



Macintosh 16 Color Display





Basics

Macintosh 16" Color Display





Monitor Distortion

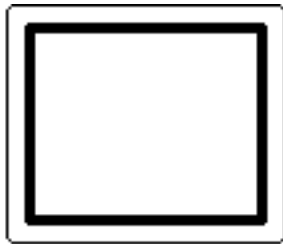
Overview

All large-screen monitors are susceptible to distortions caused by environmental conditions. These distortions are usually not visible on monitors with smaller screens.

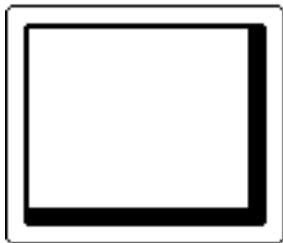
Important: Even monitors set to factory specifications may appear distorted when set up in a new environment.

Common environmentally-caused distortions are shown on this and the following pages. Always check first for environmental causes before attempting to repair or adjust a monitor with a distorted raster.

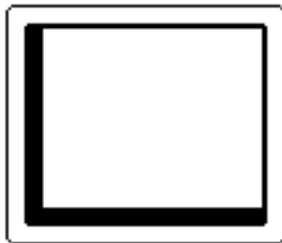




Ideal Raster



Raster Shifted Up
and Left



Raster Shifted Right

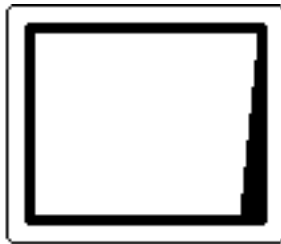


Environmental Influences

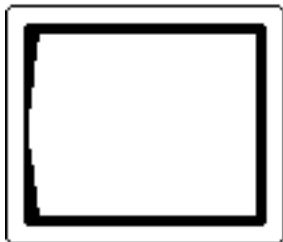
The following environmental conditions may distort the raster of a 16-Inch Color Display:

- Proximity to metal objects, such as metal desks, file cabinets, and bookshelves. Metal objects affect the earth's magnetic field. Earth magnetism usually distorts only the edges of the screen.
- Fluorescent lights, other monitors, or electronic appliances such as coffee makers and copy machines. These objects cause dynamic raster distortion, that is, movement or jitter of the image.

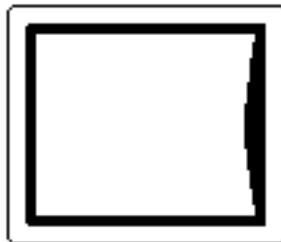




Right Edge Not Straight



Left Side Bowed Out



Right Side Bowed In



Troubleshooting

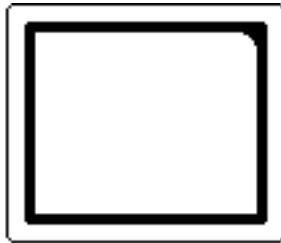
Important: Module swapping cannot fix a monitor with environmental distortion problems, and adjusting a monitor with such problems alters the factory settings.

Note: If the monitor has shifted up/down or right/left only, go ahead and adjust it using the centering controls. However, keep in mind that if you then move the monitor you may need to readjust the centering controls.

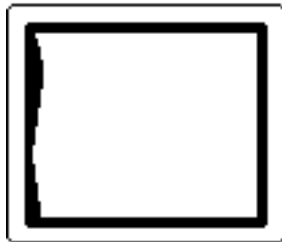
Before adjusting a monitor with a distorted raster, try the following:

- Swivel or move the monitor, or
- Remove the monitor from the building and recheck it in another location.





Upper-Right Corner Rounded



Left Edge S-Shaped



Raster Tilted Right



If the display changes (for better or worse) when you move it to another location, the environment is the source of the problem. Relocate your monitor or remove the distortion-causing object.

If the display does not change when you move it to another location, continue troubleshooting the problem (refer to the Troubleshooting chapter).



Specifications

Macintosh 16" Color Display



Characteristics

Picture Tube

17-in. diagonal, 16-in. viewable screen
Trinitron CRT; .26-mm pitch aperture grill
High-contrast glass with antiglare, anti-static coating

Screen Resolution

832x624; 70 dpi
Displays up to 256 colors with Macintosh Display Card 8•24
(rev B) or 8•24GC (rev B)

Scan Rates

Vertical refresh rate: 75 Hz
Horizontal scan rate: 50 kHz

Active Video Display Area

11.8 in. by 8.86 in.
(300 mm by 225 mm)





Input Signals

Video: red, green, and blue analog signals; RS-343 standard



Controls and Ports

User Controls

Front panel: power switch, brightness and contrast controls
Automatic degauss at power on

I/O Ports

Three Apple Desktop Bus (ADB) connectors





Physical and Electrical

Power Supply

Universal power supply

Voltage: 90–270 VAC, self-configuring

Frequency: 47–63 Hz

Power: 130 W maximum

Size and Weight

Height: 15.7 in. (400 mm)

Width: 16 in. (405 mm)

Depth: 16 in. (405 mm)

Weight: 50 lb. (23 kg)





Monitor Stand

Tilt-and-swivel base attached to the monitor

Three ADB ports (two ADB ports are in the front of the base and one ADB port is at the rear of the base)

Sound-in and sound-out ports (to the CPU) at the rear of the base

Microphone input and speaker/headphone output ports at the front of the base



Operating Environment

Temperature

50°F–95°F (10°C–35°C)

Humidity

95% maximum, noncondensing





Troubleshooting

Macintosh 16" Color Display



General

The Symptom Charts included in this chapter will help you diagnose specific symptoms related to your product. Because cures are listed on the charts in the order of most likely solution, try the first cure first. Verify whether or not the product continues to exhibit the symptom. If the symptom persists, try the next cure. (Note: If you have replaced a module, reinstall the original module before you proceed to the next cure.)

If you are not sure what the problem is, or if the Symptom Charts do not resolve the problem, refer to the Flowchart for the product family.

For additional assistance, contact Apple Technical Support.





Symptom Charts

No Raster

No raster, LED off

- 1 Check power cord and power switch.
- 2 Check all main board cable connections.
- 3 Replace blown fuse.
- 4 Replace main board.

No raster, LED on,
CRT filament on

- 1 Adjust contrast and brightness knobs.
- 2 Verify that video card in computer is working properly.
- 3 Check connectors on main board and CRT/video board.
- 4 Perform video adjustments.
- 5 Replace main board.
- 6 Replace CRT/video board.
- 7 Replace CRT.





No Raster (Continued)

No raster, LED on, no CRT filament, high voltage OK

- 1 Check connection at D-5 on main board.
- 2 Check continuity of D-5 cable from H pins on CRT socket. If bad, replace CRT/video board.
- 3 Replace main board.





Geometry

Raster too short, tall,
narrow, or wide

- 1 Adjust vertical or horizontal size controls.
- 2 Replace main board.

Raster not centered

- 1 Verify that distortion is not due to environmental conditions.
Move monitor to another location.
- 2 Adjust horizontal shift or vertical center controls.
- 3 Replace main board.

Horizontal linearity
bad (size of text
differs at sides of
screen)

Replace main board.





Geometry (Continued)

Vertical linearity bad
(size of text differs at
top vs. bottom of
screen)

- 1 Adjust vertical linearity control.
- 2 Replace main board.

Abnormal or
distorted raster

- 1 Move unit away from monitors or other electrical equipment.
- 2 Perform geometry adjustments.
- 3 Replace main board.
- 4 Replace CRT.

Entire raster tilted

Move unit away from monitors or other electrical equipment.





Synchronization

Picture breaks into diagonal lines	1	Connect another monitor to computer. Verify video signal.
	2	Replace main board.
Picture rolls vertically	1	Verify that video card in computer is working properly.
	2	Replace main board.
Picture breaks and rolls horizontally	1	Verify that video card in computer is working properly.
	2	Replace main board.
Single vertical or horizontal line appears on black raster	1	Verify that CRT/video board is tight on yoke connector.
	2	Replace main board.
	3	Replace CRT.





Video

Predominant color tint, or cannot adjust color

- 1 Verify that video card in computer is working properly.
- 2 Make sure switch SW1 on bottom of CRT/video board is toward neck of CRT. See "CRT/Video Board" in the Take Apart chapter for additional information.
- 3 Perform video adjustments.
- 4 Replace CRT/video board.
- 5 Replace CRT (if you cannot eliminate red, green, or blue tint).

Picture too dark, too bright, or washed out

- 1 Adjust contrast and brightness knobs.
- 2 Verify that video card in computer is working properly.
- 3 Perform video adjustments.
- 4 Replace CRT/video board.
- 5 Replace main board.
- 6 Replace CRT.





Video (Continued)

- | | |
|--|--|
| Out of convergence
(color bleeding out
from text or lines) | <ol style="list-style-type: none">1 Perform convergence adjustment.2 Replace CRT. |
| Green vertical line on
left side of screen | <ol style="list-style-type: none">1 Make sure switch SW1 on bottom of CRT/video board is toward neck of CRT.2 Perform video adjustments.3 Replace CRT/video board.4 Replace CRT (if you cannot eliminate red, green, or blue tint). |
| Out of focus | <ol style="list-style-type: none">1 Perform focus adjustment.2 Replace CRT.3 Replace main board.4 Replace focus control. |





Miscellaneous

Intermittently shuts down

Replace main board.

Picture jitters or flashes

- 1 Check all ground cable connections.
- 2 Verify that adjacent computer equipment is properly grounded.
- 3 Move electrical devices away from monitor. Shut off fluorescent lights near monitor.
- 4 Replace main board.

Flashing or wavy screen

Replace main board.

Black spots appear on screen (burnt phosphors)

Replace CRT.





Miscellaneous (Continued)

Does not degauss	Replace main board.
Erratic or no communication with ADB device	<ol style="list-style-type: none">1 Replace keyboard cable, keyboard, mouse, or other ADB device.2 Replace ADB cable in monitor stand.
Emits high-pitched noise	Replace main board.
Thin horizontal lines on screen	Displays larger than 15 inches with tron-style CRTs typically have two wires, each about one-quarter to one-third of the way from the top and bottom of the display image. These supporting wires, which are thinner than a human hair, stabilize the aperture grill against shocks. The lines are common to all tron-style displays and are not screen defects. They cannot be adjusted out or eliminated by repairing or replacing display modules.





Take Apart

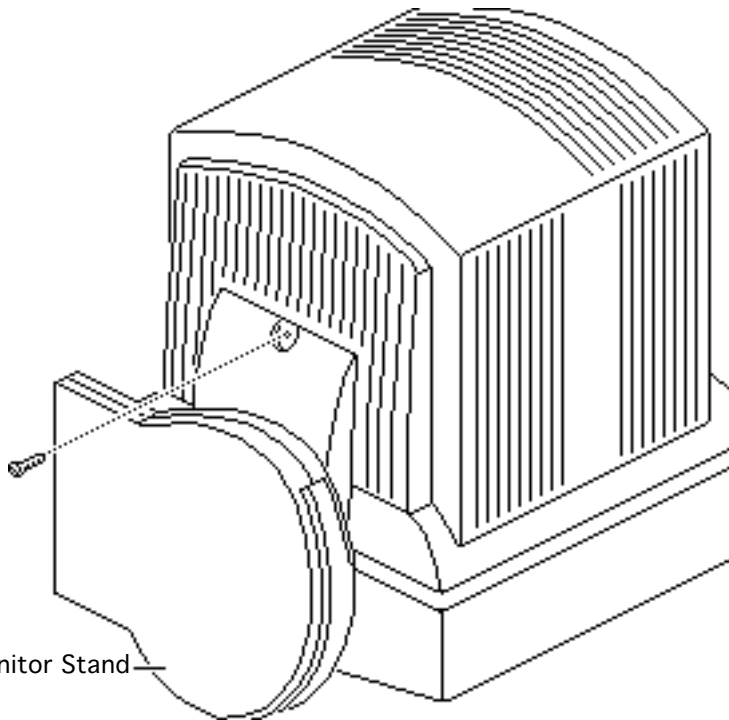
Macintosh 16" Color Display



Monitor Stand

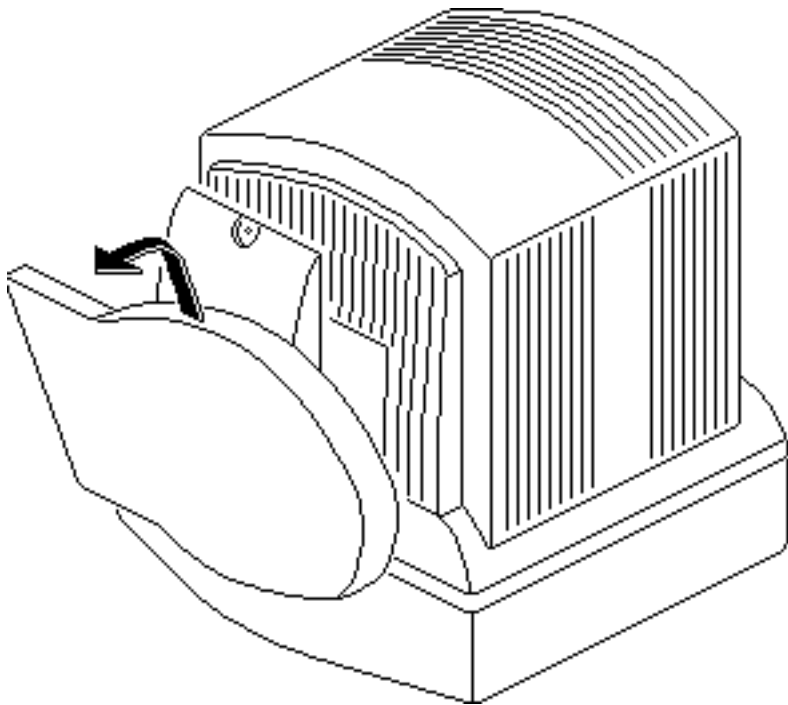
No preliminary steps are required before you begin this procedure.

- 1 With the monitor face-down on a protective pad, swivel the base to access the monitor stand mounting screw. Remove the mounting screw.



Monitor Stand





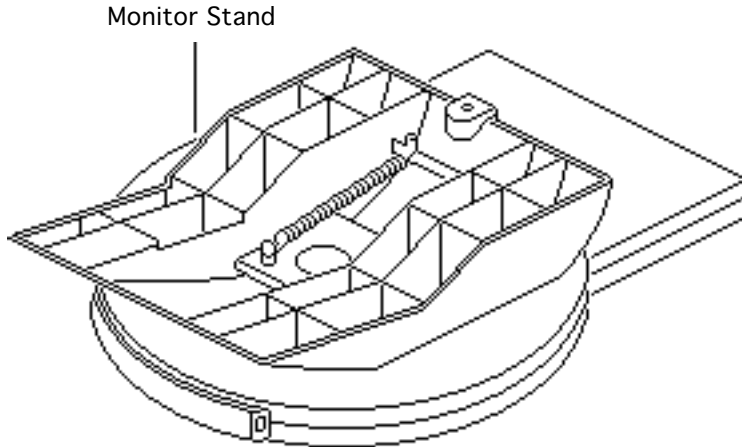
- 2 Lift the monitor stand out of the bezel.
- 3 If you do not plan to work on the monitor, return the monitor to an upright position on the protective pad.

