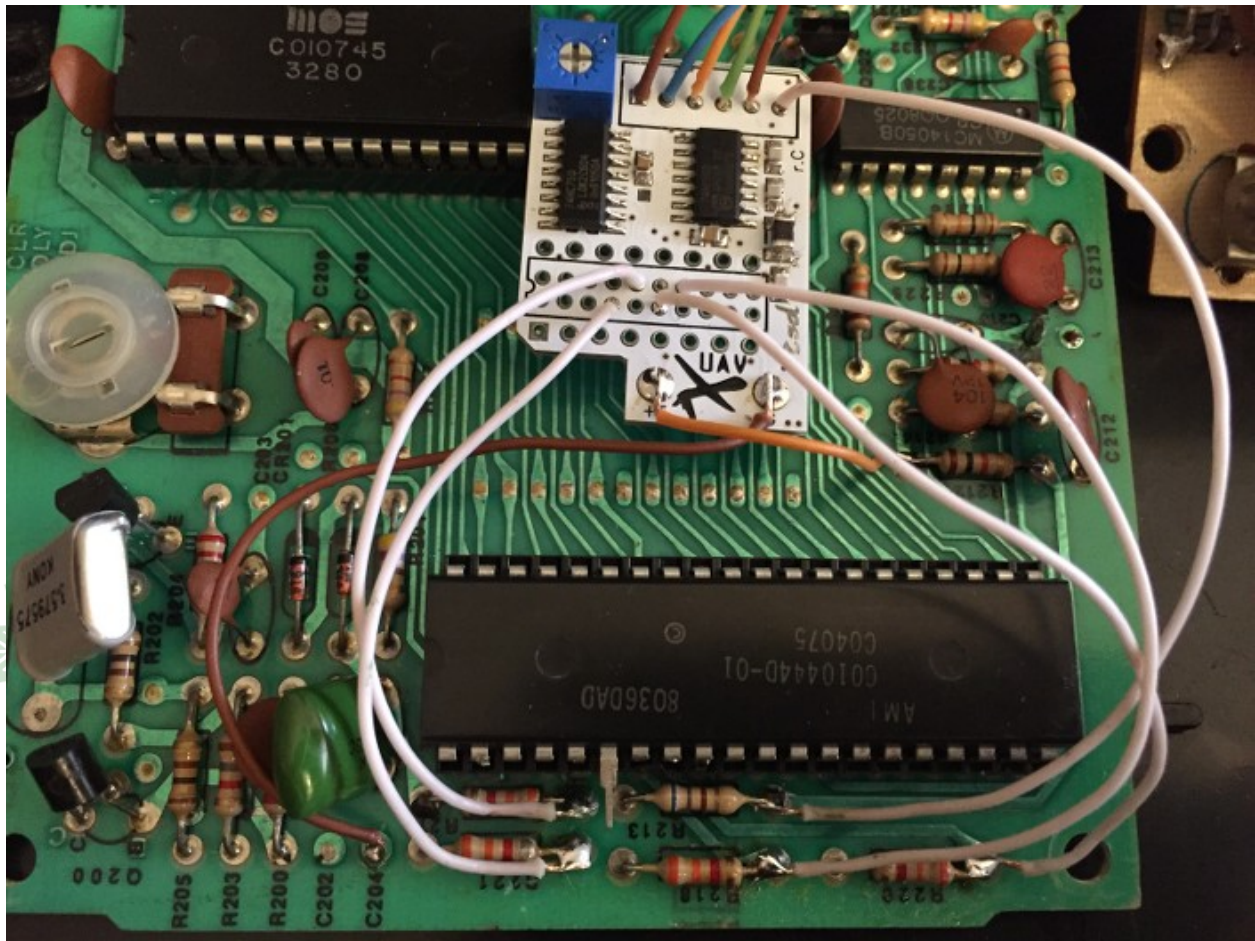
2600 (6-sw) - Yes 2600A rev 1-15 - No 2600A rev 16+ - Yes 2600jr - No

It can be added back in at another point in the circuit and it won't affect UAV.

COLOR is open collector and has a 1K pull-up that makes it toggle between logic levels (roughly). BLANK is also open collector and is tied to COLOR through a 820 ohm resistor. When BLANK pulls down (this includes colorburst time), you effectively have a 1K pull up and an 820 ohm pull down and the amplitude of the color waveform drops in half (with a big, obnoxious DC step too). UAV doesn't handle this well and the color goes wonky.

After that, the color signal goes through a 47pF cap and we can tie BLANK to this point instead, but another capacitor is needed in line with the 820 ohm resistor (.1uF is fine). Also, the resistor value can be varied to adjust the amount of saturation. This only affects the RF picture, though.



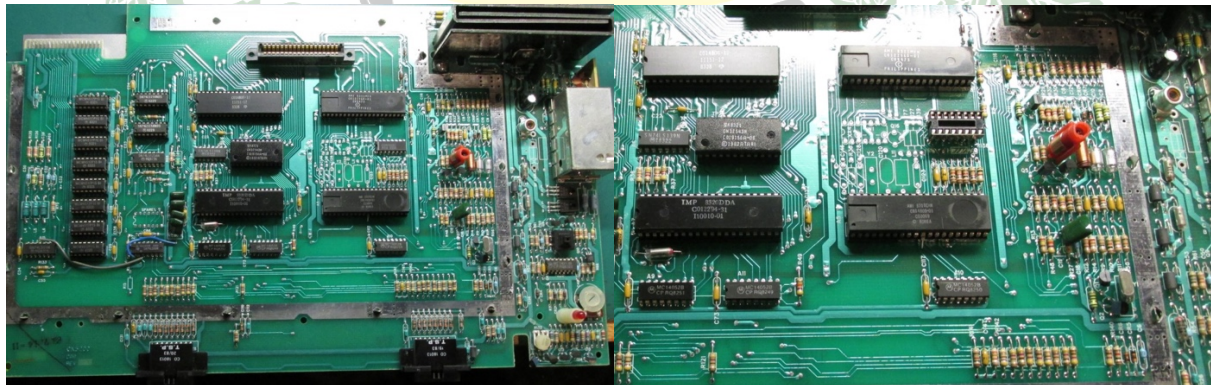


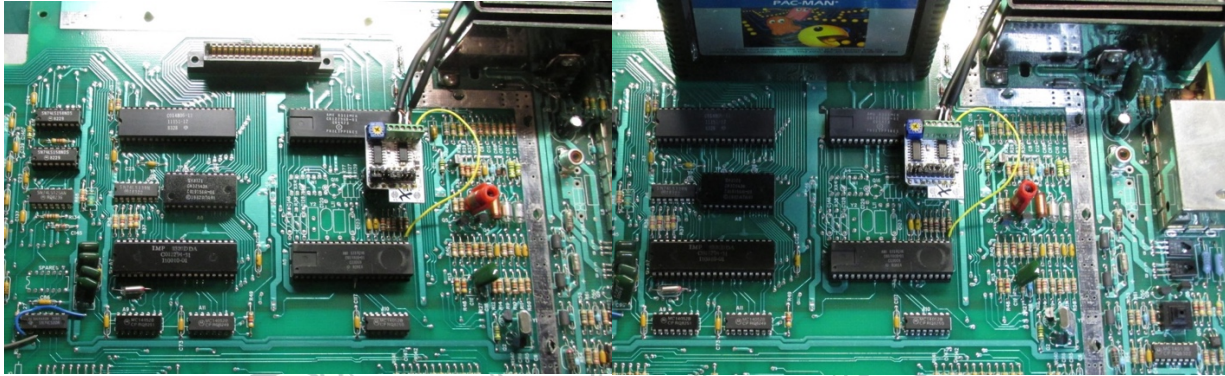
Rev. C Look @ Board silkscreen for D b

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Atari 5200 install

The board fits nicely under the shield. There is a row of resistors behind GTIA. Solder the wire either directly to GTIA pin 21 or to the close end of the far right resistor. The other end goes in terminal 1 (the one closest to the corner).





