

Cinelabs Flyback Installation Guide for Atari's Amplifone Vector Monitor



WARNING: CRT display monitors can produce lethal voltages. Refer servicing to qualified service personnel.

PLEASE NOTE: This product is intended to be installed following the guidelines contained in this document, by qualified service personnel. The manufacturer and distributors of this product will not be held liable for any damage resulting from this product's use. If you are uncomfortable with this, you may return the product within seven (7) days, for a full refund.

If properly installed by a qualified service person, this product will be warranted for a period of one year. This period starts on the date of receipt of product, if ordered directly from Cinelabs, or, from the purchase date on the original receipt, if purchased through an authorized distributor. Should you ever have to use this warranty, the distributor you purchased your Flyback from will repair or replace, at their option, the original part. The distributor's and Cinelabs' liability is limited to replacement of the part, and neither party will be responsible for any damages incidental or consequential to your game or person. This warranty does not cover "abuse" (physical, environmental, or electrical), and is only valid for parts installed in a genuine Amplifone High-Voltage board. Please contact Cinelabs in advance, regarding warranty terms for components used in third party/aftermarket HV Boards.

Terms: By installing this part, you agree to take full responsibility for any damage caused to your game and/or person, you may incur, due to lack of experience or expertise, lack of having the correct tools, etc. You agree to read the complete installation manual, prior to installing the part, and complying with all safety advisements and warnings.

Revision History:

Rev.	Date	Author	Comments
0.1	11/10/2006	Shostak	Initial edit of Amplifone Service manual
0.2	02/04/2007	Shostak	Added Cine specific content
0.3	02/11/2007	Shostak	Added pictures, incorporated comments
1.0	02/25/2007	Shostak	Official Release
1.1	04/07/2007	Shostak	Added Blue Board Specific Instructions

The most recent revision of this document can be found at:

http://www.cinelabs.com/docs/Amplifone_Install.pdf

Please send comments and/or corrections to: info@cinelabs.com

This guide is intended to assist in the replacement of the Flyback Transformer ("FBT") of Atari Amplifone 19" and 25" Color X-Y Vector monitors, when it has been determined the FBT is defective. This guide is not intended to explain how to troubleshoot or diagnose these monitors.

Be sure to read this entire document *before* working on your monitor.

CRT displays are dangerous and potentially lethal. There is risk of physical injury from the glass CRT and danger of electrocution from high-voltage.

We advise always wearing safety glasses when working on CRT displays, as well as keeping one hand behind your back when working on a CRT display, energized or not. When working on Star Wars, keep both hands behind your back, and use the force.

Remember, CRT picture tubes can store a High-Voltage charge for extended periods of time. Always be sure to discharge the CRT prior to FBT replacement and **follow ALL industry safety practices and procedures**, regardless of how long the display has been turned off. Never make any assumptions.

Be sure to perform the high-voltage adjustment and perform the high-voltage safety shutdown adjustment.

If you are unsure of how to perform any safety related procedures, or are unsure of how to safely perform this procedure, please contact a trained service technician to perform the installation or return the never installed FBT, for a full refund.

Helpful Hints:

- Cinelabs *highly* recommends installation of a cap kit when replacing the Flyback transformer. The design of the Amplifone High Voltage unit is such that dry caps can produce erratic behavior and cause poor performance.
- This Flyback reuses the original Amplifone Focus Assembly (FA) and does NOT include an integrated FA. The Flyback's housing is generic, and used in multiple transformers, some of which have an integrated FA. Do NOT remove the original FA, and do not attempt to adjust the dummy FA (See Figure 1).



Figure 1: Dummy Focus Controls

- The typical high-voltage output range for the Amplifone HV Unit is roughly 15,000V to 22,000V. Flyback Transformers are capable of producing **significantly higher** voltage. Be sure to perform the over-voltage shutdown adjustment to ensure safe operation.
- When adjusting the High Voltage or Shutdown Voltage (or at any point), we recommend keeping the length of time you may have the HV adjustment at either extreme (lower range of HV output or upper range of HV output) to a minimum. Operating the HV Unit out of its normal resonance puts excess strain on the output transistor and Flyback, and can **cause the output transistor to fail**.
- The Amplifone FAQ is a good source of background information, as well as specific information on troubleshooting the Amplifone HV unit. Copies are available across the internet, at sites such as Ionpool:
http://ionpool.net/arcade/tech/ampfaq_12.pdf

- If you have a **Blue High-Voltage board**, installation is slightly different. Be sure to follow the specific instructions for your PCB.
- For further information on trouble-shooting the Amplifone Color Vector monitor, the reader is directed to the RGVAC Usenet news group (Rec.Games.Video.Arcade.Collecting), and to the Vectorlist archive, which is located at <http://www.vectorlist.org>.

Cinelabs is a proud sponsor of the Vectorlist. :-)

HV Cage Removal:

1. Determine FBT is defective.
2. Turn game off and unplug the AC power cord from the wall power outlet.
3. **Discharge any residual energy from the CRT, following industry standard CRT discharge procedures.**
4. Disconnect the FBT anode cap from the CRT, following industry standard procedures (we recommend, at minimum, keeping one hand behind your back).
5. Momentarily short the anode cap to the chassis, to ensure the FBT is discharged.
6. Disconnect HV Unit cable from the back of the neck of the CRT.
7. Disconnect HV Unit cable from Deflection Board.
8. Remove PCB retaining screws.
9. Remove HV Unit from monitor.
10. Installation is reverse of removal.

