

<http://www.crtsolutions.com/CRTSafety.pdf>

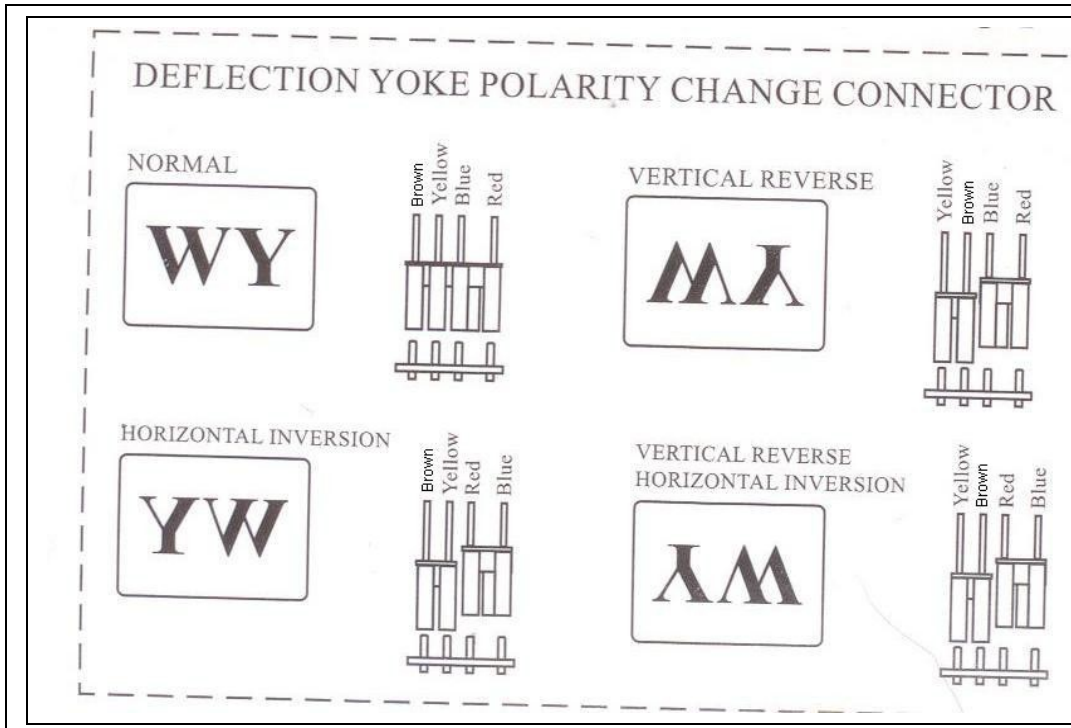
# CRT Safety and Engineering Notice

## YOKE PLUG ORIENTATION

Note: Your CRT has been provided with a Factory mounted yoke.

It has been designed to work with a variety of different chassis configurations, thus it may be necessary to correct the polarity of the image by simple means.

Below is a diagram explaining the various configurations.



Yoke harness color code:  
**Horizontal:** Red & Blue

**Vertical:** Yellow & Brown,  
or Yellow & Green, or  
Violet and Brown.

For instance, if your image appears upside-down and reverse, then by simply swapping the yellow and brown (Vertical) wires on the yoke connector will correct your image orientation. If your image is right side-up but backwards (Inverse) then all you need to do to correct the image orientation is swap the Red and Blue (Horizontal) wires. This is because some games use Mirrors, others mount the CRTs upside-down, or various other configurations.

## YOKE Plug / Connectors

Although your CRT may have been provided with the correct yoke, you may have to re-use your original yoke connector from your old CRT.

Yokes are provided with various connectors, depending on the chassis versions and requirements.

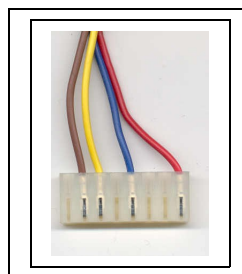
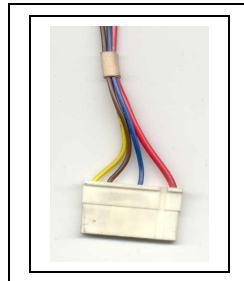
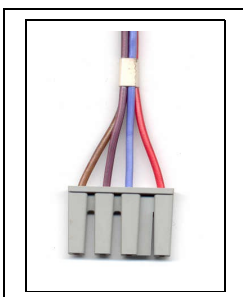
When swapping the connectors, simply maintain the color code on the connectors.

Splice the same color leads together, solder then heat shrink for insulation.

RED and BLUE for Horizontal. Yellow and Brown, Yellow and Green, Violet and Brown, etc for Vertical.

If the image is inverted or backwards, refer to the chart above for Orientation correction methods.

Here are some examples of different yoke connectors.