Atari 7800 Installation

AtariAge user -^Cro\$Bow^- created a GREAT 7800 installation manual. You can access it here:

<https://tinyurl.com/y62kgqxb>

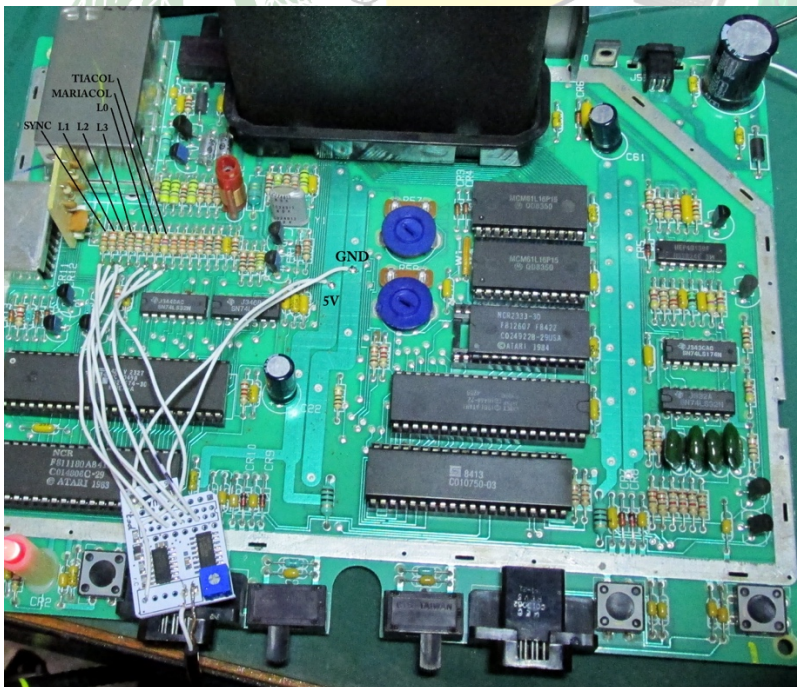
or here: http://www.thebrewingacademy.net/UAV_Installation_A7800.pdf

or

Video: <https://youtu.be/t7b3JXgZzcw>

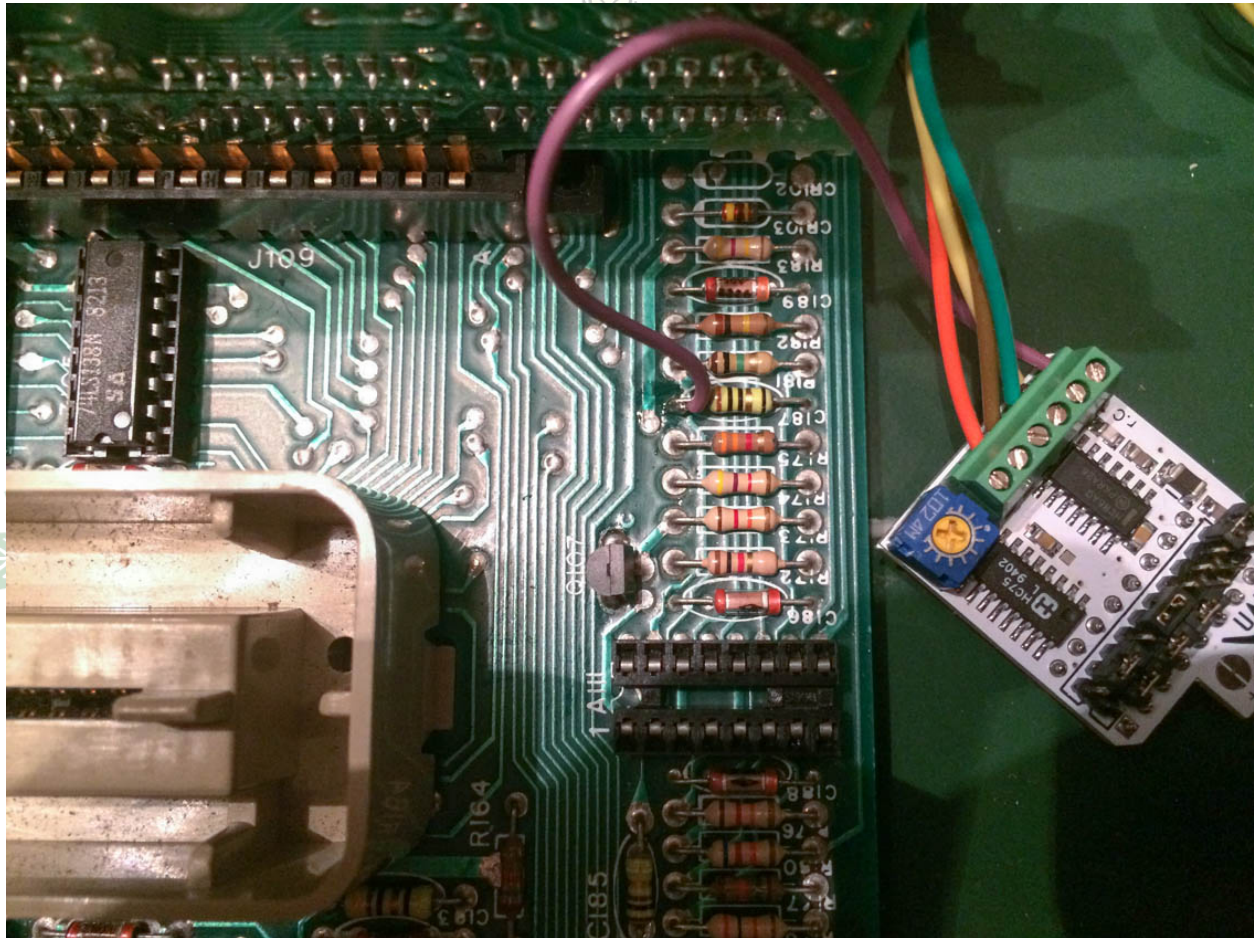
OR

If you've got a NTSC Rev A, just follow the picture. Works great in both 2600 and 7800 modes and you don't have to cut or remove anything. RF output will still work too.



Atari A8 Installation

Atari 400



Recommended board: **Plug-In**

The 400 has socketed chips including the 4050. The easiest installation is to put the UAV in the 4050 socket, but if you want to keep the RF output, you'll need to solder the socket on top of the 4050 and then mount the UAV on top of it. These instructions should work for NTSC and PAL systems.

Position the main PCB with the CPU board slot toward the back.

1. Connect a wire to the left side of C187. This is Color-In.
2. Make sure the UAV jumpers are set for the 400 and install it in the socket. The green terminal should be facing away from you.
3. Put the Color-In wire in the right-most terminal (terminal 1 when facing the terminal openings).
4. Attach your video cables to the UAV. The remaining terminals (R to L) are Ground, Chroma, Luma, Composite, and a 2nd Ground.