Green PCB Flyback Replacement:

(If you have a **Blue PCB**, use the [Blue PCB Installation Instructions](#) on page 9)

1. Unsolder and remove the white wire going between the original Flyback and the Focus Assembly input terminal (topmost connection), and retain the rubber boot (See Figure 2), which will be used later.

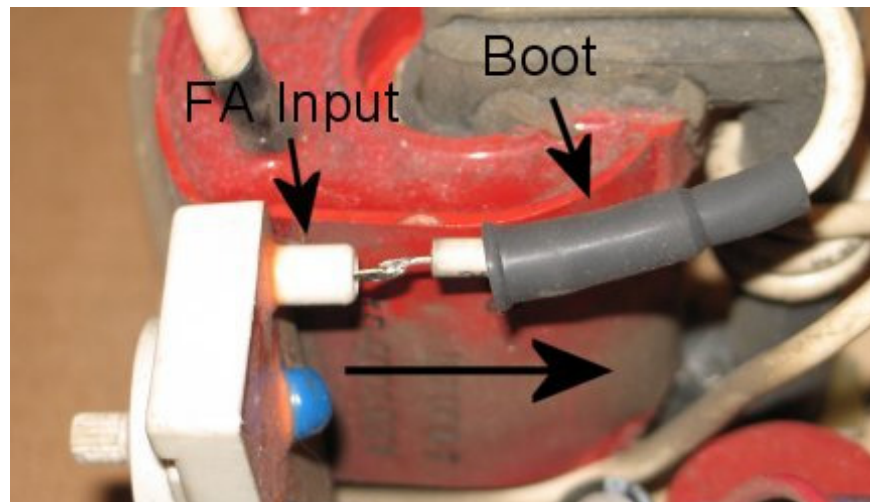


Figure 2: Flyback / Focus Assembly Connection

2. Unsolder and remove the white heater wire running from the original Flyback to the PCB location marked "WHT".
3. Remove the two small hex Flyback retaining nuts from the bottom of the PCB.
4. Unsolder and remove the original Flyback transformer.

5. To begin installation of the new Flyback, first solder the (new) heater wire (the wire wrapped around the core of the Flyback) to the hole in the PCB from which you removed the original heater wire (marked “WHT” on the PCB).
6. Note the notch in the front of the Flyback, towards the lower right (See Figure 3).



Figure 3: FBT Heater Wire Cutout

7. Install the Flyback into the PCB, being careful to route the heater wire installed in step 5, through the notch in the bottom of the Flyback (See Figure 4). If the heater wire is not routed through this notch, the Flyback will not sit flush with the PCB.

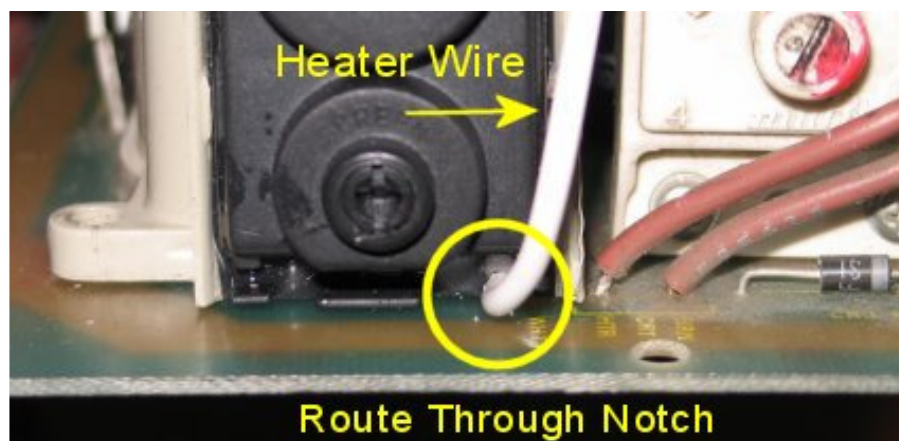


Figure 4: FBT Mounted Flush, Heater Wire Properly in Notch

8. Solder the new Flyback in place.
9. Slide the rubber boot you saved in step 1 onto the remaining wire coming from the new Flyback (this white wire comes out of the top of the FBT).

10. Solder this remaining Flyback wire to the input lug on the Focus Assembly (the lug you disconnected in step 1) (See [Figure 2](#)).
11. After the solder cools, slide the rubber boot forward over the connection, so it contacts the Focus Assembly.

The installation is complete. Please proceed to the [High-Voltage Adjustment procedure](#).

Blue PCB Flyback Replacement:

(If you have a **Green PCB**, use the **Green PCB Installation Instructions** on page 6)

1. Unsolder and remove the white wire going between the original Flyback and the Focus Assembly input terminal (topmost connection), and retain the rubber boot (See Figure 5), which will be used later.