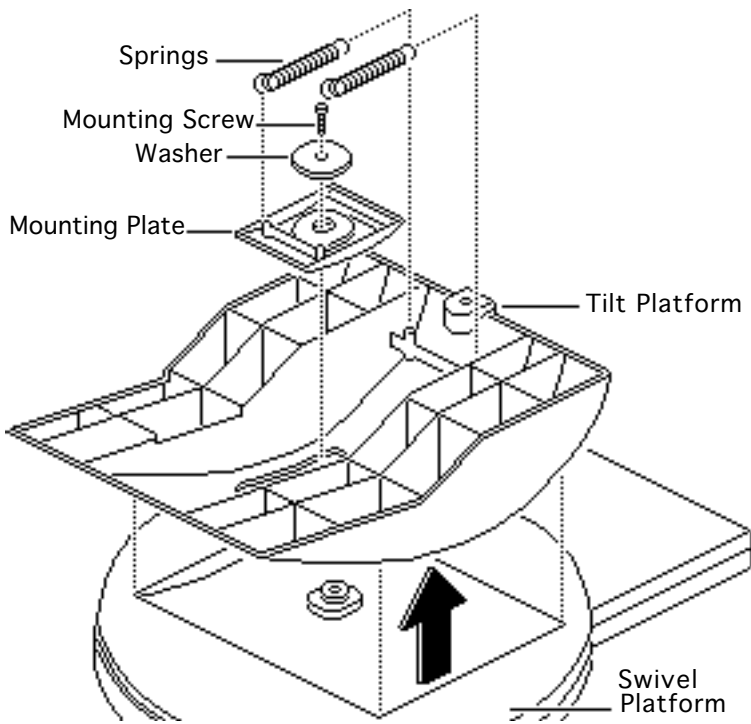


Monitor Stand Cables

Before you begin, remove the monitor stand.

Note: The monitor stand includes sound-in and sound-out cables and an ADB speaker board. You can replace the monitor stand as an assembly, or you can replace its parts individually.



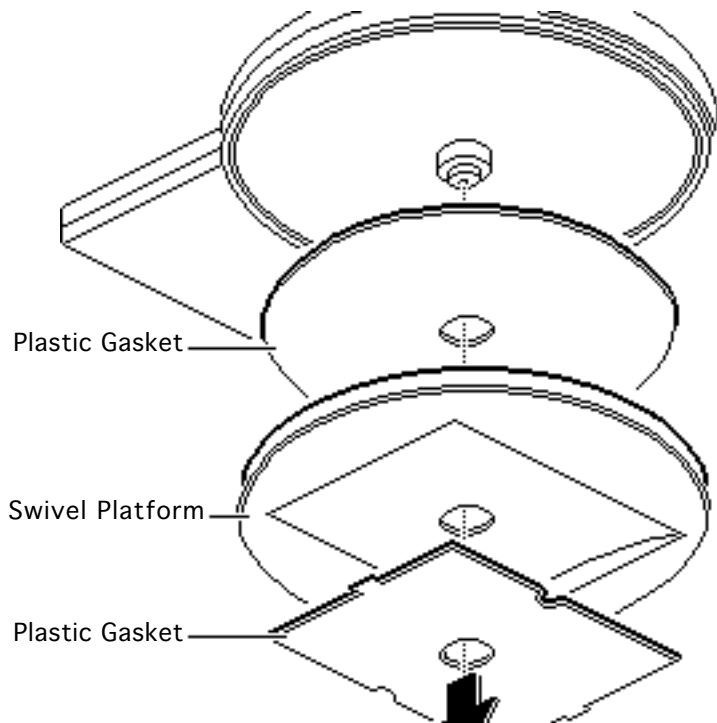


- 1 Unhook the two springs and remove the mounting screw that secures the tilt-swivel platform to the base.
- 2 Remove the mounting plate (with washer) and separate the tilt platform from the swivel platform.

Replacement Note:

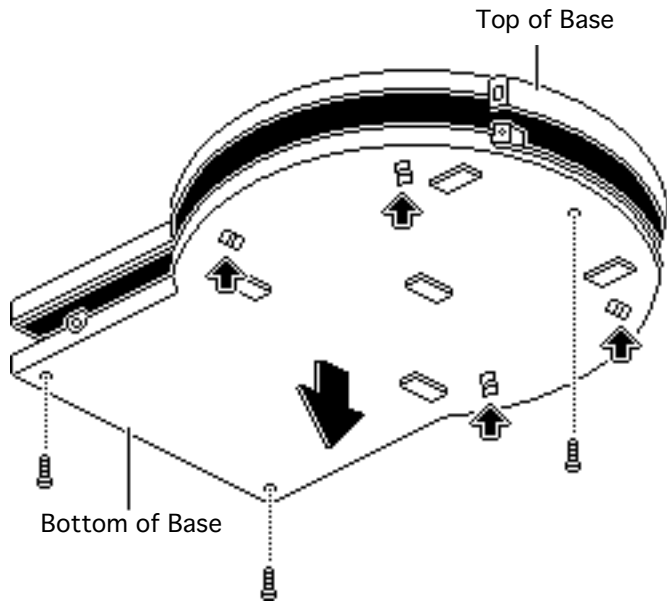
When replacing the tilt and swivel platforms, align the arrows etched on the platforms with the front of the base.





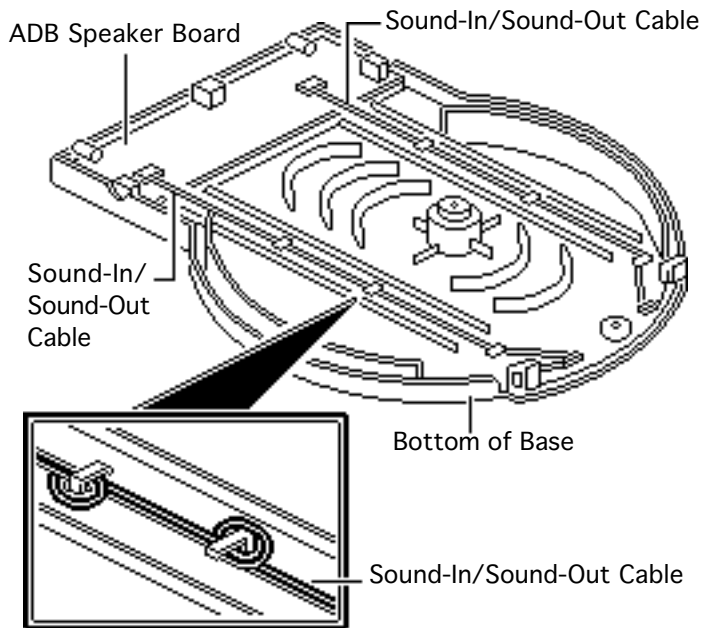
- 3 Turn over the base and allow the swivel platform and two plastic gaskets to drop out.





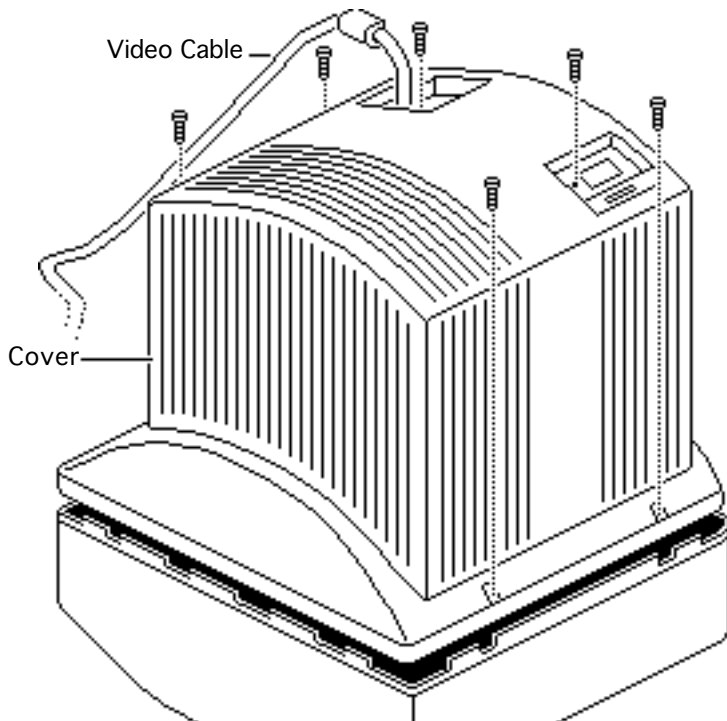
- 4 Remove the three screws, push out the four release tabs, and separate the bottom from the top of the base.
- 5 Place the bottom of the base on the protective pad.





- 6 Disconnect the sound-in and sound-out cables from the ADB speaker board.
- 7 If defective, remove the ADB speaker board.
- 8 Unlace the defective cable(s) from the bottom of the base and remove the cable connector(s) from the plastic mounting bracket(s).



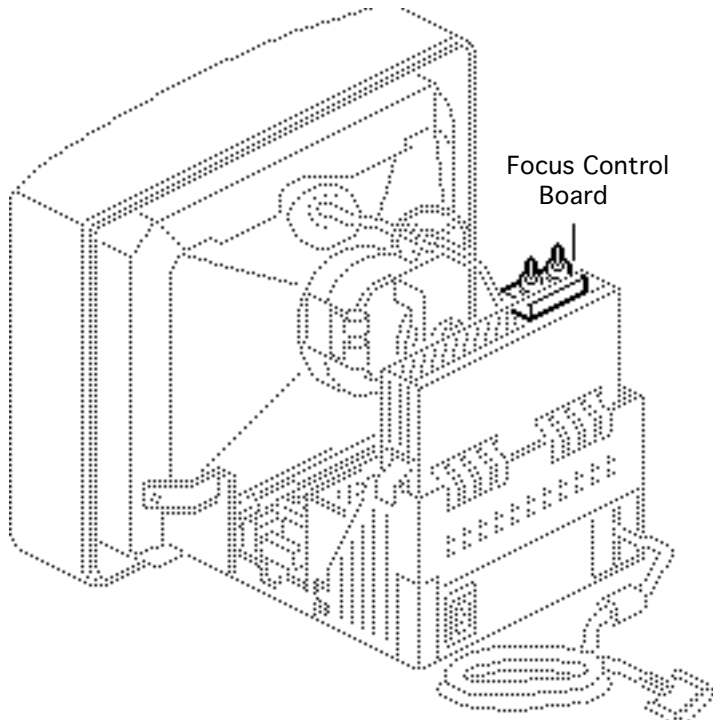


Cover

Before you begin, remove the monitor stand.

With the monitor face-down on a protective pad, remove the six case screws and pull the cover off the chassis. Feed the video cable through the cover.





Focus Control

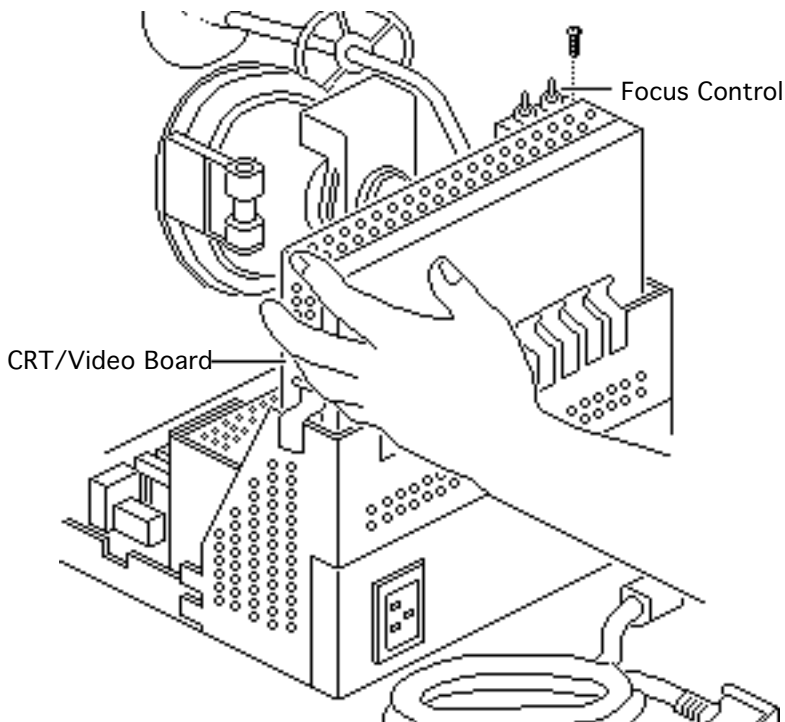
Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT

⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.

⚠ Warning: Never use a grounding wriststrap until after discharging the CRT.

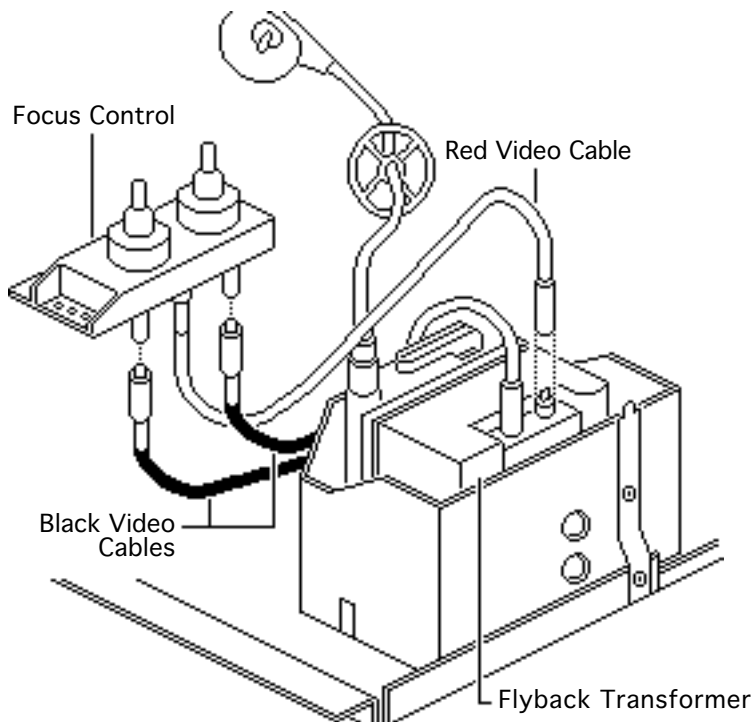




Caution: When removing the focus control from the CRT/video board, be careful not to apply excessive pressure to the neck of the CRT.

- 1 Brace the CRT/video board with one hand and remove the screw that secures the focus control to the CRT/video board.