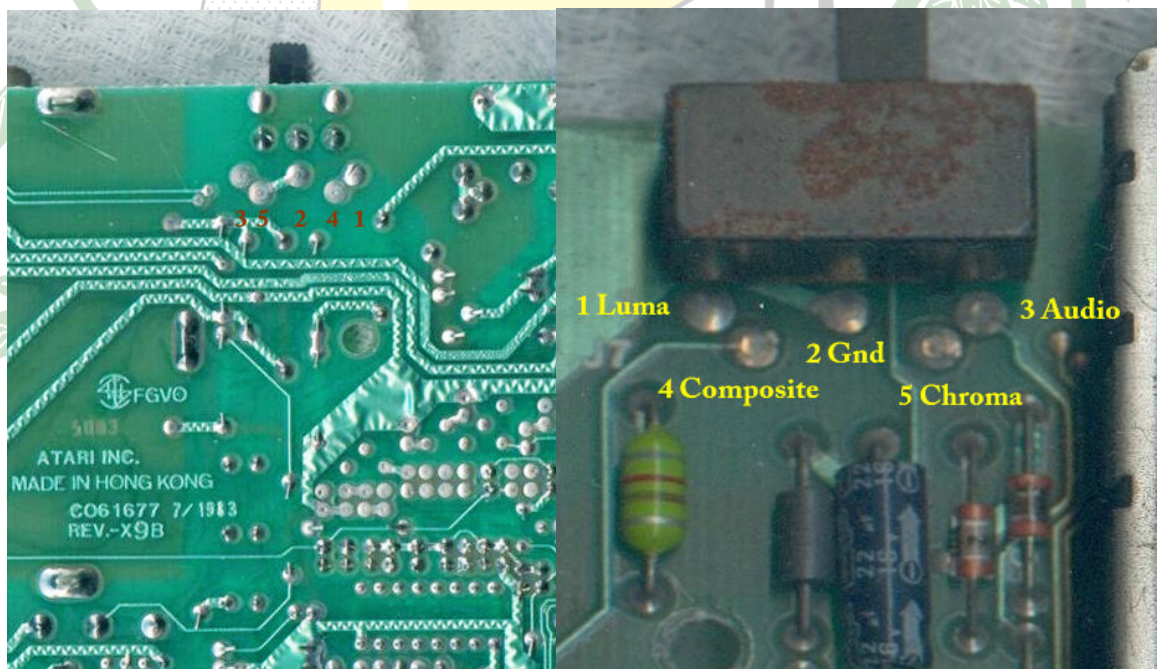
Atari 600XL

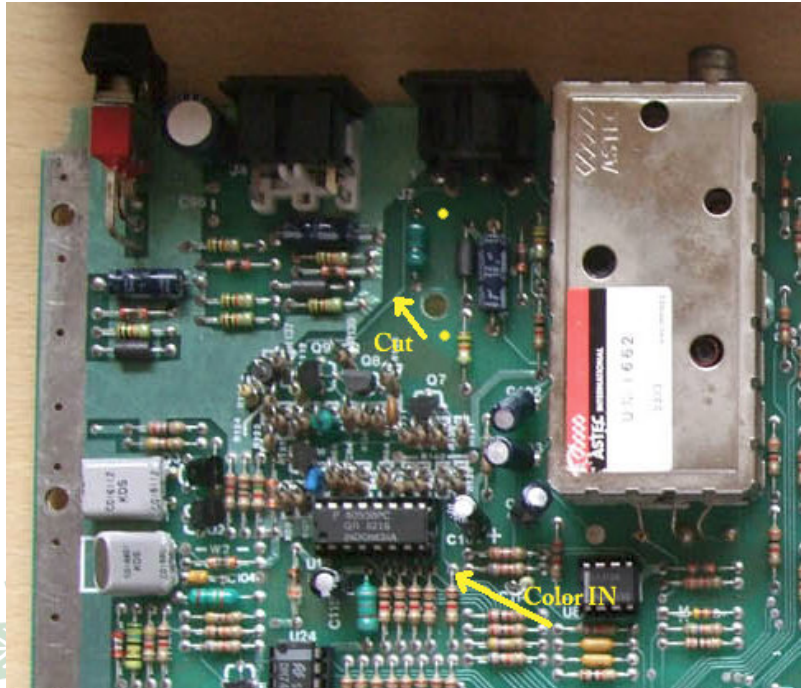
The first problem is that the Luminance pad (5) is shorted to ground (2) on the bottom, so be sure to cut that trace. It looks like sound is already hooked up on pin 3.

On the top, the pads from L to R are: 1. Luma 4. Comp. Video 2. Gnd 5. Chroma 3. Audio

The only other pad that has a trace is Composite and it looks like it goes to unstuffed (missing) components.

You'll also need to run a wire from pin 21 of the GTIA chip (OR There's also a closer place to pick off GTIA pin 21 at the top of the resistor shown) to UAV 6 (color in), otherwise you'll only get black and white. Put the board in the socket (logo facing front) and attach Composite, Luma, Chroma, and Color IN to the terminals. BTW, if you remove the 4050, you lose the modulator function.





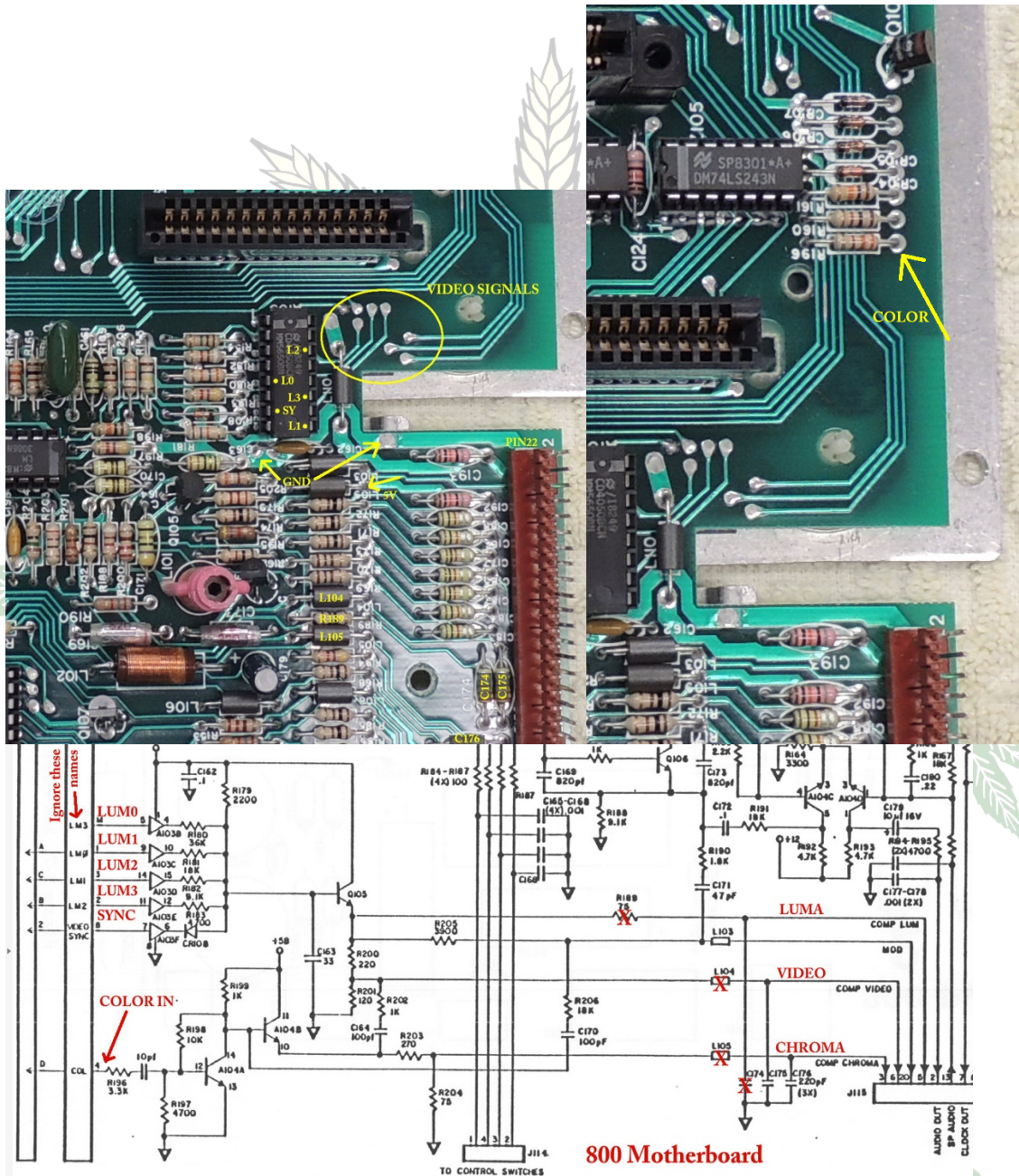
Directing UAV's output to the 5-pin monitor jack