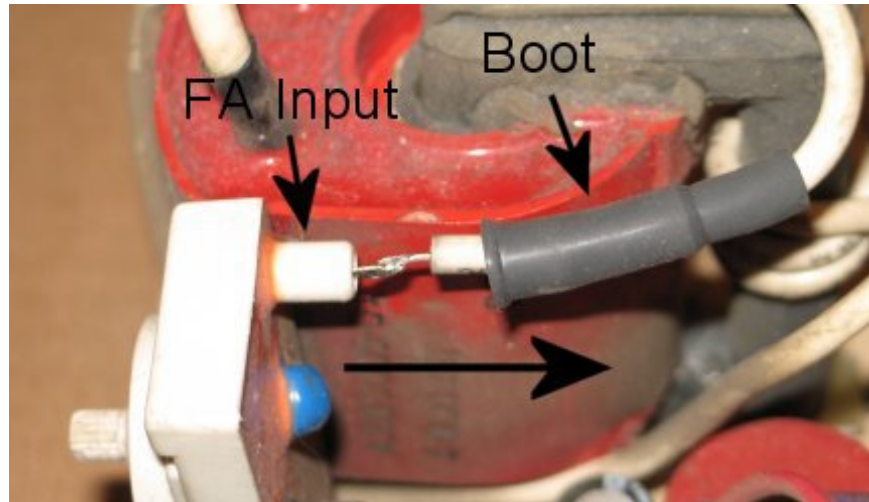


Figure 5: Flyback / Focus Assembly Connection

2. Unsolder and remove the white heater wire running from the original Flyback to the PCB location marked "HTR WHT".
3. Remove the two small hex Flyback retaining nuts from the bottom of the PCB.
4. Unsolder and remove the original Flyback transformer.

5. Carefully unsolder and remove diode CR3. (See Figure 6)

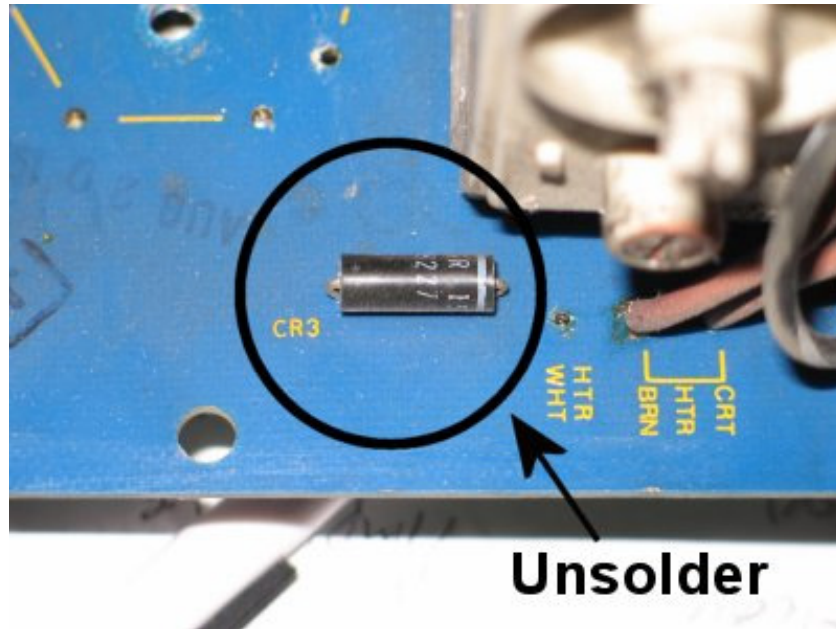


Figure 6: Diode CR3

6. Turn the PCB over, and solder CR3 to the bottom of the PCB with the banded end facing the Atari copyright statement (towards the regulators). (See Figure 7)