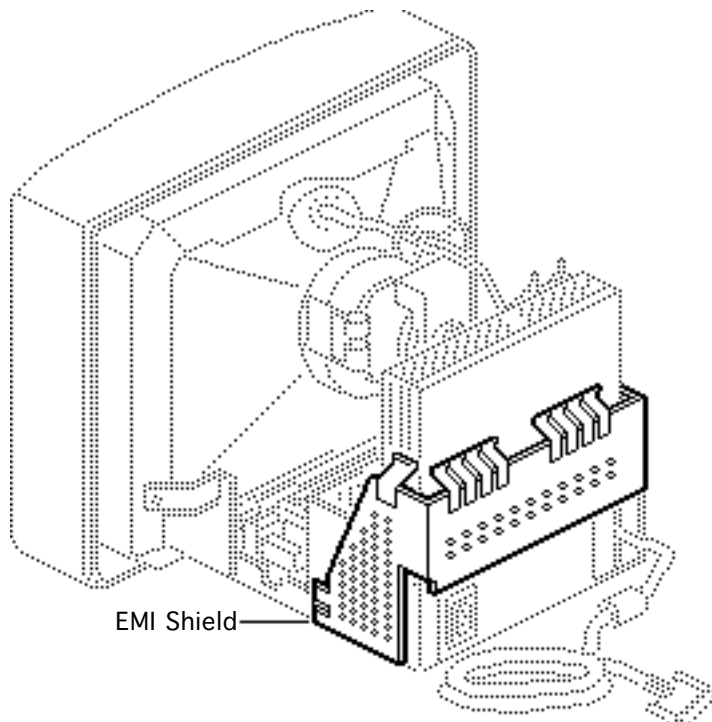


- 2 **Caution:** Reversing the black video cables that connect to the focus control could damage the monitor. When removing these cables, be sure to mark them for correct installation later.

Disconnect the red video cable from the flyback transformer and the two black video cables from the terminals beneath the focus control.

- 3 Remove the focus control.





EMI Shield

Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT

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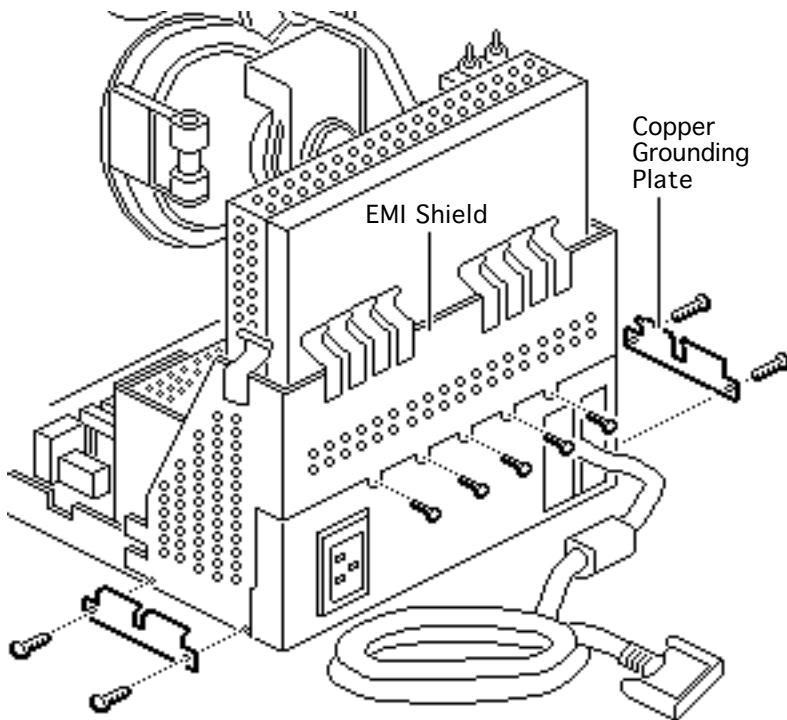
⚠ Warning: Never use a grounding wriststrap until after discharging the CRT.





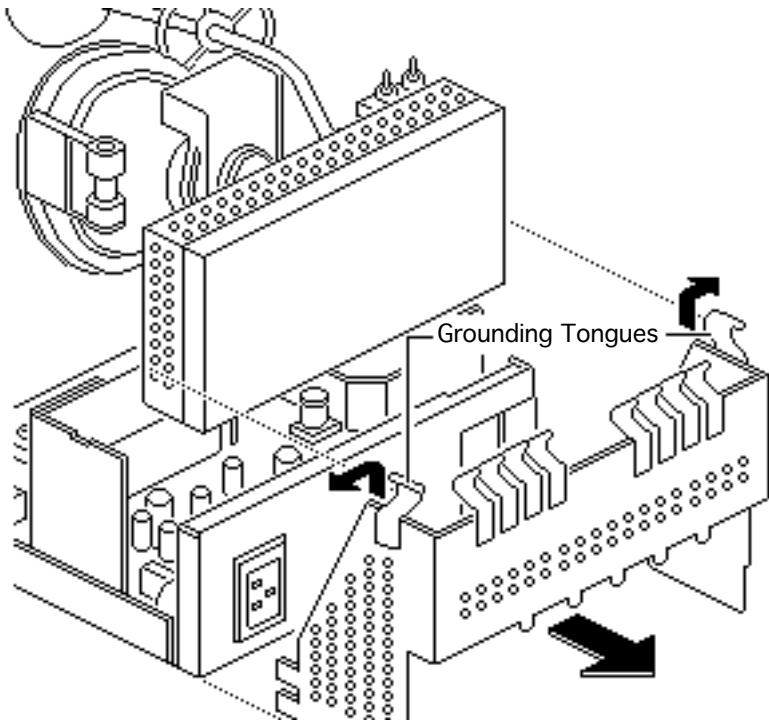
Note: The EMI shield is not replaceable. Perform this procedure only when you must remove the EMI shield to access another module.





- 1 Remove the five small screws from the back of the shield.
- 2 Remove the four larger screws and the two copper grounding plates from the sides of the EMI shield.





- 3 Pull out the grounding tongues at the sides of the EMI shield and slide the shield off the CRT/video board.

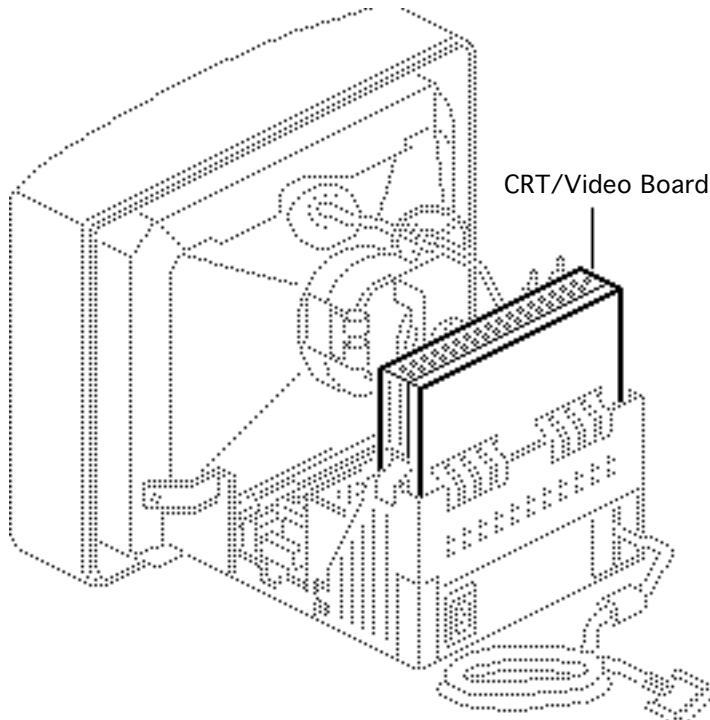


CRT/Video Board

Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT
- Remove the focus control
- Remove the EMI shield

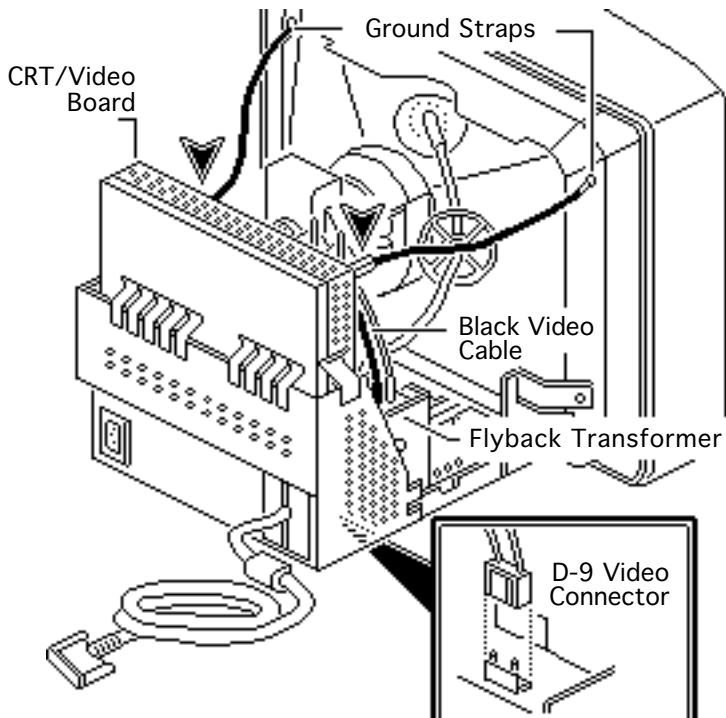
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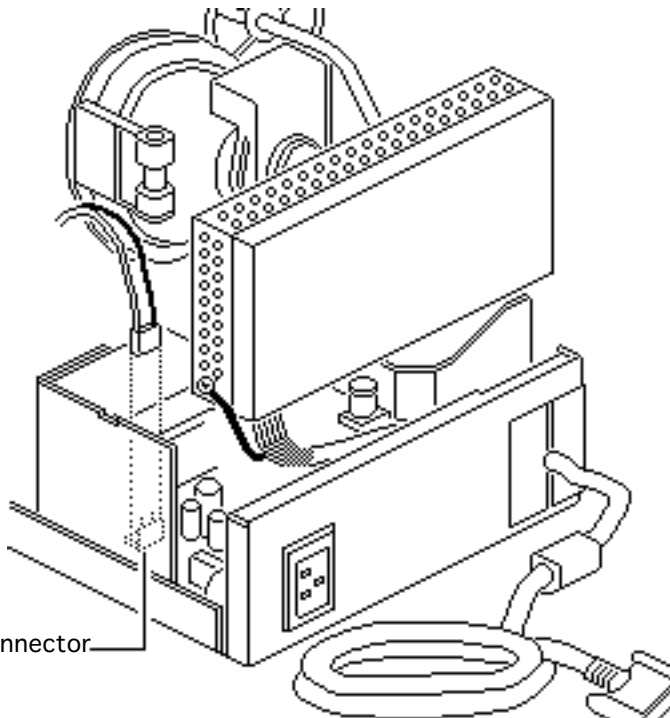
- 1 Disconnect the two ground straps from the terminals on the front of the CRT/video board.
- 2 Disconnect the long black video cable from the flyback transformer.
- 3 Disconnect the 2-wire cable from connector D-9 on the main board.

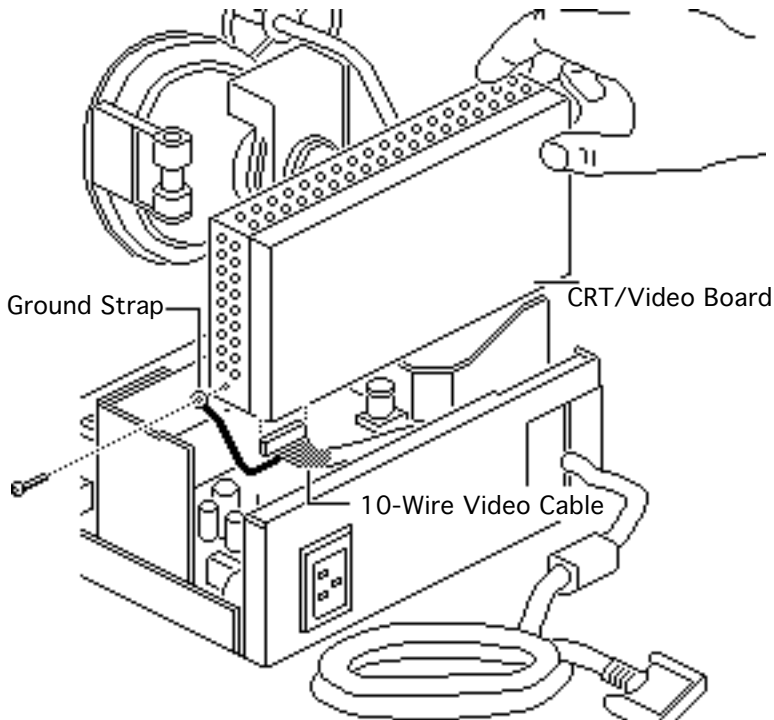




- 4 Disconnect the 2-wire cable from connector D-5 on the main board.

D-5 Connector



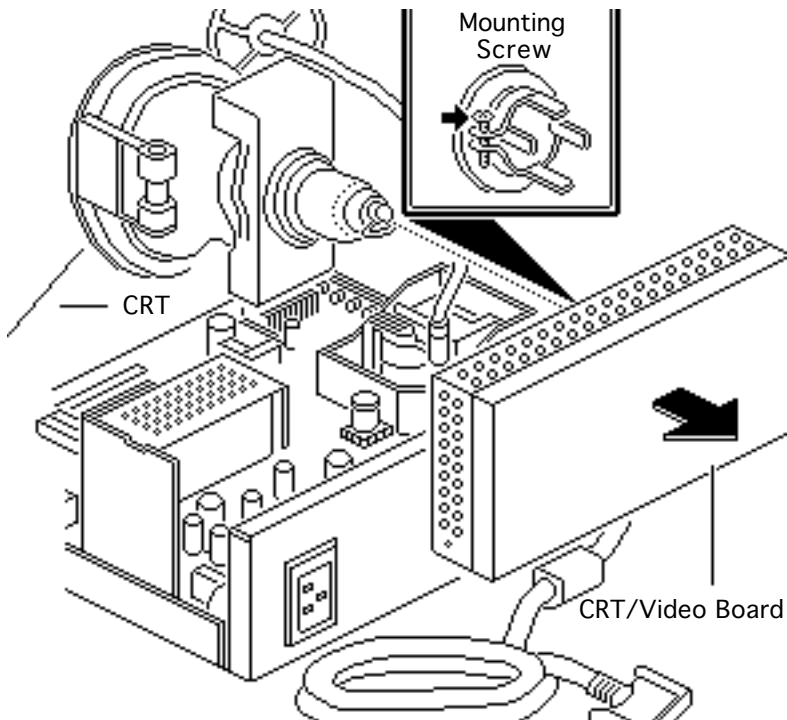


- 5 **Caution:** When removing the ground strap from the CRT/video board, be careful not to apply excessive pressure to the neck of the CRT.

Brace the CRT/video board with one hand and remove the screw and ground strap from the side of the CRT/video board.

- 6 Disconnect the 10-wire video cable from the CRT/video board.