1. Install UAV either by soldering all the input wires to a Basic board and securing it somewhere, or pulling out the 4050 and putting the UAV in its place, or by soldering a socket onto the 4050 and plugging the UAV in on top. The presence or absence of the 4050 doesn't matter because we're not going to be using the built-in video
2. When internal signals are routed to a port, there is usually some kind of filter to reduce the likelihood of RF leakage. This component can be lifted to break the path back to the original video circuits.

Example: The 800

Here's some pictures of the 800. If we lift R189, L104, and L105, we can then inject UAV's signals on the right side of these components. Also, C174-176 will have a softening effect, so lift one leg of each. (at least lift C174 for sharper Luma).

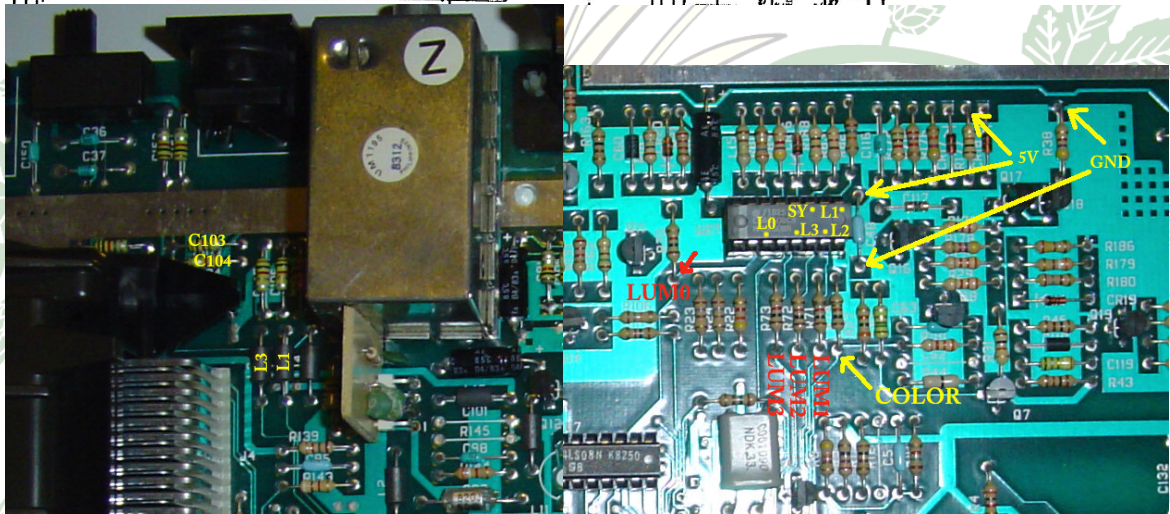
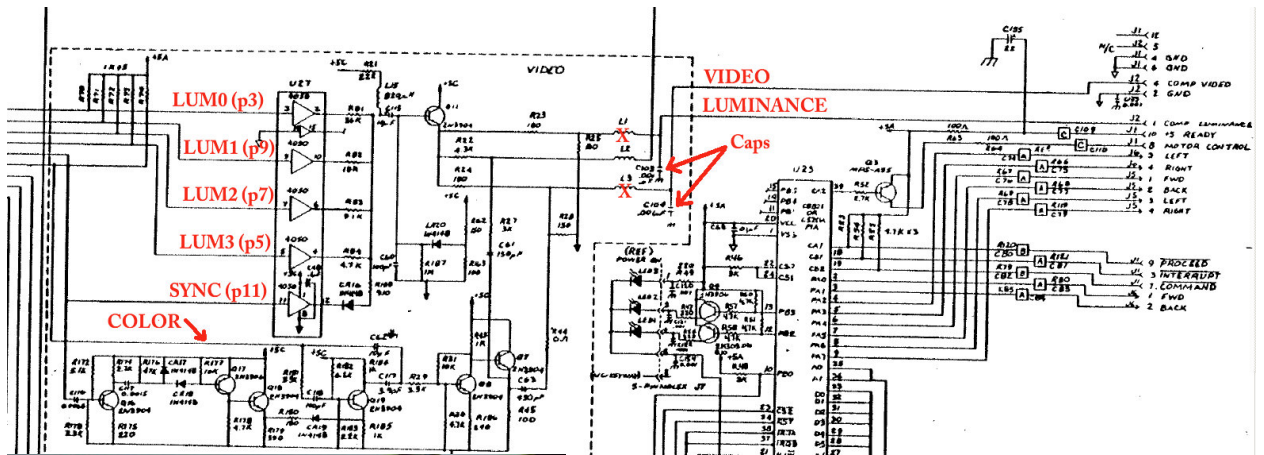
The on-board video will continue to feed the RF modulator as long as the 4050 is still in the socket. We can take our signals off the chip itself or from the vias to the upper right. Color is picked off at R196.



Example: The 1200XL

In the XL series, for some reason we'll probably never know, Atari dropped Chroma support from the monitor jack. This means we only need to lift **Video** and **Luma**, and run a wire to the jack for Chroma.