## **CRT Safety**

The CRT is a picture tube that operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself) and scatter fragments of glass. When working on or near a CRT, follow all safety rules and take every precaution against breaking the tube, especially at the neck where the tube is thinnest.

The following precautions must be taken to ensure your safety, especially when you are making adjustments on a live CRT.

### **CRT Safe Electrical Setup Precautions**

#### **Electric Outlet**

Be sure your outlet is correctly wired and properly grounded. Polarity and ground testers are available from most electronics stores.

Test all outlets in your service shop before working on any electrical equipment.

If you have any doubts about the wiring in your building, consult a qualified electrician.

#### **Adapter Plug**

Never use an adapter plug to connect a monitor's three-pronged power plug to a two-pronged wall outlet. Adapters defeat the ground pin, which is a safety feature.

#### **Buddies**

***Do not work on a CRT alone.***

If there is an accident, having someone else nearby could save your life. Apple recommends that your staff be trained in cardiopulmonary resuscitation (CPR).

#### **Metal Jewelry**

Remove rings, wristwatches, hanging necklaces, and other jewelry before performing repairs on a CRT.

Metal jewelry is an excellent conductor of electricity. Removing jewelry will reduce the possibility of electrical shock.

#### **Grounding Devices**

Never use a grounding wrist-strap or heel-strap or work on a grounded workbench mat when discharging a CRT or when performing live adjustments. Even though the straps and mats contain one meg-ohm resistors and conduct only small electrical charges, it is recommended that straps and mats be used only when working on "dead" (uncharged) equipment.

#### **Safety Goggles**

Wear safety goggles when working with a CRT. The CRT contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself) and scatter fragments of glass.

#### **Power**

Before working inside a monitor containing a CRT, turn off the power and disconnect the AC power cord. Certain parts of a monitor chassis are hot (electrified) when the unit is under power. Except when you must have the power on (for example, when making live adjustments), never work on a plugged-in monitor.

#### **One Hand**

Keep one hand in your pocket or behind your back when working on a live monitor. Working with only one hand reduces the risk of current passing through your heart, should you accidentally contact high voltage.

#### **Anode**

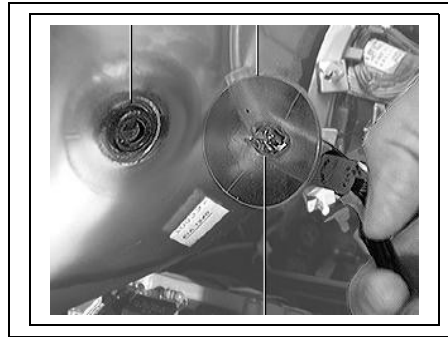
Discharge the anode before working inside the unit. See "Discharging the Cathode Ray Tube (CRT)" in this manual.

Some monitors and some Macintosh computers containing CRTs have a bleeder resistor on the anode that drains the charge when the power is turned off. Nevertheless, in case the resistor fails and leaves the anode fully charged, you must perform the discharge procedure.

### Anode Connector and Aperture

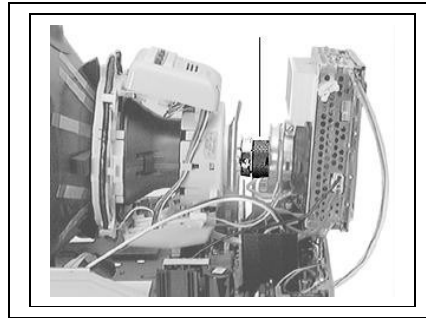
#### Warning:

Never touch the anode connector or the anode aperture. Normally, the anode aperture has a connector plugged into it. When a CRT is replaced, the anode connector is removed, exposing the anode aperture. If the bleeder resistor fails, the anode can retain a charge of several thousand volts (even when power is off) and can regain some charge even after it has been discharged.



#### CRT Neck Warning:

Do not pick up or handle a CRT by its neck, where the tube is the thinnest. To prevent an implosion, take every precaution against breaking the CRT.



### CRT Live Adjustment Rules

#### Plastic Adjustment Tool

When performing live adjustments, use a plastic adjustment tool or insulated screwdriver only.

#### Live Components

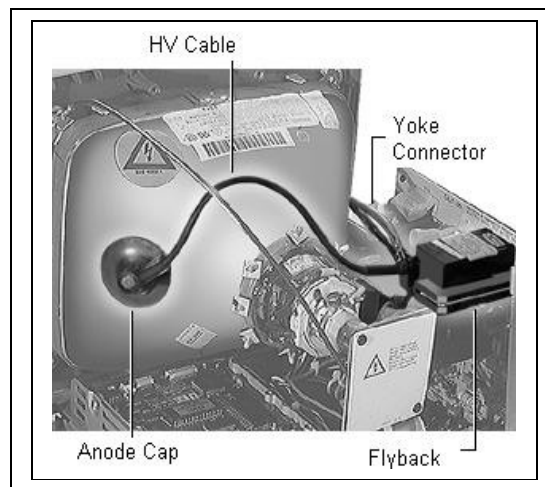
When adjusting a live monitor, never touch the components shown here (the actual location of these components will vary by product).