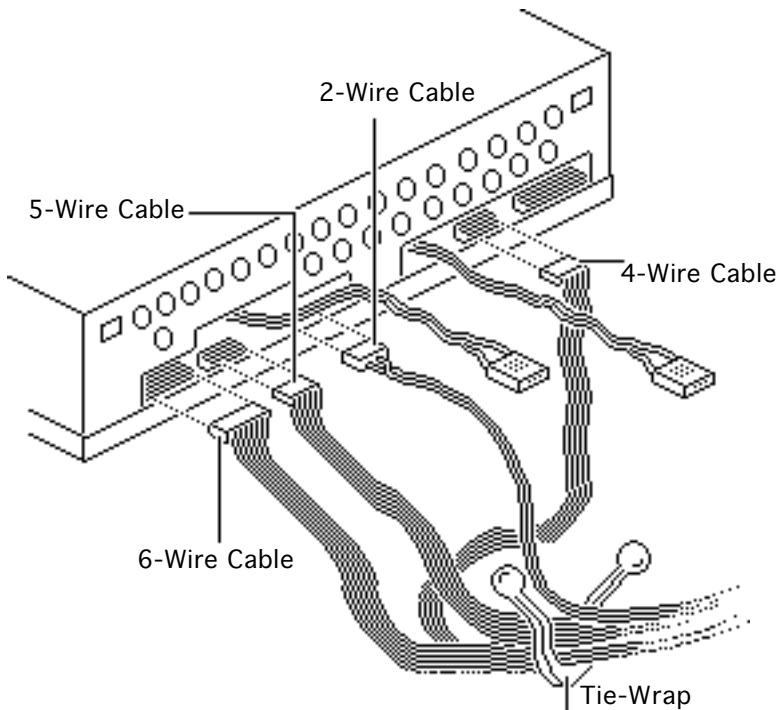




- 7 **Caution:** Twisting, bending, or applying force to the CRT/video board could damage the neck of the CRT. Be sure to pull the CRT/video board straight off the CRT.

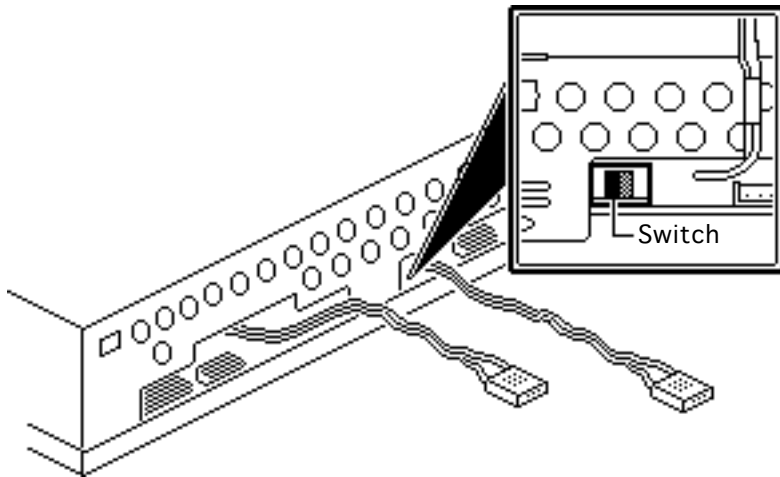
Loosen the mounting screw and pull the CRT/video board straight off the neck of the CRT.





- 8 Disconnect these cable connectors from the CRT/video board:
 - 4-wire contrast/ brightness cable
 - 2 - wire ground cable
 - 5-wire cable
 - 6-wire cable
- 9 Remove the CRT/video board wires from the tie-wrap.





Replacement Note: Make sure switch SW1 is in the position shown. Otherwise the color adjustments will not be accurate and will display an over saturation of green.





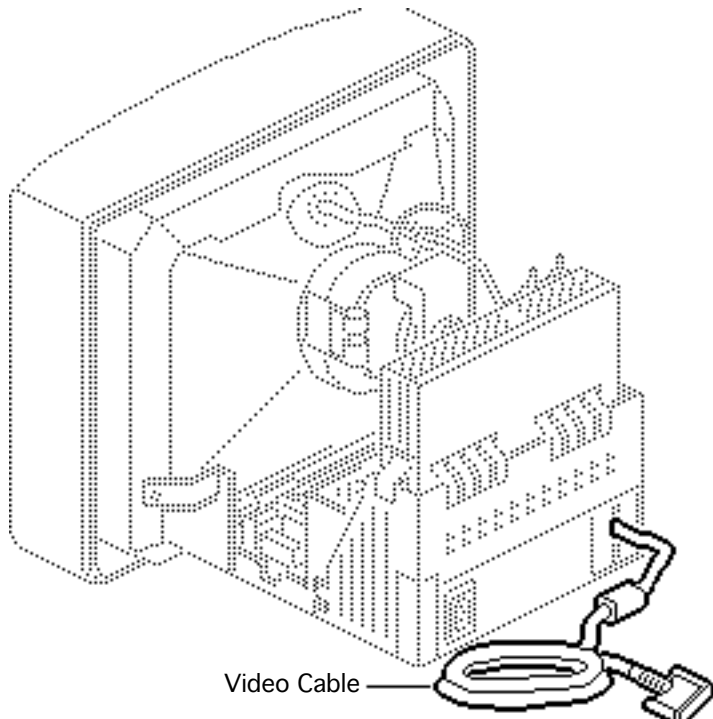
Video Cable

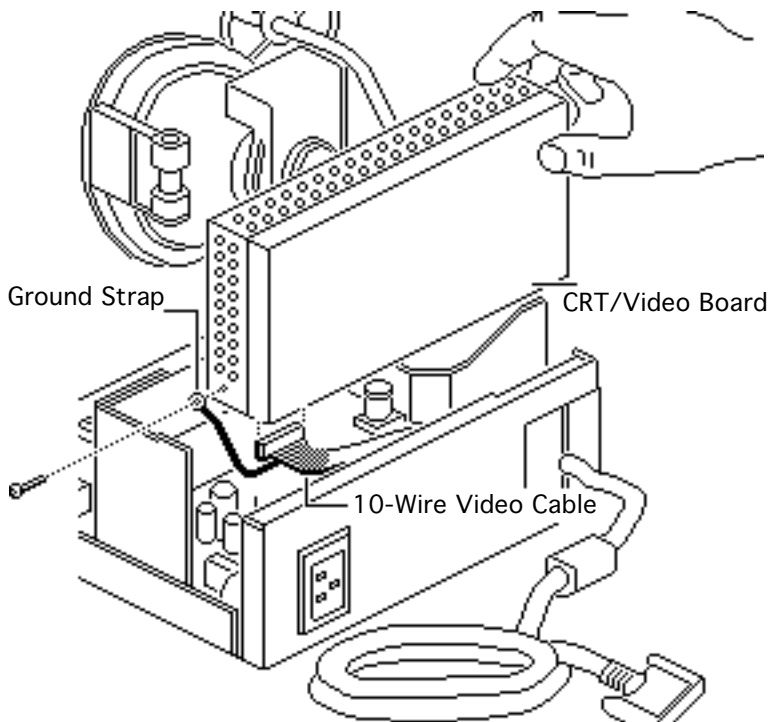
Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT
- Remove the EMI shield

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⚠ Warning: Never use a grounding wriststrap until after discharging the CRT.

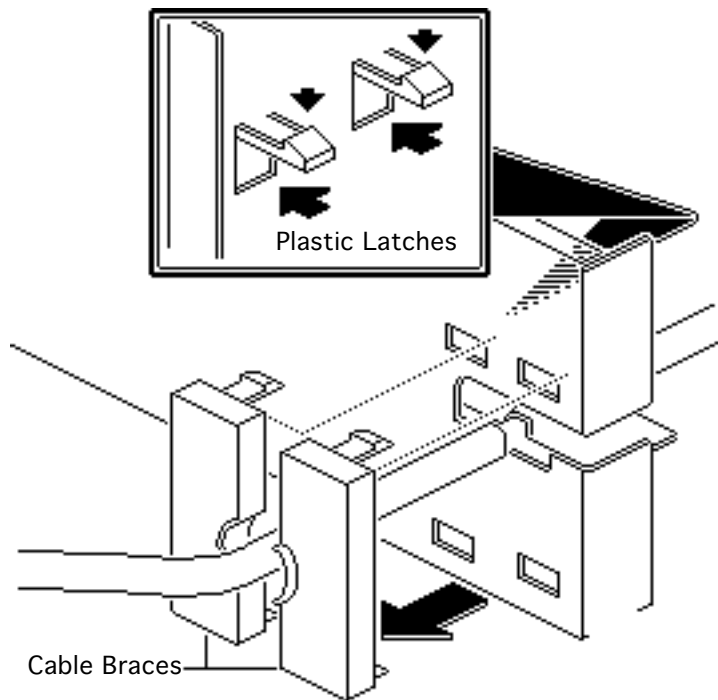




Caution: When removing the ground strap from the CRT/video board, be careful not to apply excessive pressure to the neck of the CRT.

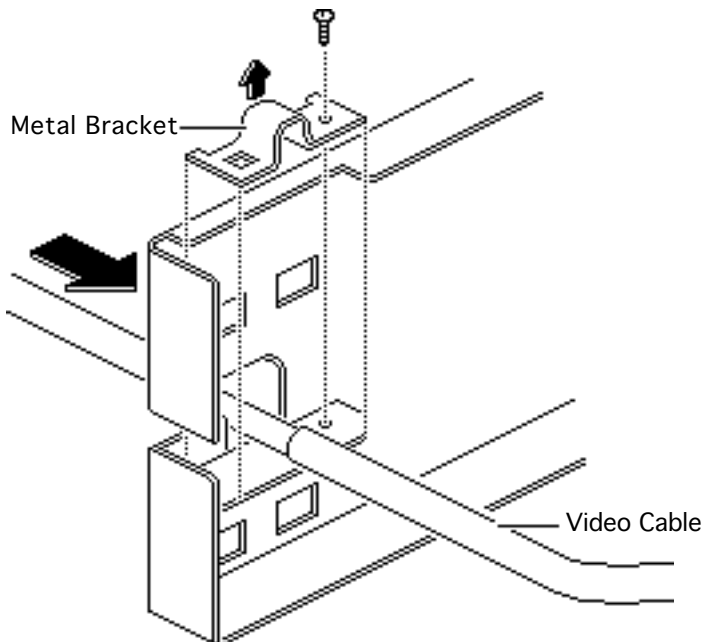
- 1 Brace the CRT/video board with one hand and remove the screw and ground strap from the side of the CRT/video board.
- 2 Disconnect the 10-wire video cable from the bottom of the CRT/video board.





- 3 Release the four plastic latches. Pull the left and right cable braces off the chassis.





- 4 Remove the cable mounting screw. Push in the cable to release the metal bracket.
- 5 Pull out the video cable.



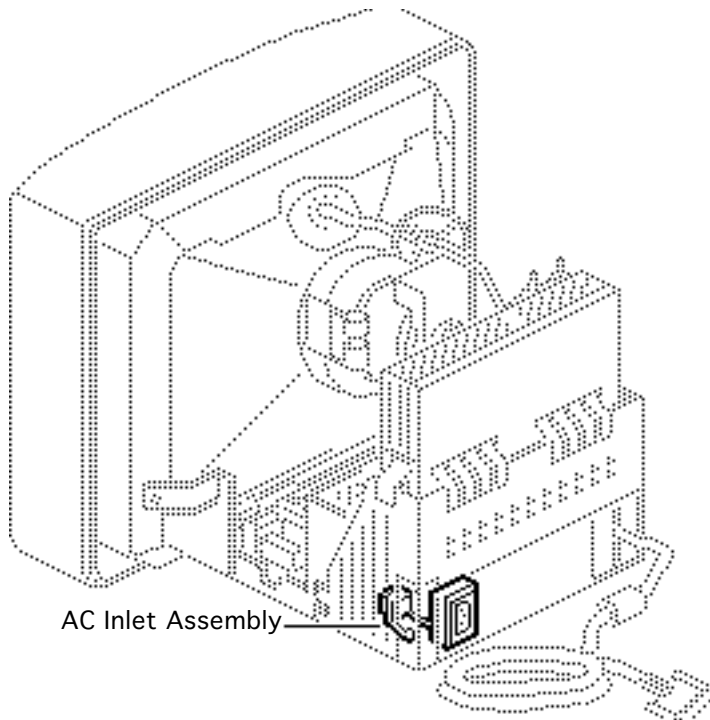


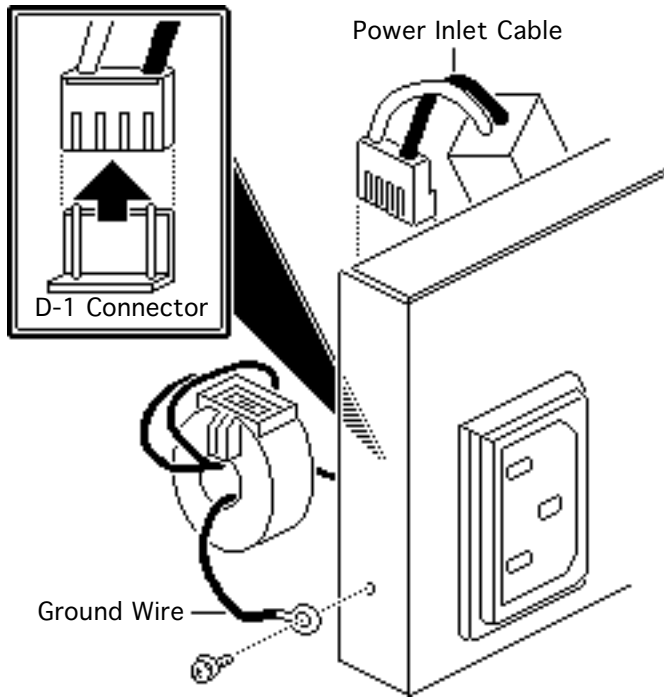
AC Inlet Assembly

Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT
- Remove the EMI shield

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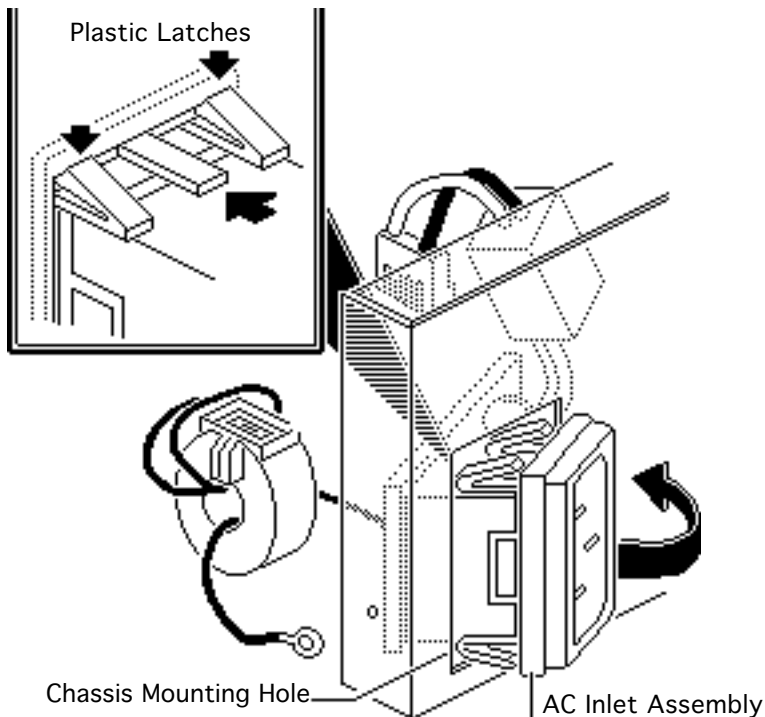




⚠ Warning: Never use a grounding wriststrap until after discharging the CRT.