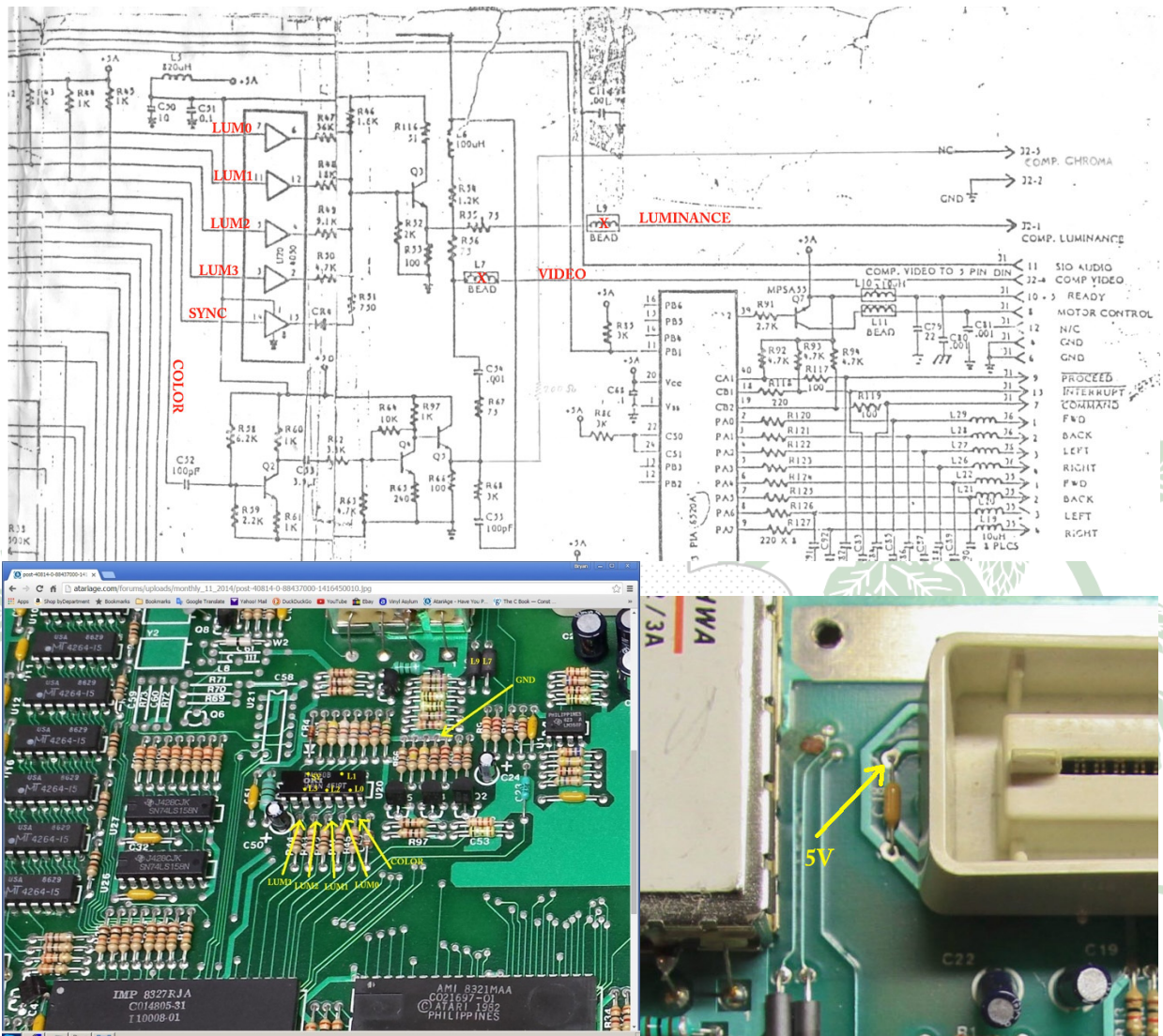
Lift the back pin of L1 and L3, and connect Video and Luma to the pads on the board (Luma is L1). Also lift one side of C103 and C104.



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Example: 800XL

There are several versions of the 800XL motherboard, but I believe the video circuits are pretty similar. Power to the video circuits tends to be affected by RAM noise. Your choice of Ground location can make a difference in the quality of the picture. The ground location shown has wide copper back to the ground plane, so it should work pretty well. The absolute best location is the ground pin of the monitor jack, or on the ground plane nearby. Again, lift the two ferrite beads (L7, L9) in the back, and put your Video and Luminance there. Run a wire for Chroma.