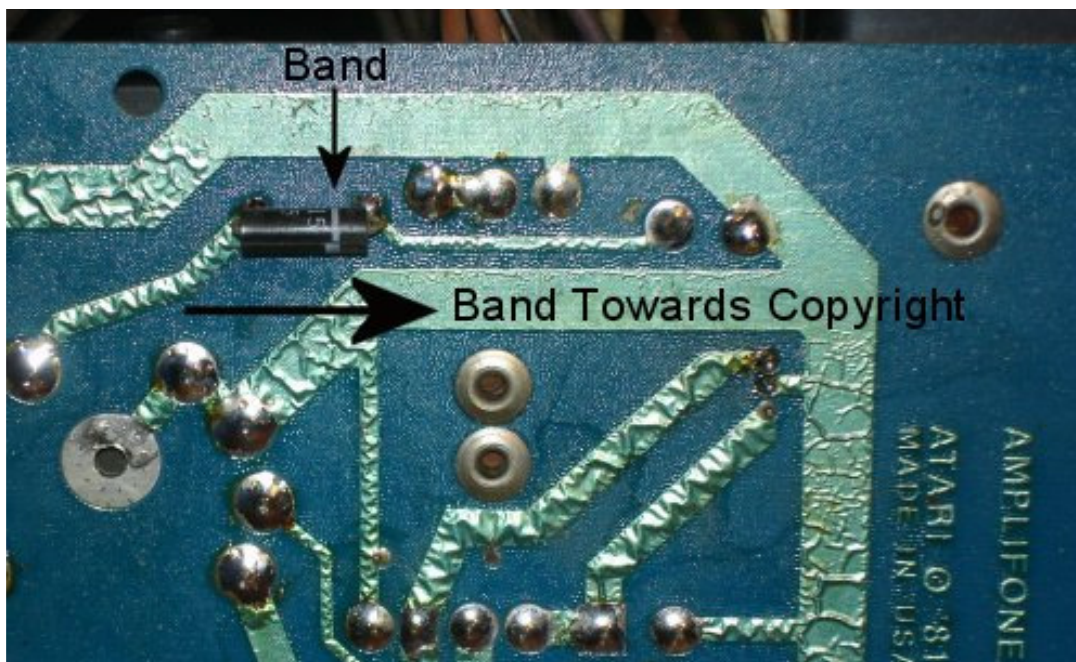


Figure 7: Diode CR3 Properly Installed

7. Turn the PCB right-side up, and solder the (new) heater wire (the wire wrapped around the core of the Flyback) to the hole in the PCB from which you removed the original heater wire (marked "HTR WHT" on the PCB).
8. Install the Flyback into the PCB and solder it in place.
9. Slide the rubber boot you saved in step 1 onto the remaining wire coming from the new Flyback (this white wire comes out of the top of the FBT).
10. Solder this remaining Flyback wire to the input lug on the Focus Assembly (the lug you disconnected in step 1) (See [Figure 5](#)).
11. After the solder cools, slide the rubber boot forward over the connection, so it contacts the Focus Assembly.

The installation is complete. Please proceed to the [High-Voltage Adjustment procedure](#).

HV Adjustment:

The following adjustment should be performed with no video signal applied to the monitor. DO NOT attempt to adjust the HV using the Video B+ supply as a reference, as many factors influence this rather poorly regulated rail, and it will most likely result in a significant adjustment error.

1. With power OFF
2. Find the center position of the HV output control (R7) by turning it to its extremes and adjusting to the center of travel.
3. Connect a high-voltage probe to the monitor (following the probe's manufactures' instructions).
4. Apply power to monitor and allow it to warm up for at least 15 minutes.
5. Adjust the HV output control for a reading of 19.5KV.
6. Inject a video signal into the monitor.
7. Adjust the Screen and Focus controls to taste.

HV Shutdown Adjustment:

Turning the HV Over-Voltage control (R17) to its minimum position (fully counter-clockwise) will set it for roughly 23KV, which is higher than it should ever reach during normal operation.

This procedure assumes the HV Cage is properly assembled and working correctly.

1. Set the HV Trip adjustment (R17) fully clockwise (Highest Trigger Voltage).
2. Adjust the HV output control (R7) to 24KV¹ (**SEE WARNING BELOW**).
3. Rotate the HV Trip adjustment (R17) counter-clockwise, until the HV shuts down, and the LED illuminates.
4. If you rotate R17 fully counter-clockwise, and the unit has not shutdown, you either have a HV unit that does not produce a high enough voltage to trip the Over-Voltage circuit (see note 1), or a fault in the HV unit which needs to be corrected before this procedure can be completed and the unit returned to normal operation.
5. Center the HV output control (R7) (NOT the Trip adjustment), and perform the regular 19.5KV HV adjustment.

Note¹ – Not all HV Cages will produce 24KV. In this case, adjust the unit to shutdown at the minimum HV trigger point (i.e. fully counter-clockwise).

Note² – If the Over-Voltage protection circuit triggers (i.e. LED illuminates), power must be completely removed from the system in order to reset the protection circuit.

WARNING: When adjusting the High Voltage or Shutdown Voltage (or at any time), we recommend keeping the length of time you may have the HV adjustment at either extreme (lower range of HV output or upper range of HV output) to a minimum. Operating the HV Unit out of its normal resonance puts excess strain on the output transistor and Flyback, and can **cause the output transistor to fail**.

Congratulations, FBT Installation is complete!