- 1 Remove the screw (with captive lockwasher) and the inlet assembly ground wire from the chassis.
- 2 Disconnect the 2-wire power inlet cable from connector D-1 on the main board.





- 3 Release the four plastic latches and pull the AC inlet assembly off the chassis. Pivot the inlet assembly and carefully pull it from the chassis mounting hole.

Replacement Note:

When replacing the AC inlet assembly, insert the power inlet cable and ground wire through the chassis mounting hole before inserting the circuit card end of the AC inlet assembly.



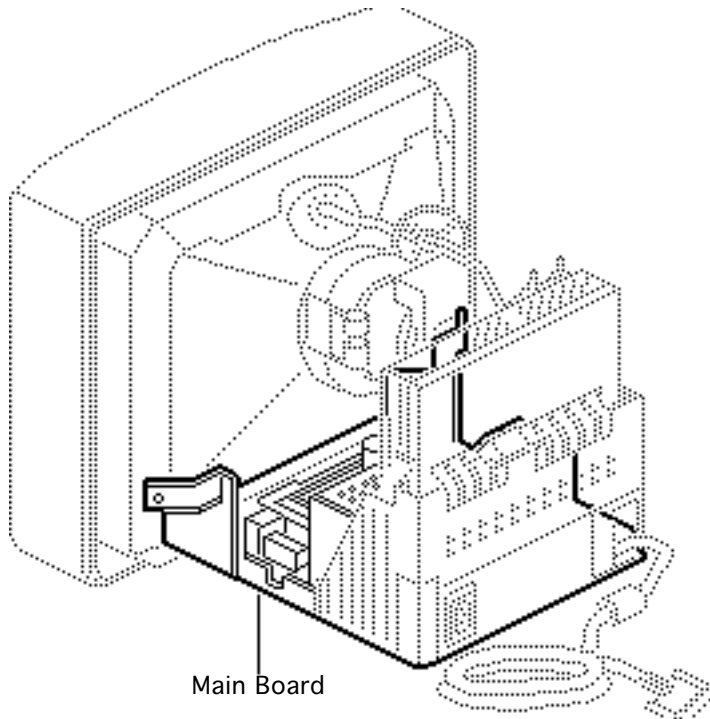


Main Board

Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT
- Remove the anode cap
- Remove the EMI shield

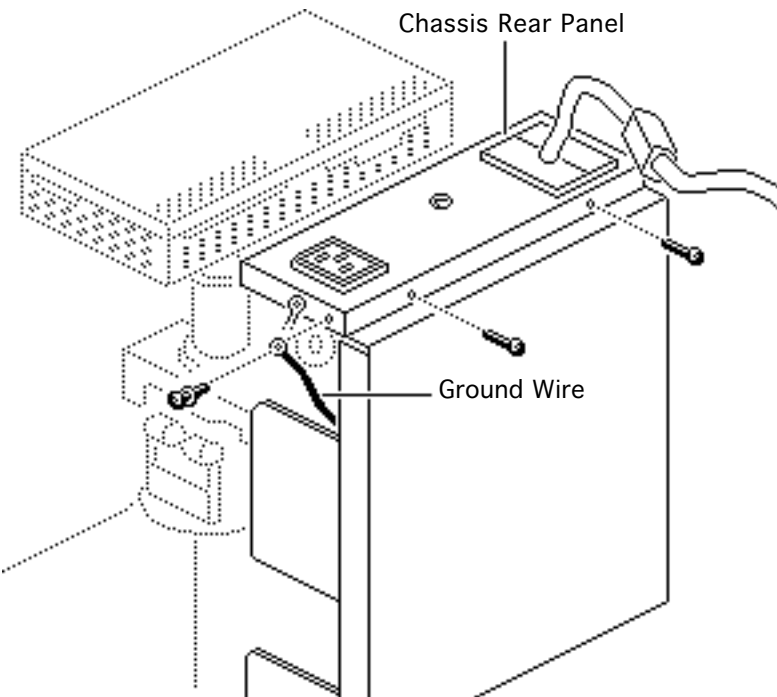
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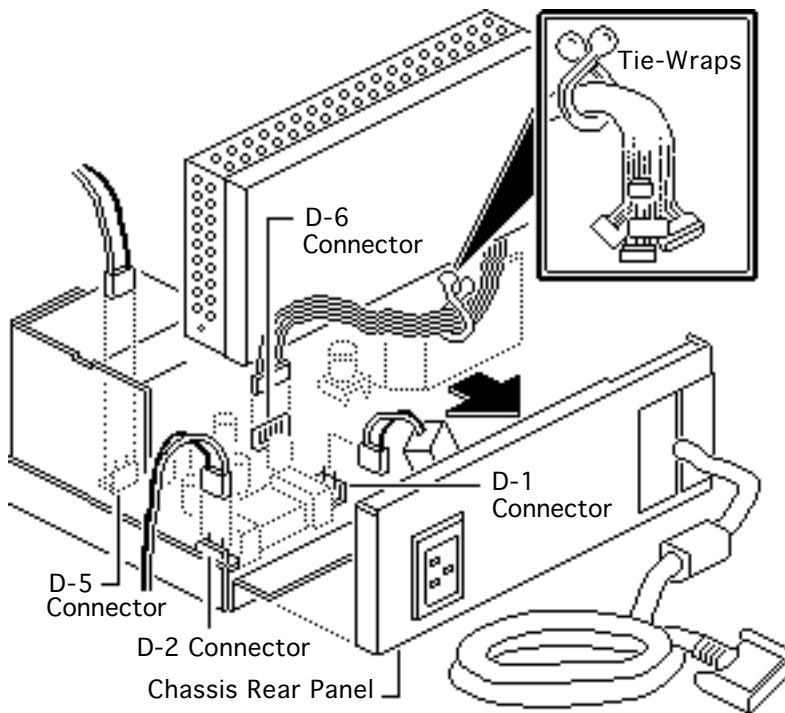




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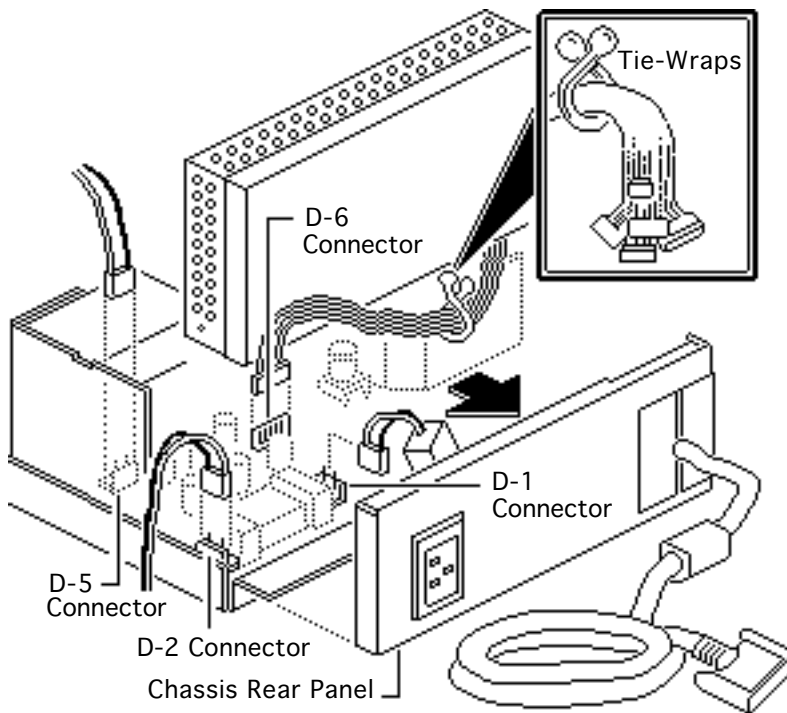
- 1 With the monitor face-down on the protective pad, remove the screw (with captive lockwasher) that secures the ground wire to the chassis rear panel.
- 2 Remove the two chassis mounting screws.





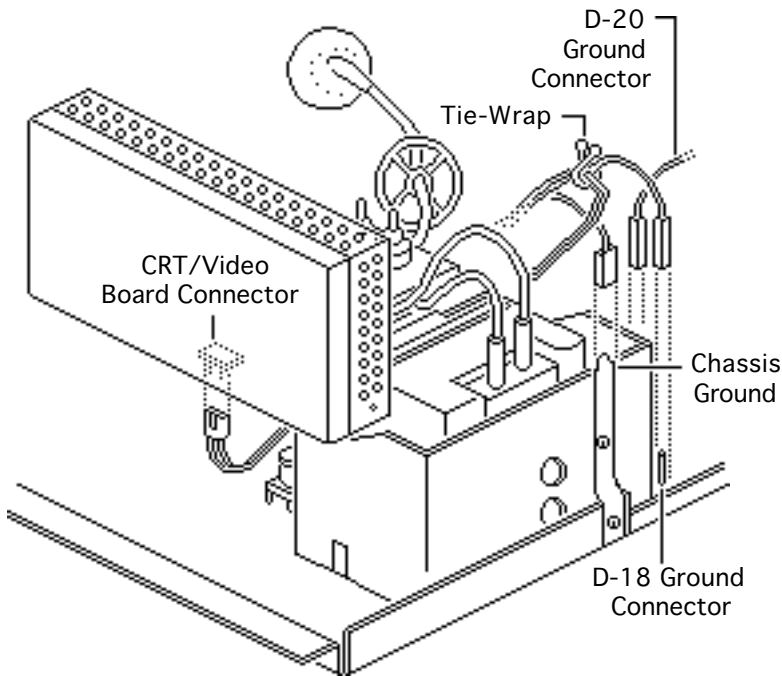
- 3 Return the monitor to an upright position. Pull the chassis rear panel away from the main board.
- 4 Disconnect the following cable connectors from the main board:
 - 2-wire on/off switch connector from D-2
 - 2-wire AC inlet assembly connector from D-1
 - 2-wire video connector from D-5
 - 5-wire video connector from D-6





Remove the wires from the tie-wraps and cable retainers.



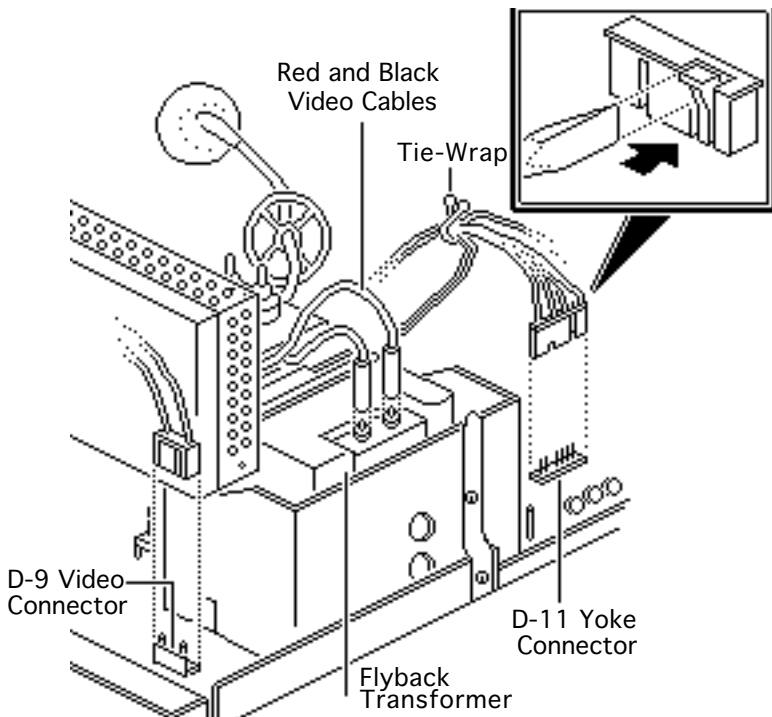


5 Disconnect the following cables:

- 2-wire video cable from the CRT/video board
- 1-pin ground cable from the chassis ground terminal
- 1-pin ground cable from the main board ground connector D-18
- 1-pin ground cable from the bezel D-20 (Rev B board only)

Remove the wires from the tie-wrap.

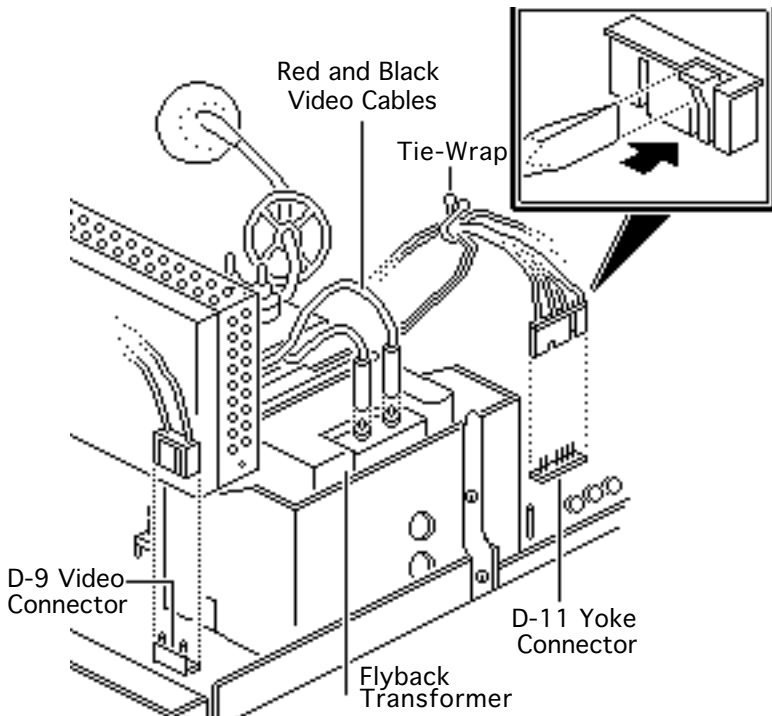




- 6 **Note:** When disconnecting the yoke connector, you may need to use a jeweler's screwdriver to press its release tab.