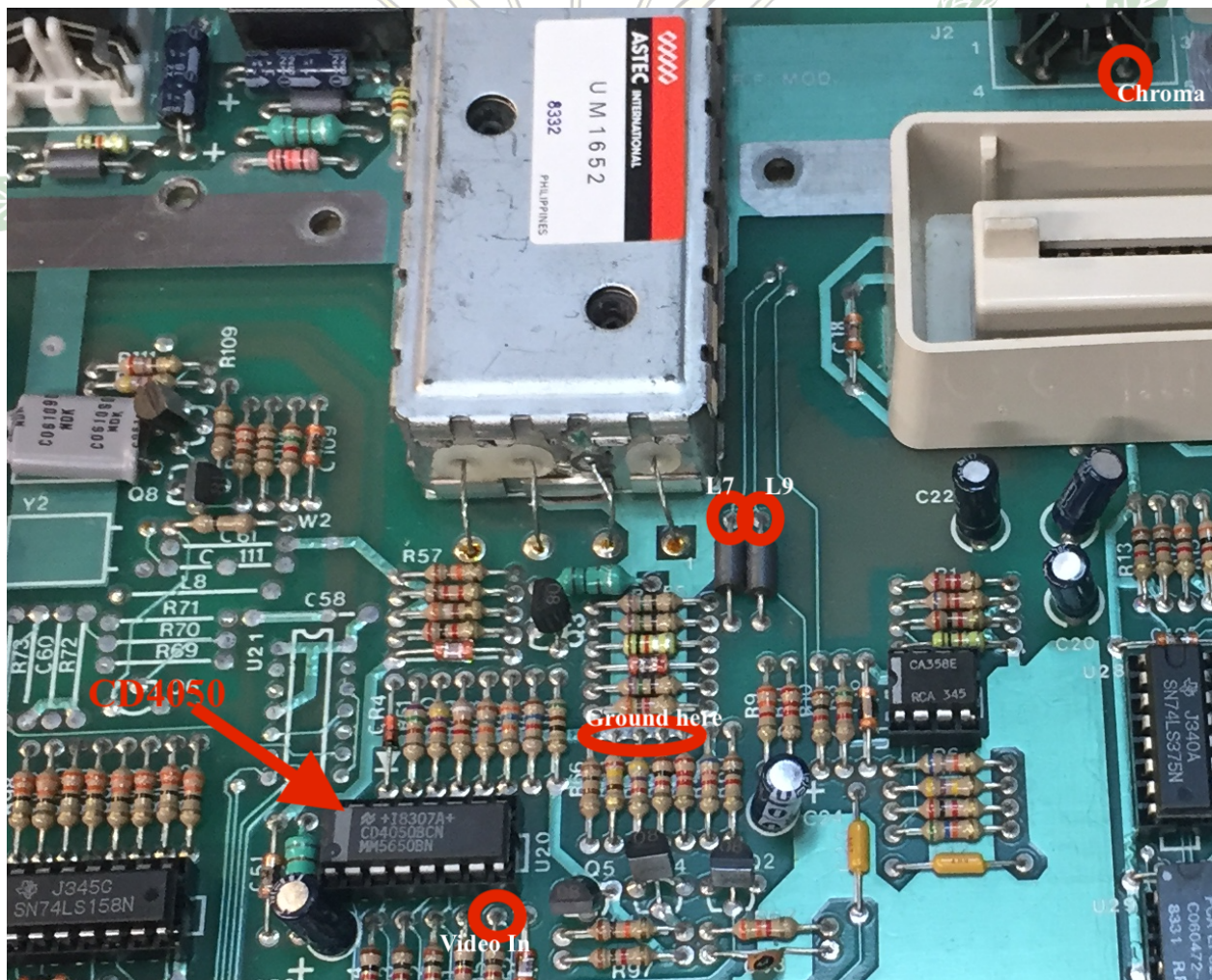


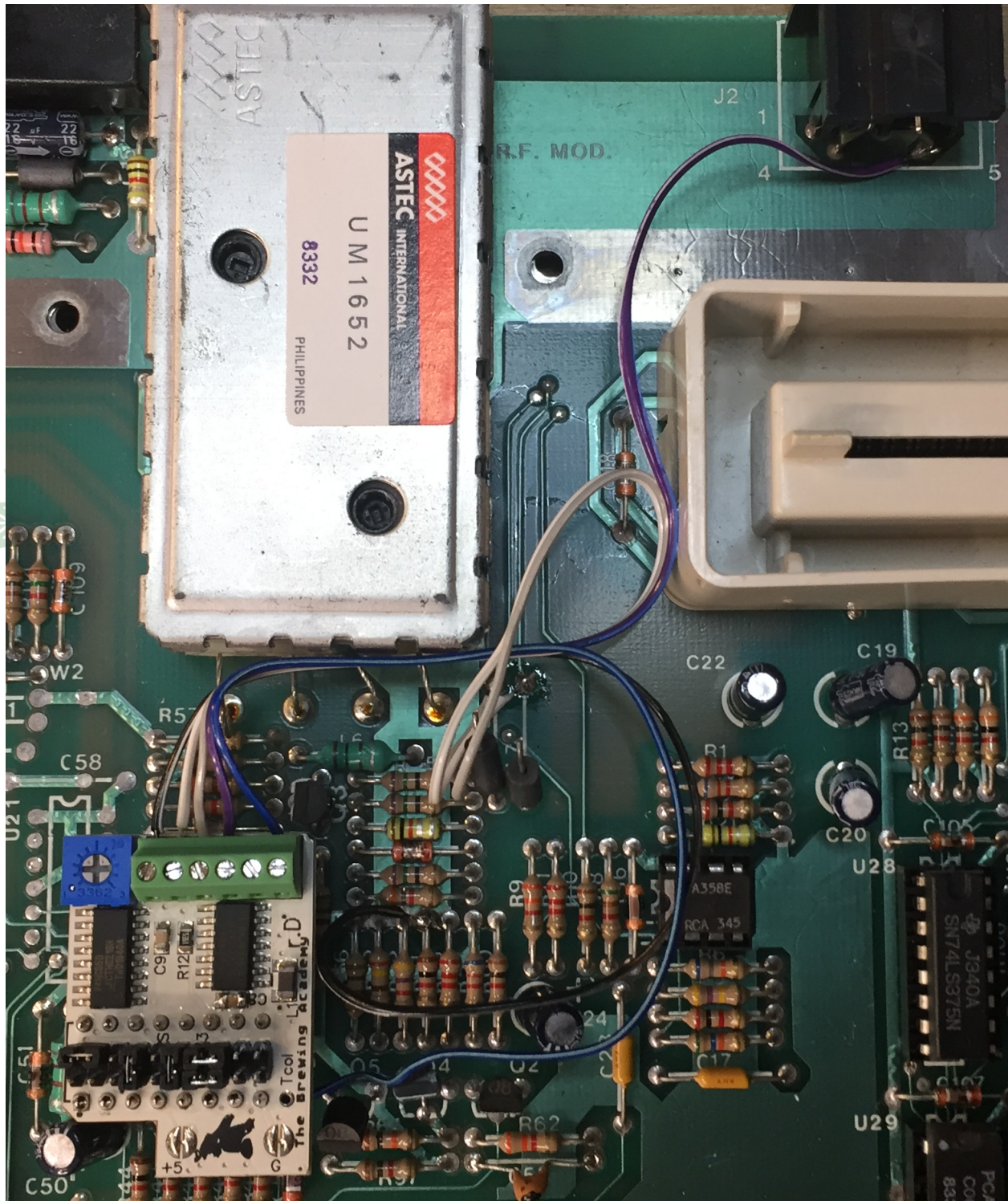
Step-by-Step for 800XL

This video is perfect. But if the video is not clear enough . . .

1. Locate the 4050 chip on your 800XL. It is a location U20
 - a. Remove the 4050 Chip.
 - b. If yours is not socketed, you will have to remove it and install the provided socket.
2. Connect the top lead of R45 to "Color in" on the UAV
3. Clip the upper ends of L7 & L9
4. Connect the motherboard connection at L7 to Comp. Video on the UAV
5. Connect the motherboard connection at L9 to Luma on the UAV

6. Connect the top end of R66 (or any resistor in this block) to Ground on the UAV
7. Install UAV in the socket at U20
8. Connect a wire from Chroma to Pin 5 on the monitor port.
 - a. Alternatively install an external connector for video output.
9. Remember to combine Chroma & Luma output at the monitor if not using an external connector.

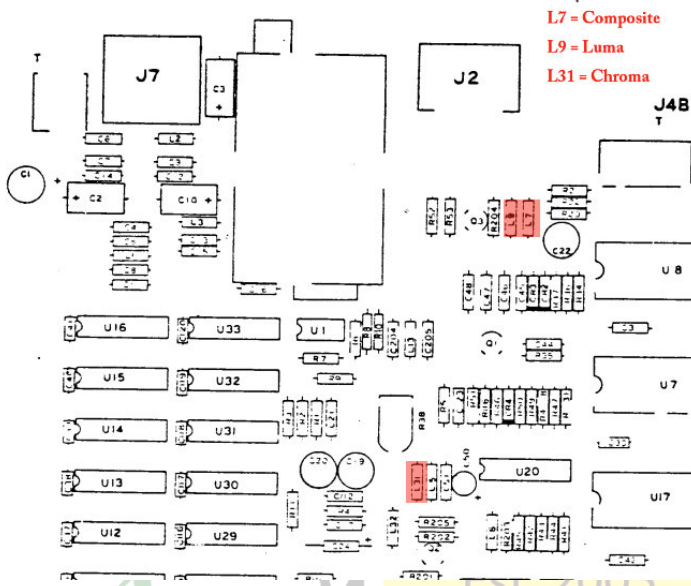
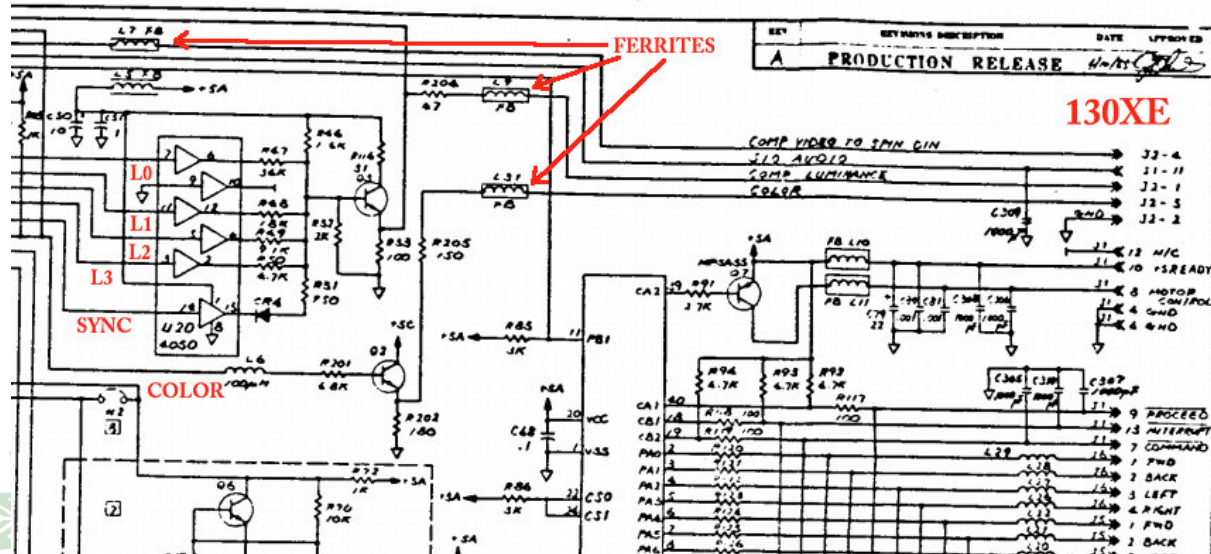




Example: 130XE

Three ferrites need to be lifted to break the original connections to the DIN port: L7, L9, L31. Then you can attach these signals to the back pads for these 3 parts.