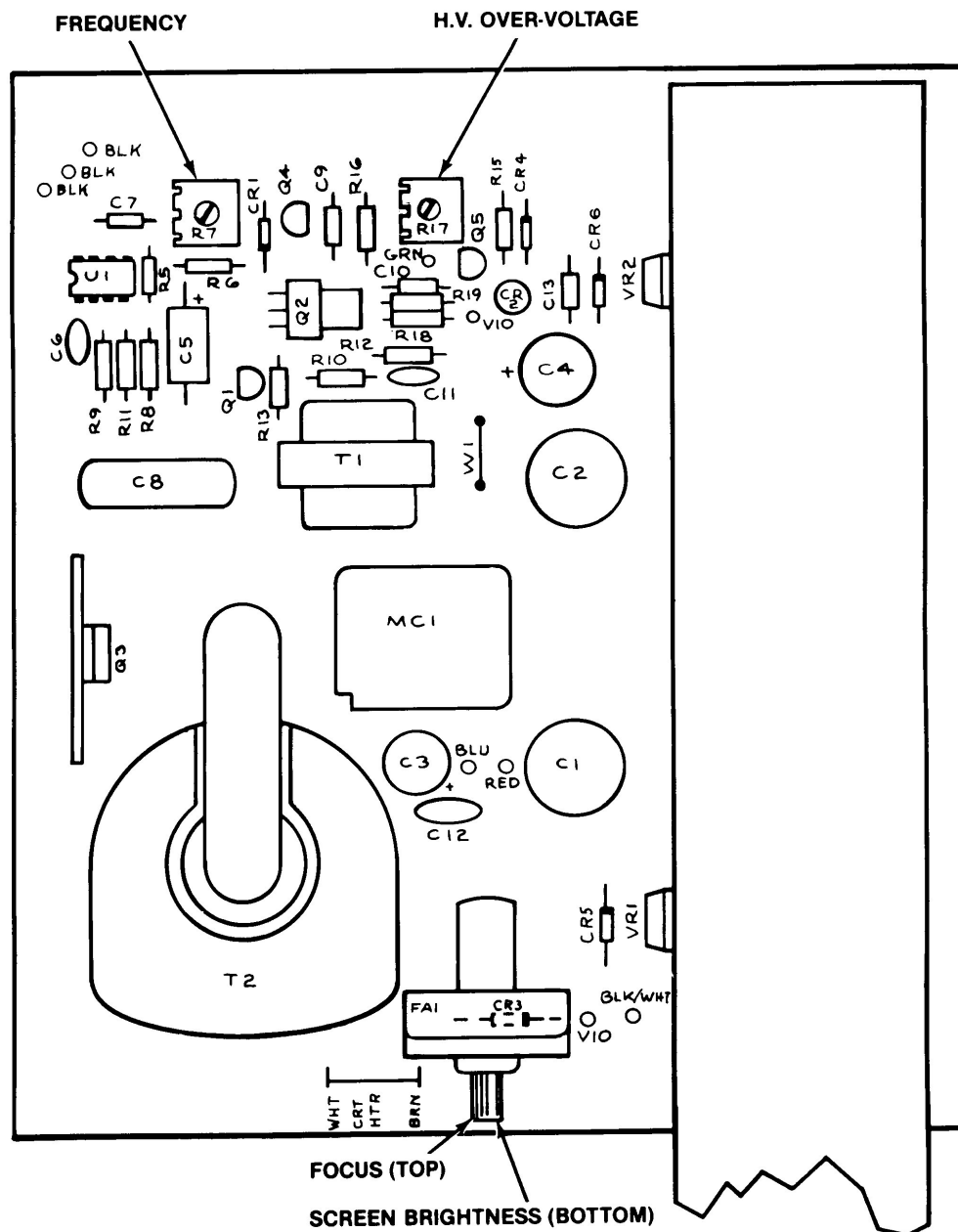


Figure 8: HV PCB Parts Locations



For reference, a list of electrolytic capacitors is provided. This list is based on the schematic on the preceding page. You may want to verify it against your actual board.

Electrolytic Capacitor List:

Component Location	Capacitance	Voltage	Type
C1	470uF	50V	Radial
C2	470uF	50V	Radial
C3	220uF	35V	Radial
C4	220uF	35V	Radial
C5	4.7uF	50V	Axial

Table 1: Cap List

CR3 – The B+ rectifier is listed in the service manual as a 0.4A, 1500 PIV Fast-Recovery Rectifier. The part originally populated in the Green Amplifone HV unit was an HY15F. Although no sub has been identified for that specific part number, an NTE558 will work in its place.

The following pages were extracted from Atari's Amplifone 19 and 25-Inch Color X-Y Display Service Manual. **PLEASE READ THEM, INCLUDING ALL SAFETY WARNINGS!**

For reference, the original, unedited manual can be found here:

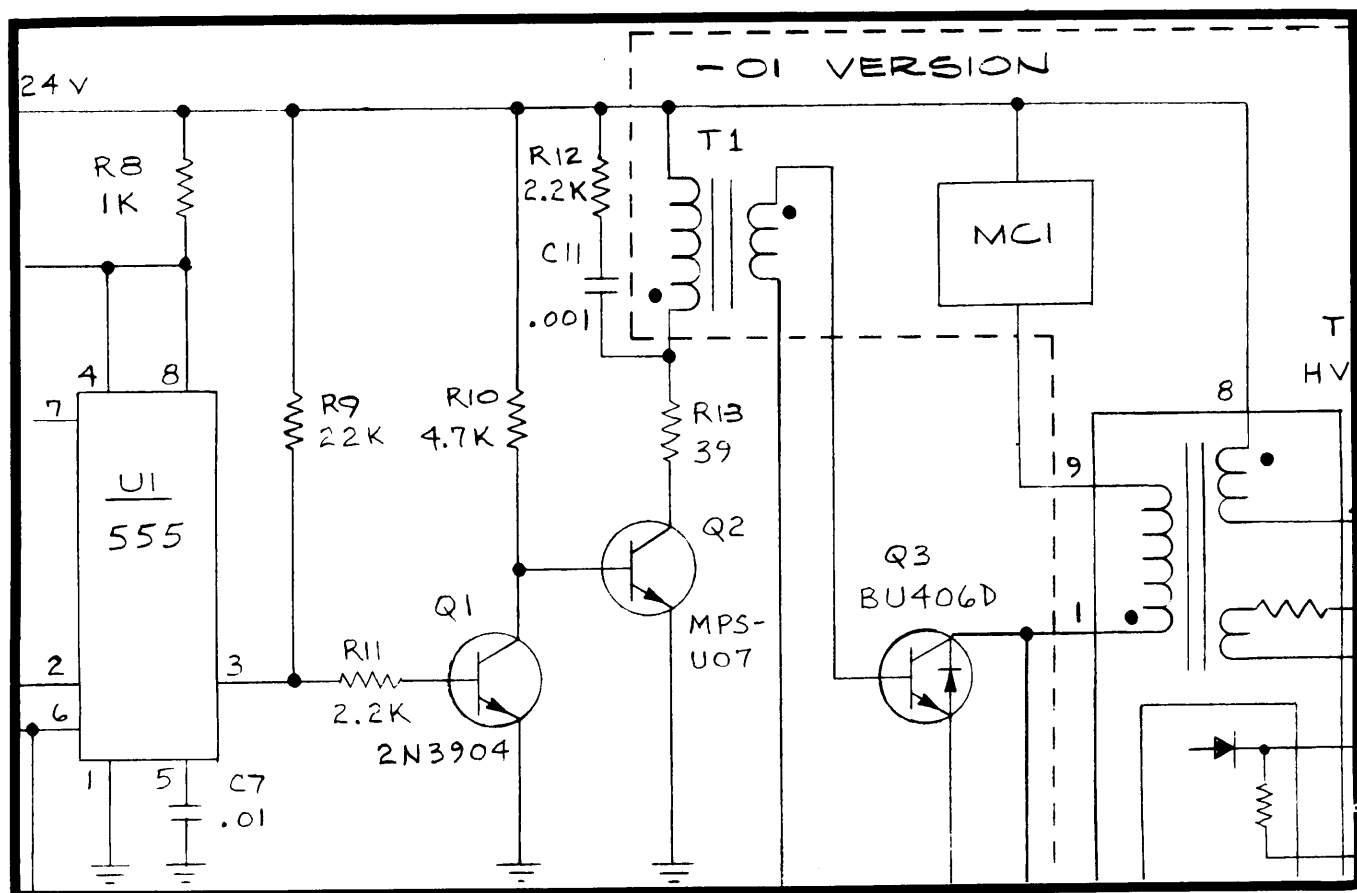
http://www.gamearchive.com/Video_Games/Manufacturers/Atari/monitors/amplifone/amplifone.pdf

(Thanks to Jess Askey for supplying the original manual scan.)

ATARI 19- and 25-Inch Color X-Y Display

Atari Part Nos: A200009-01 (19-Inch) & A200011-01 (25-Inch)

Service Manual Complete with Illustrated Parts Lists



Manufactured by Amplifone, Inc., Brownsville, Texas—
a wholly owned subsidiary of

Atari, Inc.
790 Sycamore Drive P.O. Box 906
Milpitas, California 95035

1 WARNINGS AND CAUTIONS

This color X-Y display has been built to Atari specifications by Amplifone, Inc. The display is not contained within a separate chassis; instead, each of the two printed-circuit boards (PCB) and the cathode-ray tube (CRT) assemblies is separately mounted inside the game cabinet. The Deflection PCB is mounted just to the right of the cathode-ray tube as viewed from the back of an upright cabinet. The High-Voltage PCB is mounted to the left of the cathode-ray tube in an upright cabinet. Input signals for the display are supplied through a 15-pin harness connector wired to the Deflection PCB.

A. Before You Start

Never attempt to work on a display until you are familiar with servicing precautions and procedures necessary for high-voltage equipment. Remember, any video display has at least three sources of possible danger:

- Strong electric shock, due to high voltage or AC line voltage
- X-ray radiation (when the display is incorrectly adjusted)
- Implosion

Therefore, never modify any circuit in this display.

Service a video display only after you are thoroughly familiar with all warnings and safety measures given in this chapter.

WARNINGS

High Voltage

This display contains lethal high voltages. To avoid danger, do not attempt to service the chassis until you take all precautions necessary for working on high-voltage equipment.

X-Radiation

This display has been designed to minimize X-radiation hazard. However, to avoid possible exposure to soft X-radiation, never modify the high-voltage circuitry.

Implosion Hazard

If you drop the cathode-ray tube and it breaks, it will implode! Shattered glass and the yoke assembly can fly 6 feet or more from the implosion site. Use care when replacing the cathode-ray tube.

B. Safety Measures

Good safety habits will allow you to take the proper precautions automatically, even if you are rushed. Whenever you work on a display assembly, always ground it first. Also, only use one hand. This avoids the possibility of carelessly putting one hand on electrical ground and the other on an electrical connection. Doing so could cause a severe electrical shock.

If you service the Atari 19- or 25-Inch Color X-Y Display on a test bench, use only the power supply that came with the game. (Refer to the parts list in the game manual for the Atari part number of the Power Supply Assembly for Color X-Y Games.) Do not use line voltage or a power supply from a black-and-white X-Y game, because the voltages produced by those sources will damage this display.