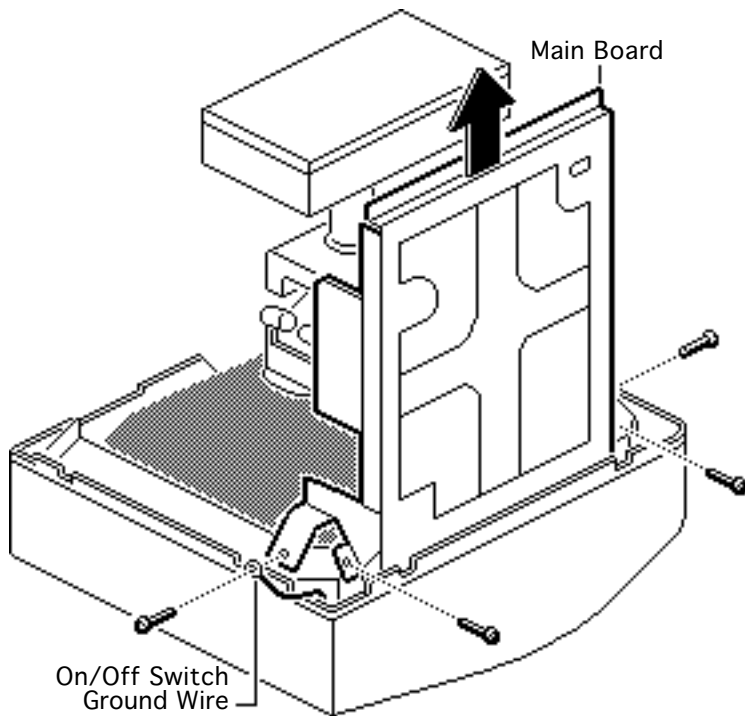
Press the release tabs and disconnect the 2-wire video connector from D-9 and the 4-wire yoke connector from D-11 on the main board. Remove the wires from the tie-wrap.





- 7 Disconnect the red and black video cables from the terminals on the flyback transformer.





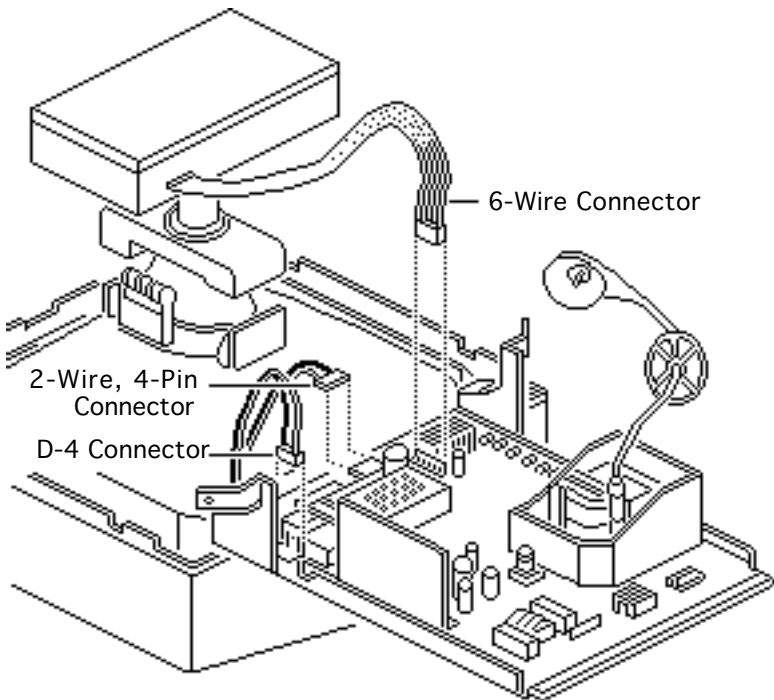
- 8 With the monitor face-down on the protective pad, remove the four screws that secure the main board chassis to the CRT chassis.

Replacement Note:

Connect the on/off switch ground wire to one of the chassis mounting screws.

- 9 Lift out the main board and prop it against the bezel.





10 Disconnect the following cable connectors from the main board:

- 2-wire, 3-pin connector from connector D-4
- 2-wire, 4-pin connector
- 6-wire CRT/video board connector

11 Return a defective main board to Apple in its chassis.





Replacement Note: Rev. A and Rev. B versions of the main board must be replaced like-for-like. If vendor part number A-1335-028 appears on the board near connector D3, order main board number 661-1634. If any other vendor part number appears in this location, order the Rev. B replacement board (part number 661-1671).



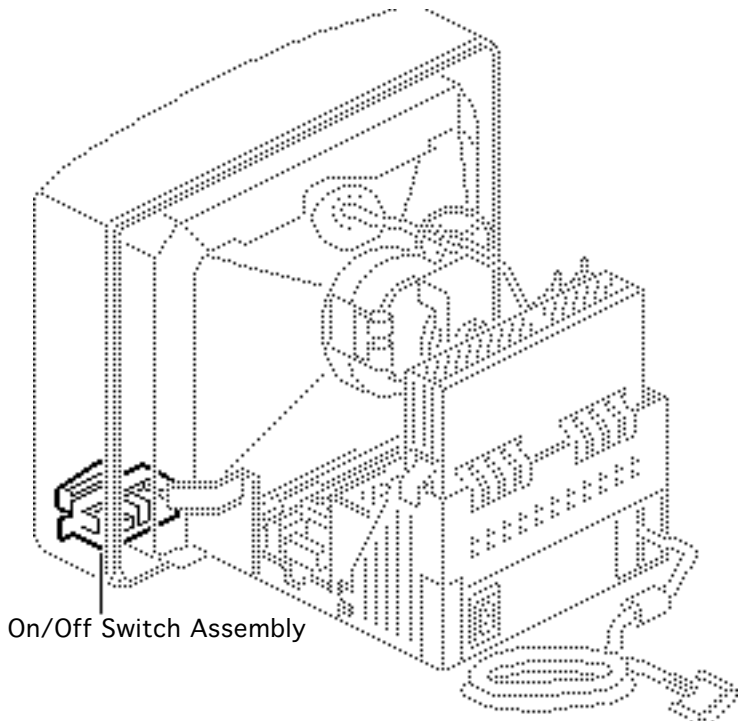


On/Off Switch Assembly

Before you begin,

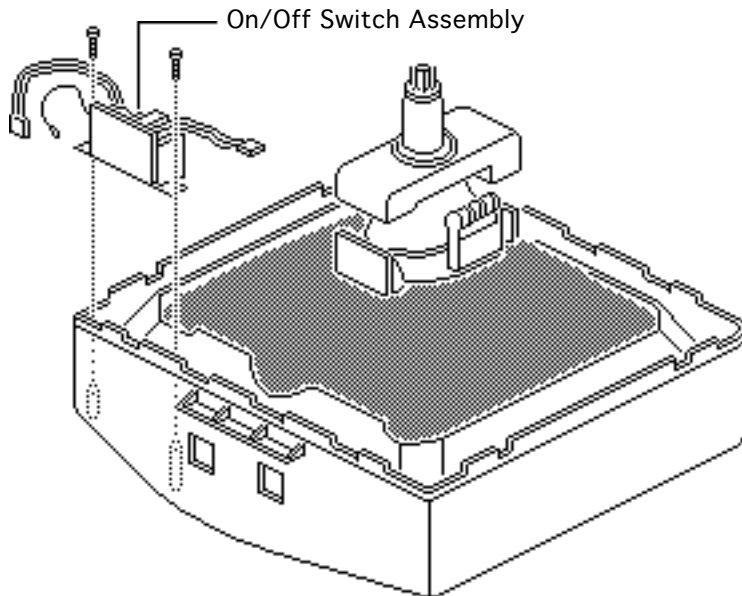
- Remove the monitor stand
- Remove the cover
- Discharge the CRT
- Remove the anode cap
- Remove the EMI shield
- Remove the main board

⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.



On/Off Switch Assembly





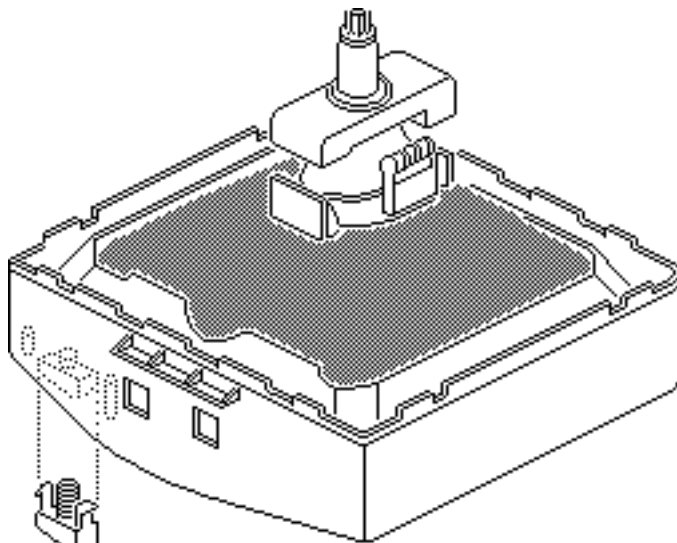
⚠ Warning: Never use a grounding wriststrap until after discharging the CRT.

- 1 Remove the two mounting screws and pull the on/off switch assembly from the bezel.





- 2 If you need to replace the plastic on/off switch, press the two latches and pull the switch and spring off the front of the bezel.



Plastic On/Off Switch

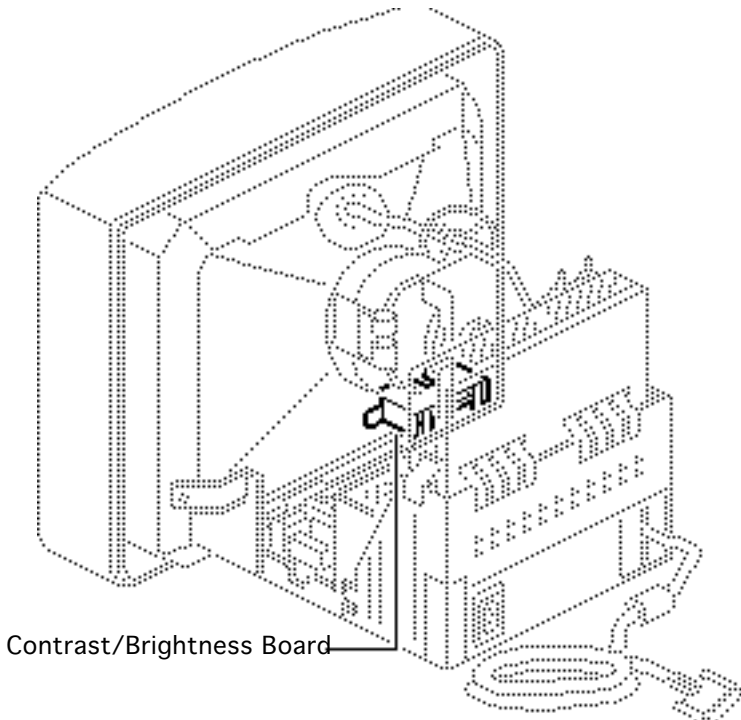




Contrast/ Brightness Board

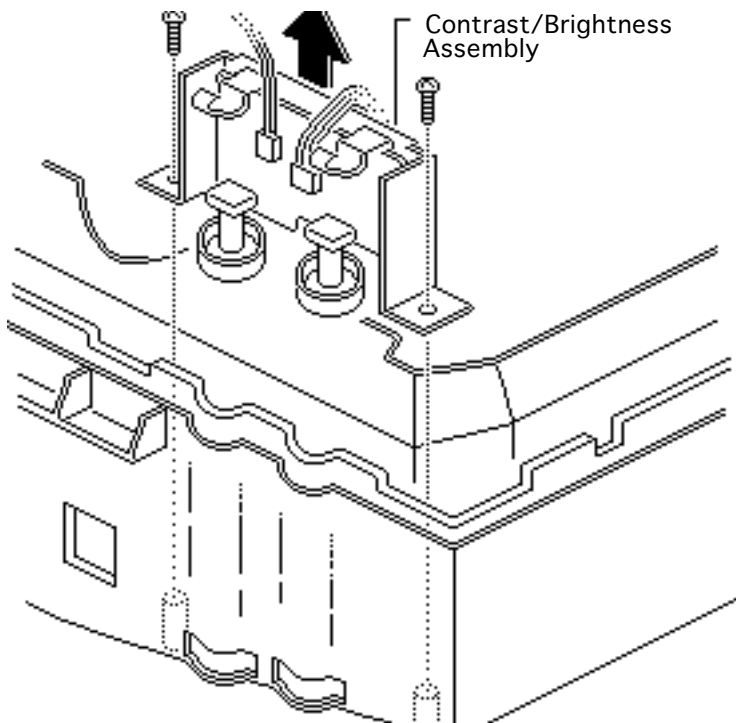
Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT
- Remove the anode cap
- Remove the EMI shield
- Remove the main board



Contrast/Brightness Board



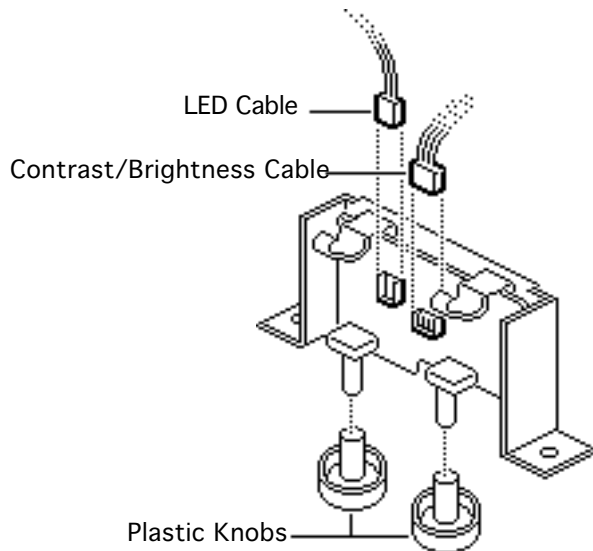
Contrast/Brightness
Assembly

⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.

⚠ Warning: Never use a grounding wriststrap until after discharging the CRT.

- 1 Remove the two mounting screws and pull the contrast/brightness assembly from the bezel.



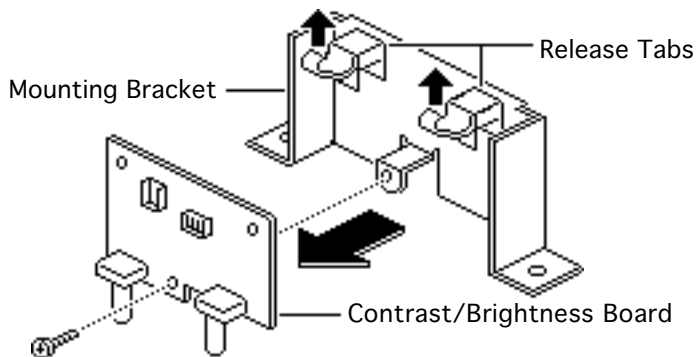


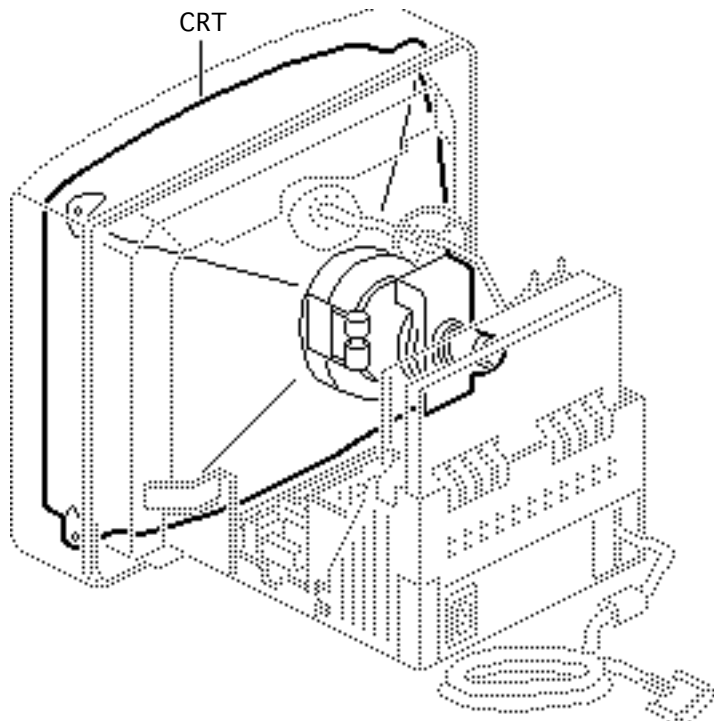
- 2 Disconnect the 2-wire LED cable and the 4-wire contrast/brightness cable from the contrast/brightness board.
- 3 Pull off the two plastic knobs.