Because the 130XE tends to be noisy, run an auxiliary ground wire from the back terminals to somewhere near the DIN jack (or to the center pin itself). There's a ground via just to the right of C205 that is a good place to land this wire. If you still see any noise, cut the center of the ground split-pad on the UAV.



A 130XE install (under the shield)

This is one way to install the UAV under the shield of a 65XE/130XE which has very low clearance. This is basically a Kit with just the socket pins installed. Wire jumpers are soldered in place of the 2mm header. I cut the ground pad, trimmed about 1mm off the socket pins, and installed a ground wire just because some of the ground routing is pretty bad on the XE's. Solder the socket on top of the 4050. Notice that pin 1 is on the left. The important pins are 1, 3, 5, 7, 8, 11, 14.

Lift the front-most lead (bottom leg in the picture) of the 3 circled ferrite beads. You can do this by clipping the lead at the board, or by applying heat to the pad and gently pulling the lead out. Once the lead is out of the board, solder a wire to it. These 3 wires will go to the indicated terminals in the green block (Terminal 1 is closest to the adjustment pot).

Solder a wire to pin 21 of GTIA. This will go to terminal 6.

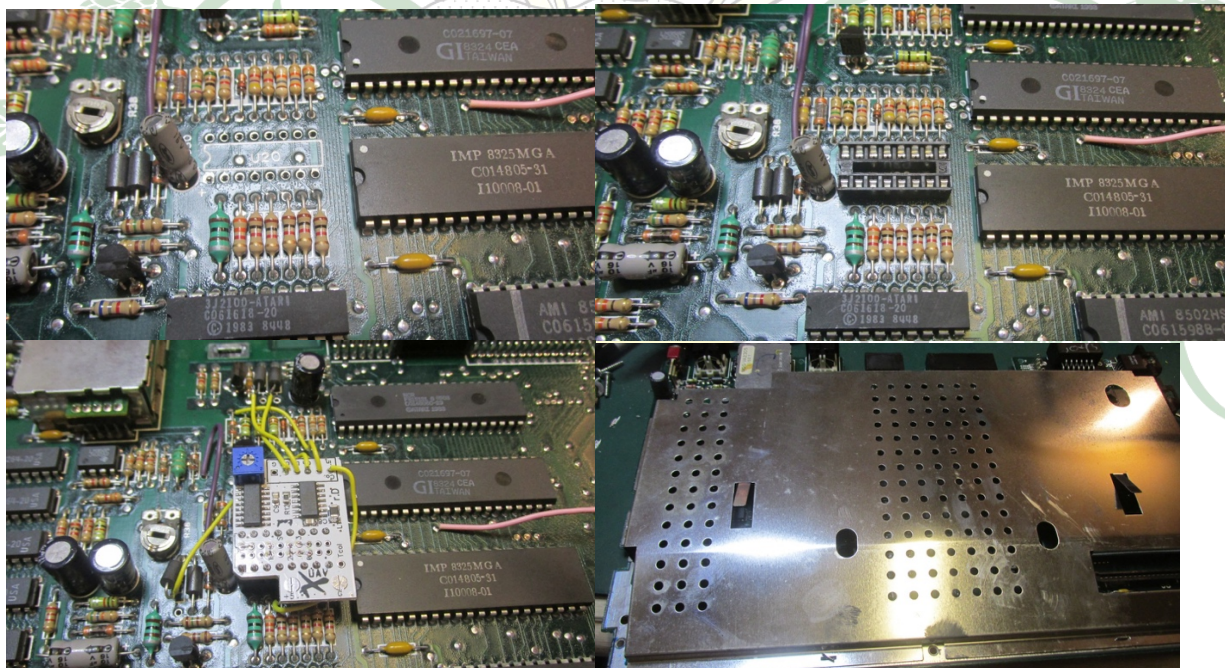
Solder a Ground wire to the top lead of R52 (left-most resistor behind the video DIN).

Make sure the jumpers are configured for the 130XE

Plug in the board with the logo toward the front. Gently push the electrolytic cap (C50) to the side if need be. Connect the terminal wires for GND, Composite, Luma, Chroma, Color-In.

Leave the pot in the default (middle) position.

Power it up and you should have video.



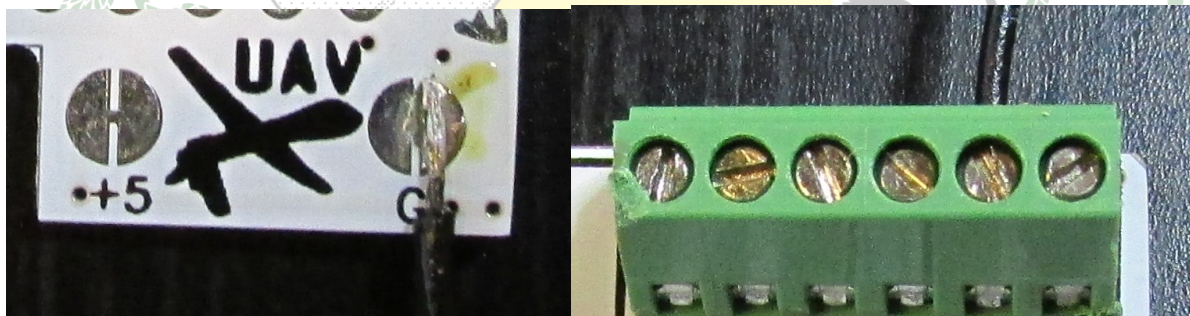
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GROUNDING:

With Audio and Video circuits, one of the most important things is the ground path. Single-ended signals (those that use coax) have no ability to reject noise on the ground/shield conductor (unlike balanced/XLR connections) so care must be taken to make sure that all video circuitry and connectors share a single, low impedance ground. UAV is tolerant of noise on the 5V line because it isn't used as a reference. It IS used as a DAC reference in the original Atari circuit, however. Because many Atari boards don't have a clean ground path from the CD4050 socket back to the supply (that is, the ground trace is shared with digital components) there can still be noise after installing a UAV Plug-In board, especially when using the monitor DIN for output. This is because your monitor will see the nice, heavy ground plane under the DIN connector while the signals will be generated using the CD4050's noisier ground path which means the difference in the two grounds gets added to the signal.

When you use the DIN connector, the absolutely cleanest way to wire the UAV is to cut the center of the split pad for ground (use a razor knife, breaking the 4050 socket ground) then soldering a ground wire to a place connected to the large ground plane near the DIN port. This wire can be attached to the UAV terminal grounds in the back, **or** soldered to the RIGHT side of the 'G' split pad. This way, the UAV and the monitor DIN have an identical ground connection. I also allow a separate 5V line to be run to the other pad in case it's needed.