To prevent fire or shock hazard, never expose this display to moisture.

Periodically check for frayed insulation on wires. If you find frayed wires, remove and replace them with the same gauge, insulation type,

thickness, and length of wire. Always observe the original routing and length of harness wires.

Use extra precaution in the high-voltage-circuitry areas of the display. If a short circuit occurs, remove and replace any components that indicate they may have overheated.

C. Handling the Cathode-Ray Tube

Wear safety goggles and heavy gloves for protection whenever you handle a cathode-ray tube. Keep other people away if they are not wearing safety goggles. Never lift the cathode-ray tube only by the neck; the neck should be used only to guide the lifting process.

Use extreme care when handling the cathode-ray tube. Rough handling may cause the tube to implode. Do not scratch the glass or subject any undue pressure upon the tube at any time.

When you are servicing the cathode-ray tube, first discharge the high voltage on the anode connection to ground—not to the cabinet or other mounting parts. When discharging the anode, use a well-insulated 18 gauge wire jumper. Allow two minutes to pass and discharge the anode again.

D. Replace with Proper Components

Maintain the specified values of all components within the display. If you change the values of components, you may cause an increase in the high voltages.

The cathode-ray tube of this display employs integral implosion protection. For continued safety, replace it only with a tube of the same type number. Refer to the parts lists in Chapter 6 of this manual. Use only exact replacement parts, especially for those parts identified in the parts lists with the (!) symbol and on the schematics with shading.

E. Final Testing Before Reinstalling Display Assemblies

Before reinstalling any assembly of this color display into the game, inspect all harness wiring within the display area. Be sure no wires or cables are pinched between the cabinet and other parts in the display.

4 REPAIR

WARNING

Before removing or installing any component of this display, always disconnect the power source! Take the precautions regarding high voltages and cathode-ray tube handling when servicing this display.

Tools Required to Replace the Display Assemblies: 7/16-inch hex socket wrench, Phillips-head screwdriver, and a soldering iron.

A. Replacing the Cathode-Ray Tube**NOTE**

You must readjust the BRIGHTNESS control, R, G and B Bias and Drive whenever you replace the cathode-ray tube.

1. Disconnect the 15-pin video-signal connector, which is wired to the Deflection PCB.
2. Discharge the high voltage from the cathode-ray tube as follows:
 - a. Attach one end of a well-insulated 18-gauge wire jumper to the DAG spring.
 - b. Momentarily touch the free end of the jumper to the anode by sliding it under the anode cap.
 - c. Wait two minutes.
 - d. Discharge the anode again.
 - e. CAREFULLY remove the large high-voltage anode connector from the cathode-ray tube.

3. Unplug the socket from the rear of the cathode-ray tube.
4. Unplug the degaussing coil 2-pin connector from the Deflection PCB.
5. Unplug the 5-wire connector from the Deflection PCB.
6. Unhook the spring that runs across the back of the cathode-ray tube.
7. Unplug the 2-pin connector to the DAG spring that runs across the back of the cathode-ray tube.
8. Refer to the game manual for detailed instructions on removing the cathode-ray tube from the game cabinet.
9. Place the cathode-ray tube on a soft mat in a protected location.
10. To install a cathode-ray tube, reverse the order of this procedure.

C. Replacing the High-Voltage PCB

1. Discharge the high voltage from the cathode-ray tube using the procedure given in step 2 under "Replacing the Cathode-Ray Tube."
2. Unplug the socket from the rear of the cathode-ray tube.
3. Unplug the 9-pin connector that is wired to the Deflection PCB.
4. Unplug the 2-pin connector from the DAG spring.
5. Refer to the game manual for detailed instructions on removing the High-Voltage PCB from the game cabinet.
6. To install a High-Voltage PCB, reverse the order of this procedure.

E. Replacing the High-Voltage Transformer

1. Remove the High-Voltage PCB from the game as previously described under "Replacing the High-Voltage PCB."
2. Unsolder the white wire at the very top of the focus assembly.
3. Remove the two small hex nuts that secure the transformer to the High-Voltage PCB.

4. Unsolder the 7 transformer connections on the bottom side of the High-Voltage PCB.
5. Lift the transformer off the High-Voltage PCB.
6. Replace the transformer by reversing this procedure. Be sure to check the picture for sharpness. If appropriate, adjust FOCUS.

5 CONTROL ADJUSTMENTS

WARNING

Remember to take the precautions regarding high voltages when making adjustments on this display!

A. Adjusting the Focus

Adjust the FOCUS control if the screen image is not sharply defined. Figure 2 shows the location of the FOCUS control above the high-voltage transformer. Turn this control until you get optimum screen sharpness. This is the only control not preset by the factory.

B. Adjusting the Brightness

The BRIGHTNESS control is set at the factory and then sealed. Do not adjust the BRIGHTNESS control unless you replace the cathode-ray tube. Figure 2 shows the location of the BRIGHTNESS control above the high-voltage transformer. To adjust:

1. Turn on the display. Allow it to warm up at least 5 minutes.
2. Place the game in the attract or play mode.
3. Use a screwdriver to adjust the display for a pleasing level of brightness or adjust as indicated in the color-level test given in the game manual.