- 4 Remove the mounting screw, release the two plastic tabs, and separate the contrast/brightness board from the mounting bracket.





CRT

Before you begin,

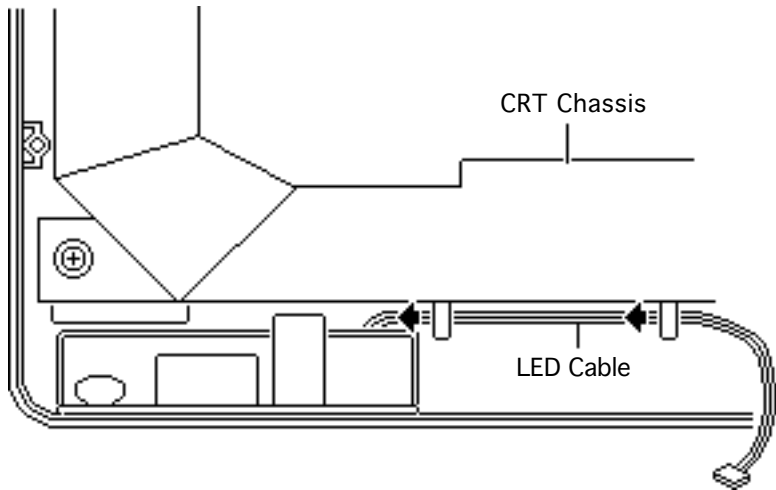
- Remove the monitor stand
- Remove the cover
- Discharge the CRT
- Remove the anode cap
- Remove the EMI shield
- Remove the CRT/video board
- Remove the main board

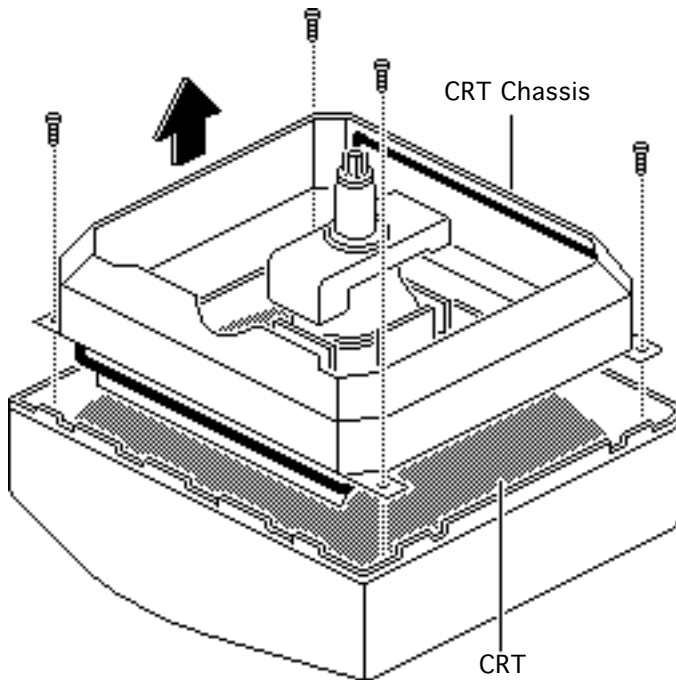
⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.





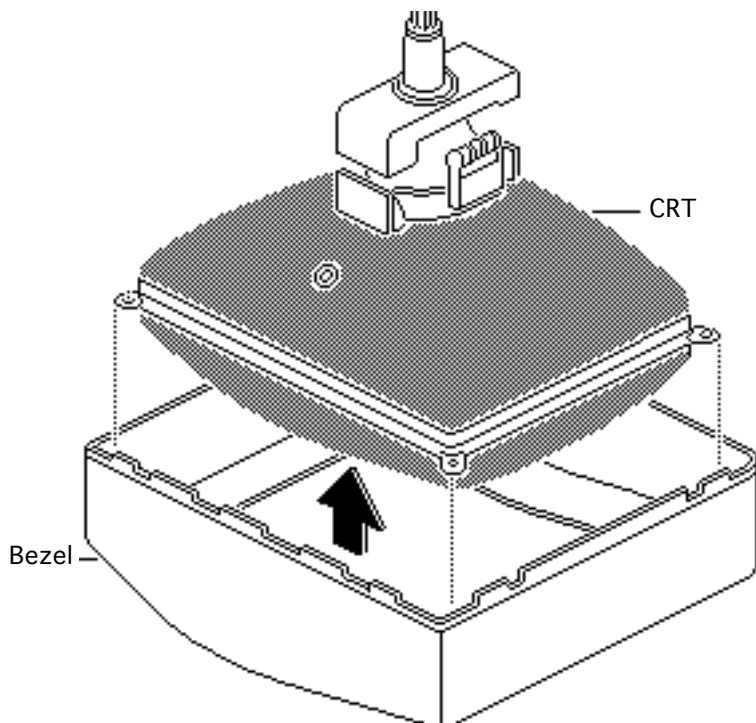
- 1 Disconnect the 2-wire LED cable from the contrast/brightness board. Route the LED cable through the cable retainers on the CRT chassis.





- 2 Remove the four capscrews that secure the CRT chassis to the bezel. Carefully lift the CRT chassis over the neck of the CRT.





- 3 **Caution:** Never grasp the neck of the CRT to remove it from the bezel. The neck of the CRT cracks and breaks easily.

Lift the CRT from the bezel. For best leverage, begin lifting from the underside of the CRT.

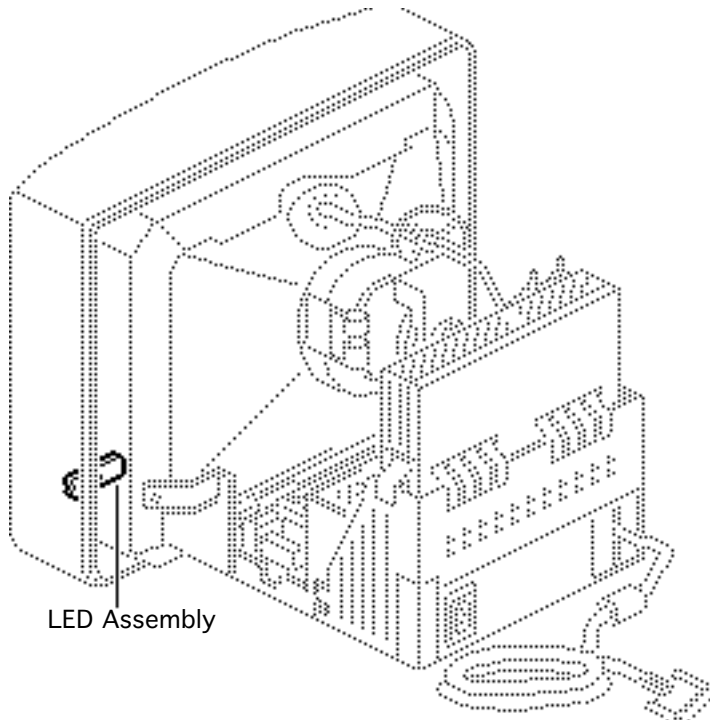


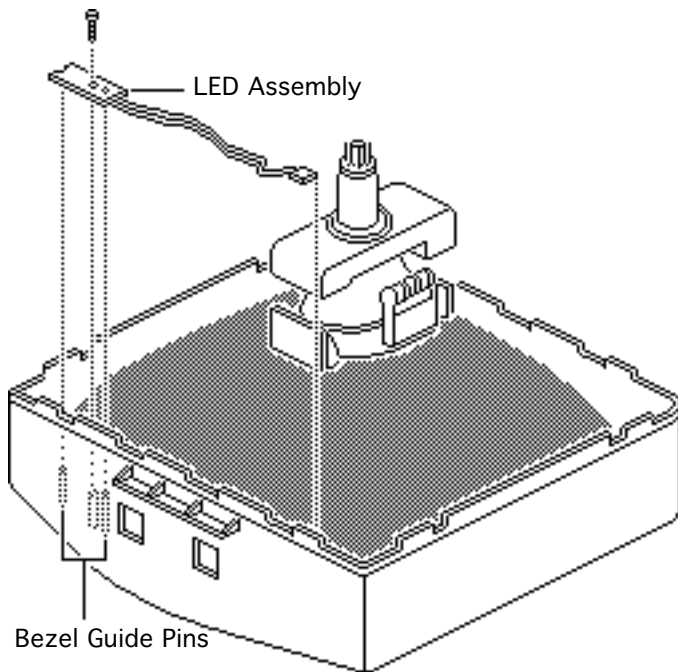


LED Assembly

Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT
- Remove the anode cap
- Remove the EMI shield
- Remove the CRT/video board
- Remove the main board
- Remove the CRT chassis only

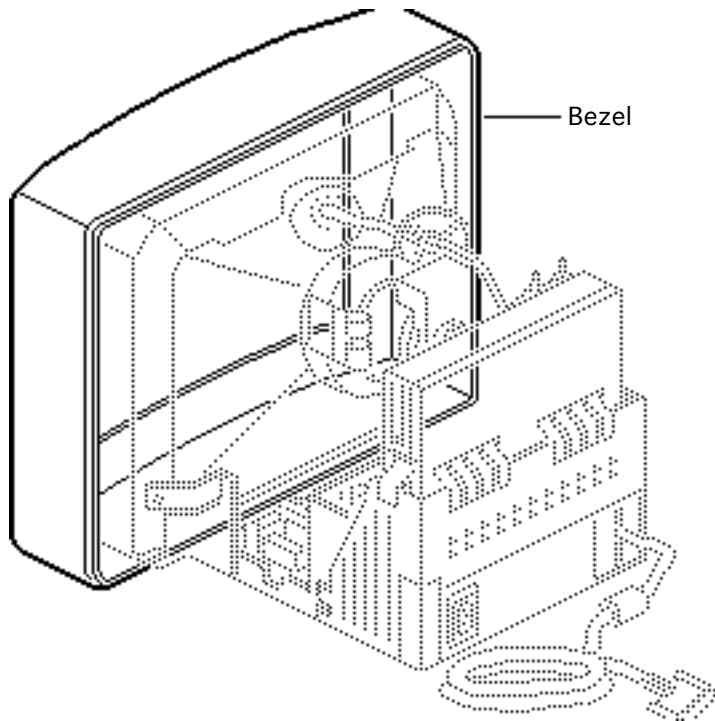




⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.

Remove the mounting screw and pull the LED assembly off the bezel guide pins.





Bezel

Before you begin,

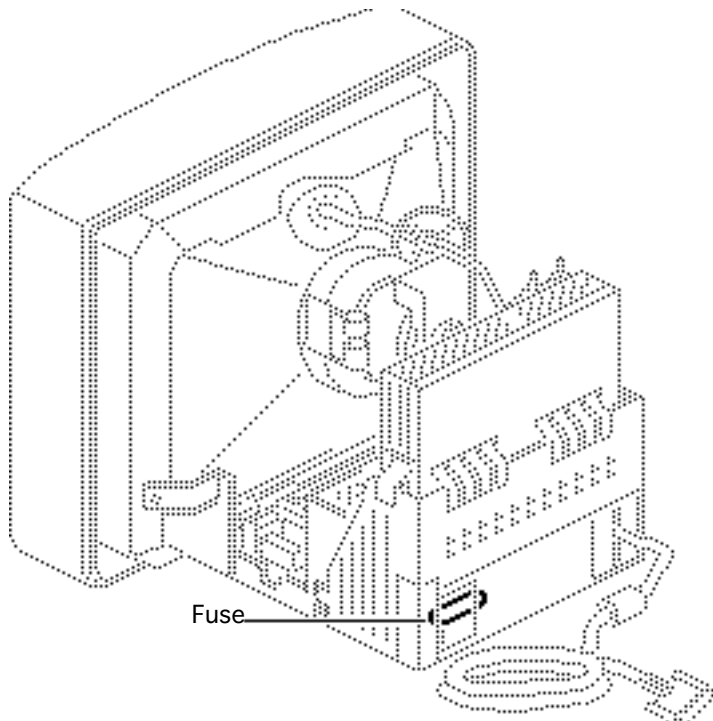
- Remove the monitor stand and cover
- Discharge the CRT
- Remove the anode cap
- Remove the EMI shield and main board
- Remove the on/off switch
- Remove the contrast/brightness board
- Remove the CRT and LED





⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.





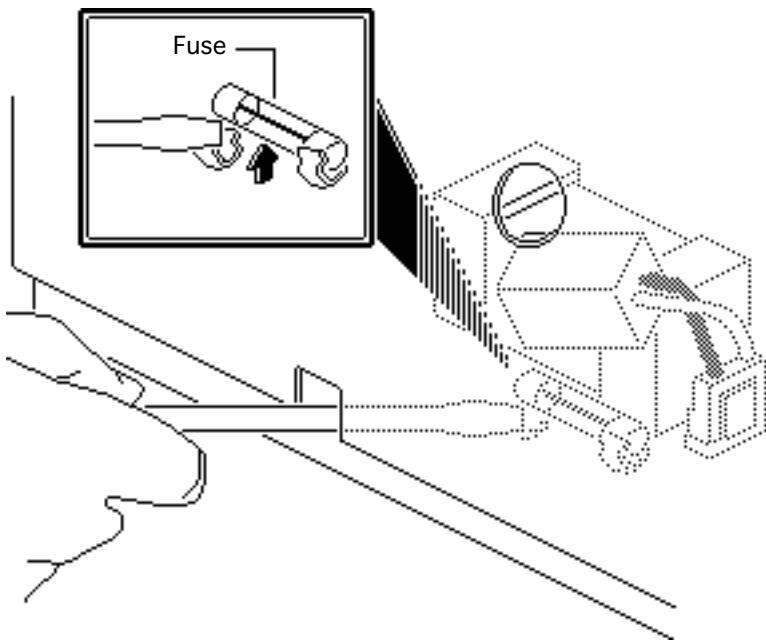
Fuse

Before you begin,

- Remove the monitor stand
- Remove the cover
- Discharge the CRT

⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.