If you're using a Plug-In board and not wiring to an onboard video connector, then there *may* be a benefit to running an auxiliary ground wire to a heavy ground point nearby. We're just trying to avoid relying on ground traces that also feed digital components.



UAV color adjustment:

Bryan wrote a program for A8 & 5200 installations to adjust the colors. It can be found at:

https://www.thebrewingacademy.net/uav_xex.zip

In the 2nd picture, you can see the effect of too much delay- to the point where pixels are not being latched (especially LUM2 in the upper right). The best setting is to back off about $\sim 10^\circ$ from the point where pixels start dropping out of the picture. Since the Atari doesn't draw all these types of pixels with exactly the same timing and width, you'll notice some dropping out before others.

The lines on the left edge of the screen represent:

1. 2 lines of even monochrome pixels.
2. 2 lines of odd monochrome pixels.

The 2nd section below it represents the same display formed with the colors and screen data inverted:

3. 2 lines formed by a gap of background color (even pixels)

4. 2 lines formed by a gap of background color (odd pixels)

The different artifact shades represent Lumas of \$02, \$04, \$08, \$0E to test the timing of each Luma bit. Below that are bars of GTIA 9 and 11

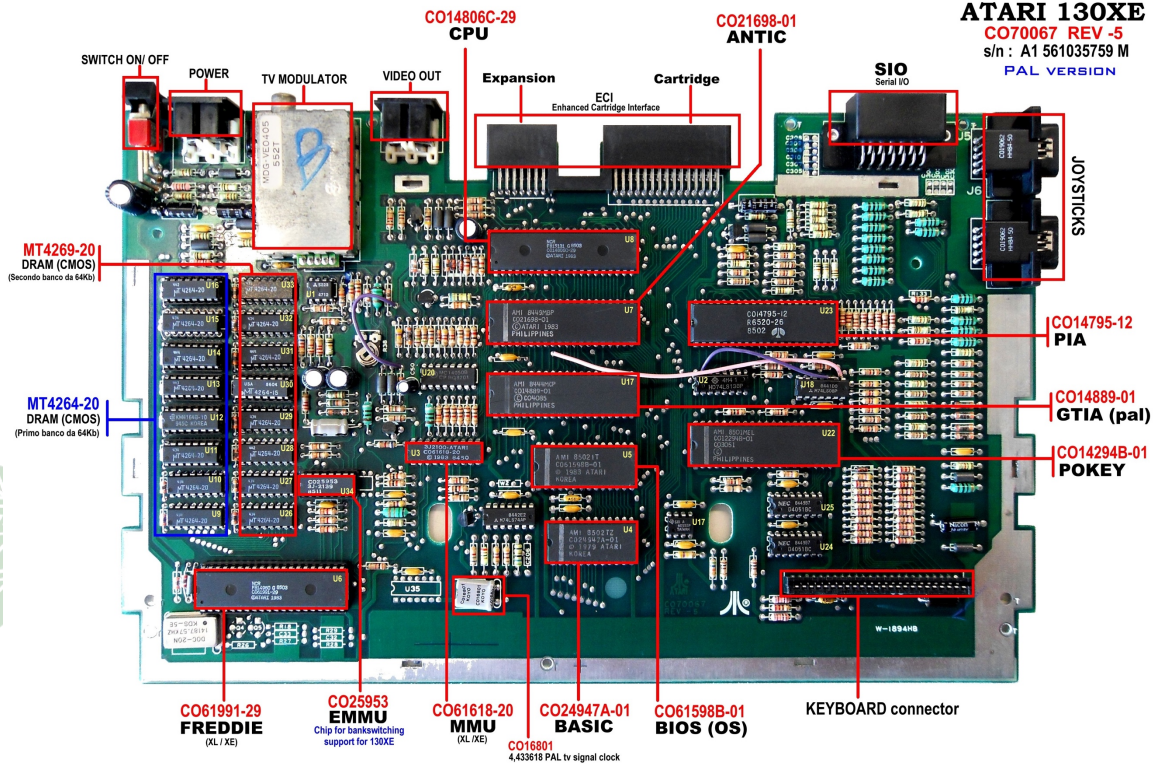


Credits

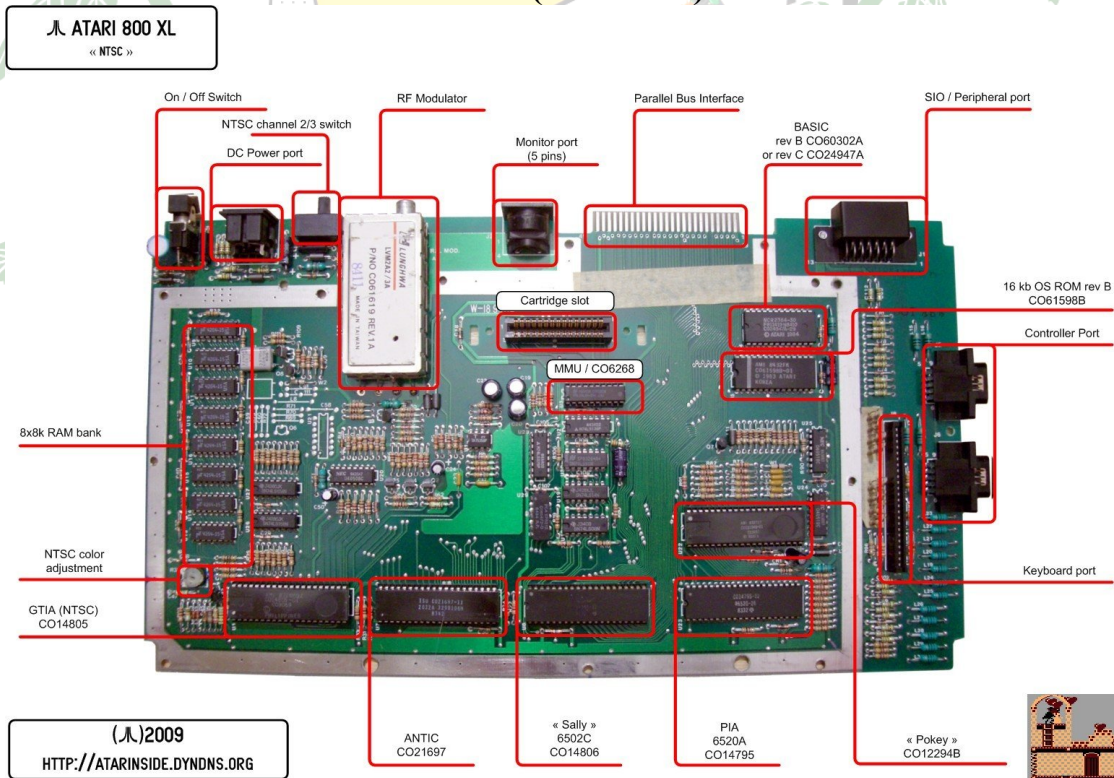
Original idea & hardware: Bryan Edewaard. Production and assembly by The Brewing Academy. All rights for UAV, rev. D: The Brewing Academy. Support provided by MacRorie of The Brewing Academy.

Appendix One

130XE Motherboard (identified)



800XL (identified)



(A)2009
[HTTP://ATARINSIDE.DYNDNS.ORG](http://atarinside.dyndns.org)



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You may have noticed that this character figures prominently in the logos and labels on The Brewing Academy merchandise. The reason is that it is my World of Warcraft character, MacRorie (as drawn by one of my daughters) and is intrinsic to who we are.



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