#### Warning:

Serious injury could result if you touch any of these components with the power on:

- High Voltage Cable
- Anode Cap
- Yoke Cable/Connector
- Flyback Transformer

In general, also avoid touching any soldered connections or exposed uninsulated wires.



## Discharging the Cathode Ray Tube (CRT)

In the following steps, you will discharge the high voltage from a cathode-ray tube (CRT). Discharging the tube before working on it lessens the chance of an electric shock.

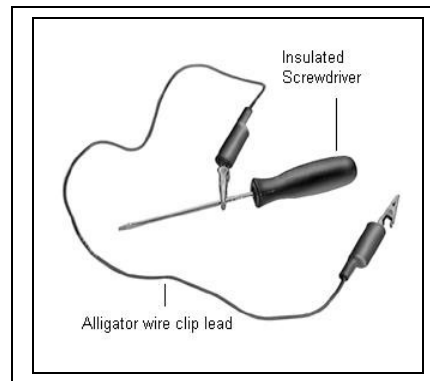
Most later video monitors are equipped with a bleeder resistor that automatically drains the charge from the CRT when the power is shut off. However, if the resistor fails, the anode may retain a charge. Thus, to ensure your safety, perform the following discharge procedure.

### Materials Required

- Safety goggles
- Ungrounded foam pad
- Needlenose pliers
- Alligator lead with clips at both ends
- CRT discharge tool

### Screwdriver and Wire Lead

If you do not have a discharge tool, you can use an insulated screwdriver attached to a wire lead with alligator clips on both ends as shown here. You should also use this discharge method as a follow-up after using the older discharge tools to ensure that the CRT is discharged.



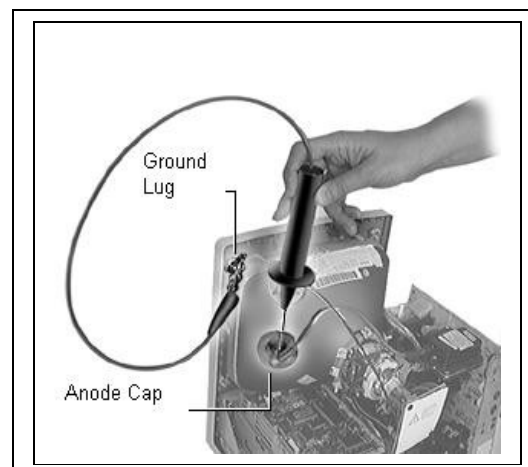
## CRT Discharge Procedure Overview

These are the major steps for discharging a CRT:

- 1 Set up a CRT-safe electrical area.
  - 2 Remove the housing.
  - 3 Attach the discharge tool to the ground lug on a built-in monitor. Attach the discharge tool to the metal chassis on a stand-alone monitor.
  - 4 Touch the discharge tool probe to the anode aperture.
- Detailed steps for the CRT discharge procedure follow.

### Touch Probe to Anode Aperture

- 1 Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.
- 2 Hold the CRT discharge tool to the tube surface, and slide the tool probe under the anode cap until the probe touches the anode aperture.
- 3 Remove the probe of the CRT discharge tool from under the anode cap.
- 4 Detach the discharge tool's alligator clip from the metal chassis ground lug.
- 5 **Warning:** If you performed this procedure using the older version of the discharge tool (and thus did not hear the electrostatic crack that confirms that the monitor discharged), ensure that the CRT is discharged by repeating the preceding four steps using the insulated flatblade screwdriver and alligator lead. Attach one



alligator clip to ground, and the other clip to the blade of the screwdriver.

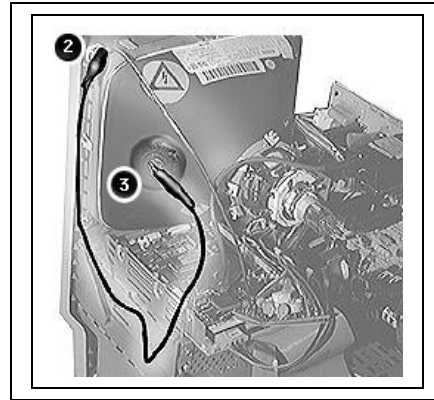
### **Establish an Ongoing Lead to Ground**

A discharged CRT can build up a charge. If a discharged CRT must remain exposed for any length of time, you must establish an ongoing lead to ground.

**Warning: 1** Be sure to discharge the CRT before attempting to establish an ongoing lead to ground.

**2** Connect one end of an alligator lead to ground.

**3** Connect the other end of the alligator lead to the anode aperture.



Information Provided by:

1. [CRT Solutions](#)
2. Apple Service