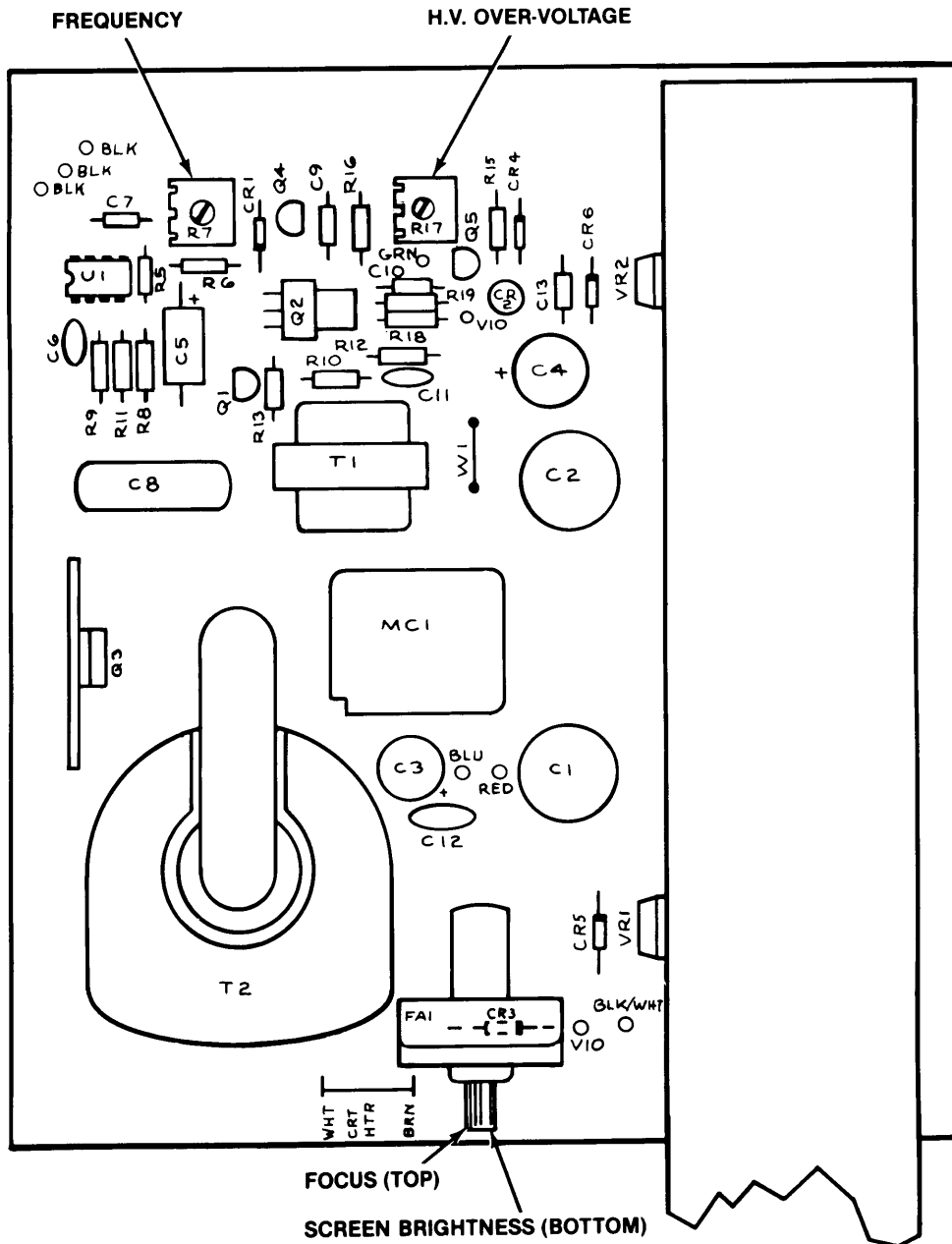


Figure 2 Adjustable Controls on the High-Voltage PCB

F. Adjusting the High-Voltage Power Supply

WARNING

To avoid possible electric shock, use extreme caution when making these high-voltage adjustments! Do not attempt to make these adjustments without the high-voltage probe!

1. Remove power from the display.
2. Attach the minus lead of the high-voltage probe to the DAG spring.
3. Connect the high-voltage probe to the anode connection of the cathode-ray tube by slipping it under the anode cap.
4. Apply power to the display.
5. Rotate HV OVER-VOLTAGE R17 to its fully counterclockwise position. Figure 2 shows the location of the HV OVER-VOLTAGE and FREQUENCY controls.
6. Rotate FREQUENCY R7 until you obtain a reading of +25 kV on the voltmeter.

7. VERY SLOWLY rotate HV OVER-VOLTAGE R17 until the voltmeter reading just drops to 0.
8. Turn the display power OFF and then ON. This resets the over-voltage protection circuit.
9. Readjust the FREQUENCY control for a voltmeter reading of +19.5 kV.
10. Remove power from the display and then remove the high-voltage probe from the anode connection.