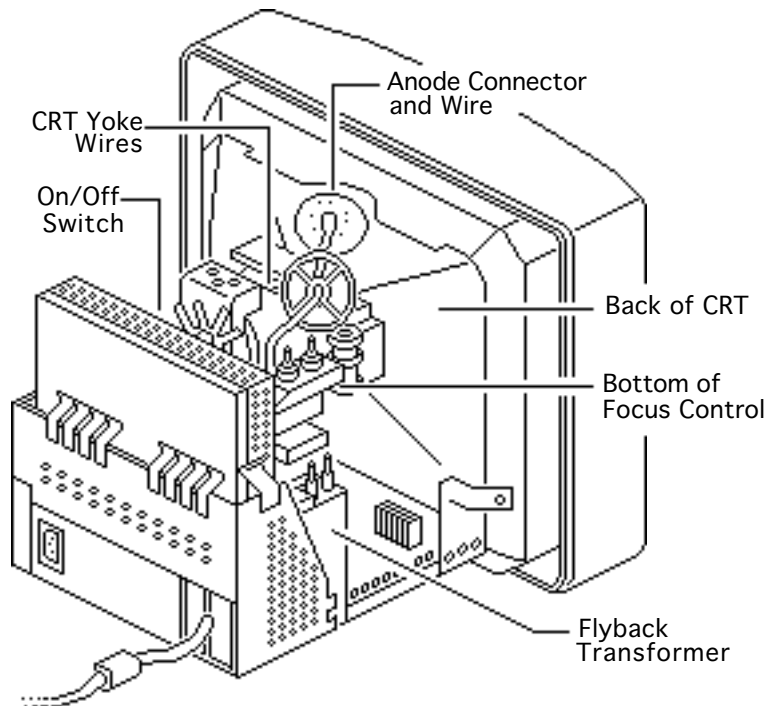
Note: To access the fuse you may need to disconnect the AC inlet cable connector.

Using a small, long-stemmed screwdriver, pry up one end of the fuse and remove it from the main board.



Adjustments

Macintosh 16 Color Display



Geometry Setup

Before you begin,

- Place monitor on level surface
- Remove the rear cover
- Switch on monitor power
- Let monitor warm up 15 minutes

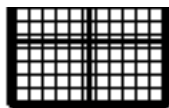
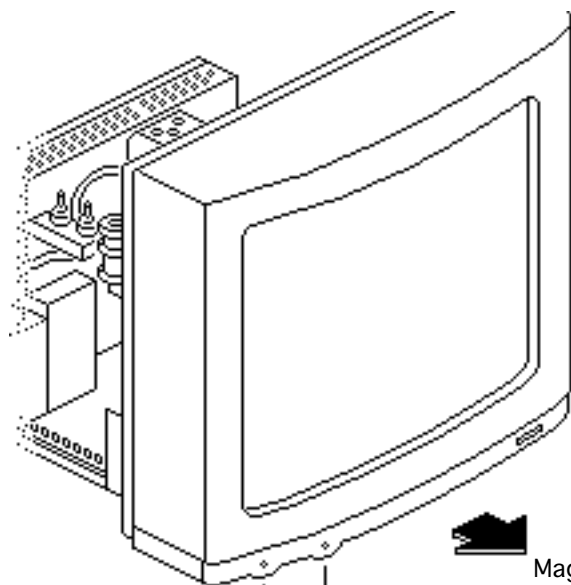
⚠ Warning: This product contains very high voltages. When performing live adjustments, be careful not to touch the high-voltage components shown at left.





Important: You must perform the geometry setup procedure before performing any other geometry adjustments. (Geometry adjustments are usually necessary whenever you replace the CRT or the main board.) After completing the geometry setup, go directly to the geometry adjustments (horizontal, vertical, focus, or convergence) that will fix the customer's monitor problem.





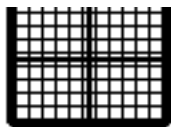
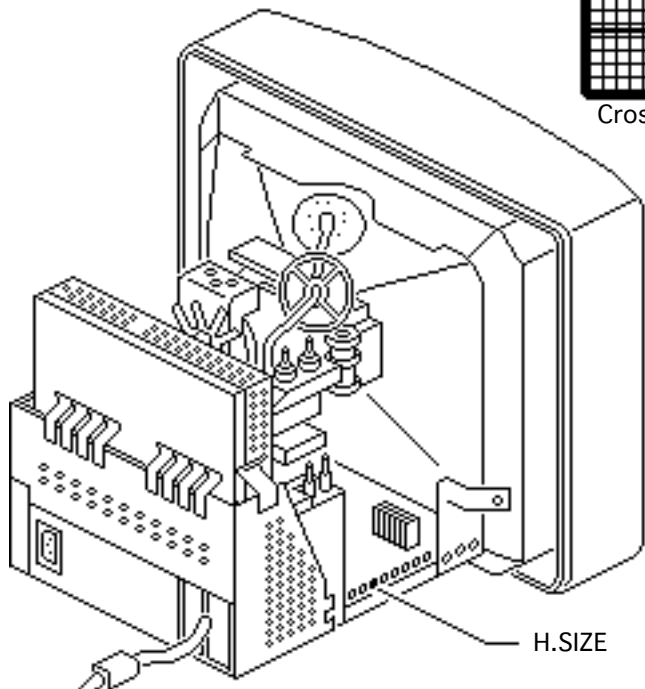
Crosshatch

- 1 Swivel the monitor so that it faces magnetic east or west.
- 2 Set the external brightness control to detent (midrange) and turn the contrast control clockwise to maximum contrast.
- 3 Use Display Service Utility to display the Crosshatch test pattern.

Brightness
Contrast

Magnetic
East/West





Crosshatch

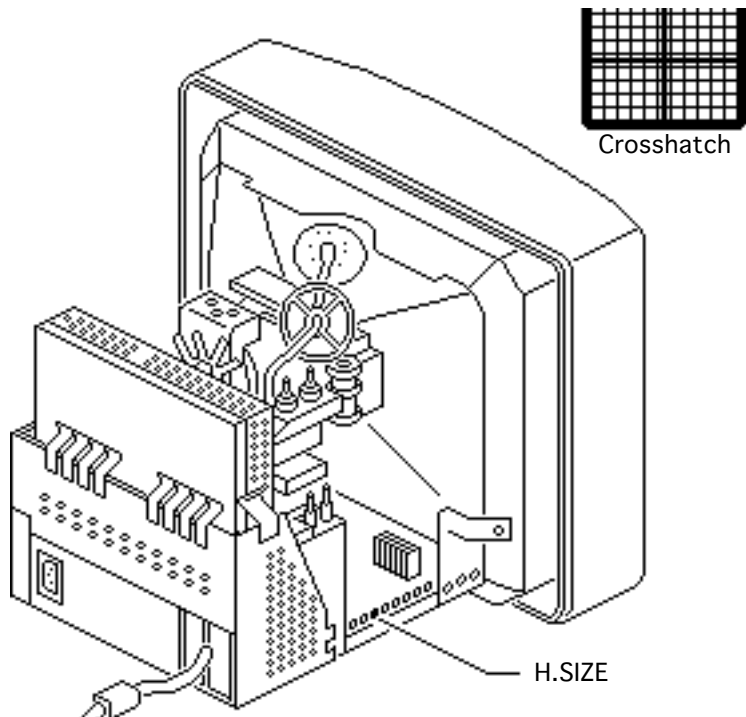
Horizontal

Before you begin, perform geometry setup steps.

Note: Perform the horizontal adjustment steps in the order presented. Perform the step only if you must attain the correct alignment.

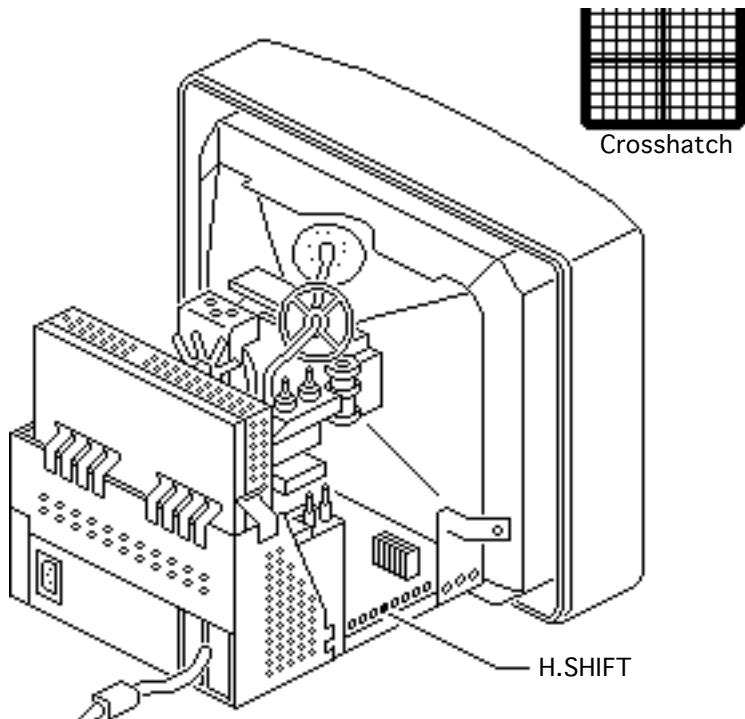
Important: Take screen measurements with one eye, and keep that eye perpendicular to the line being measured.





- 1 Using an insulated screwdriver and flexible ruler, adjust the H.SIZE control until the width of the raster is 300 mm (± 3 mm) or 11 7/8 in. ($\pm 1/8$ in.).

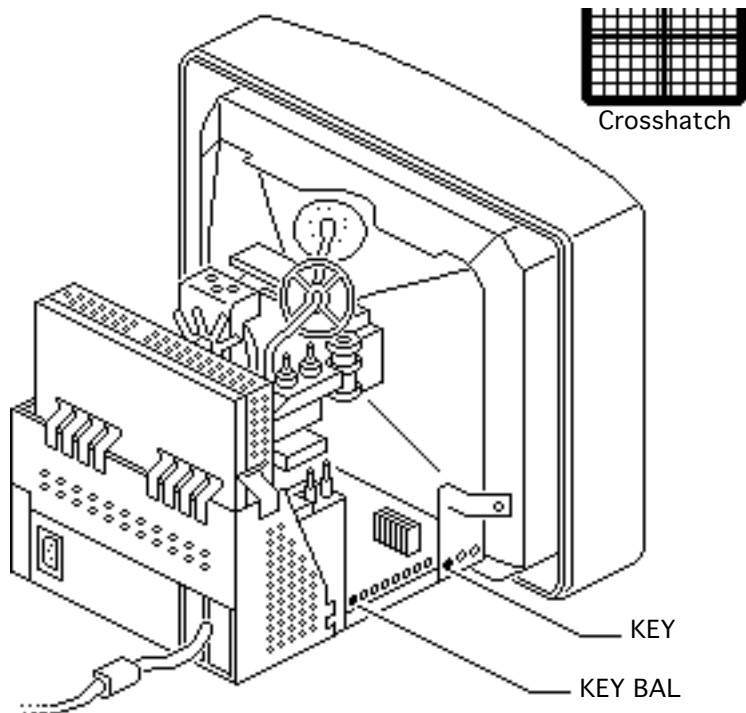




Important: Straight lines may appear bent if viewed from the side. When checking screen geometry, position yourself perpendicular to and about 18 inches from the lines you are checking.

- 2 Using an insulated screwdriver, adjust the H.SHIFT control until the raster is centered horizontally within the bezel.



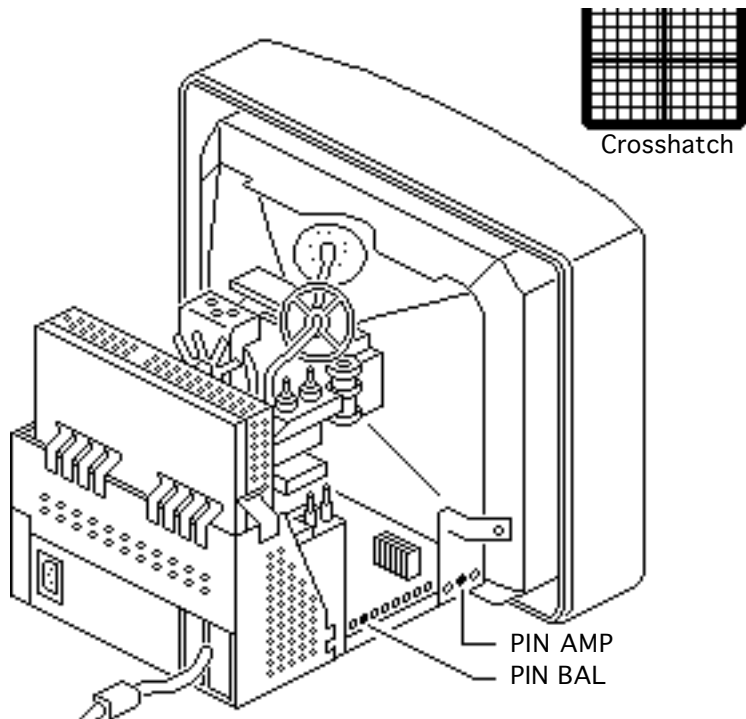


- 3 **Note:** Go back and forth between the KEY and KEY BAL controls until the sides of the raster are parallel.

Using an insulated screwdriver, adjust the KEY control until the left and right sides of the raster are parallel to each other.

Using an insulated screwdriver, adjust the KEY BAL control until the left and right sides of the raster are parallel to the bezel.



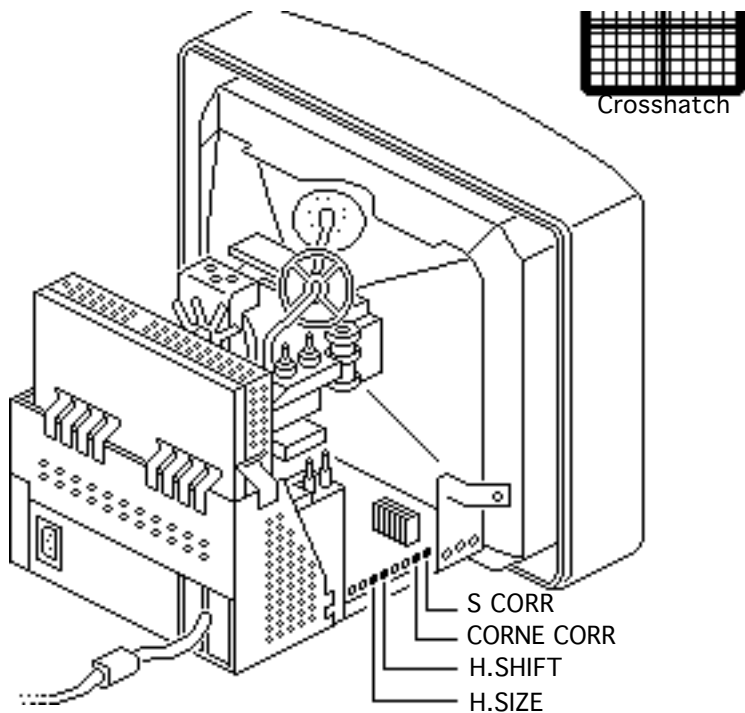


- 4 **Note:** Go back and forth between the PIN AMP and PIN BAL controls until the sides of the raster are straight.

Using an insulated screwdriver, adjust the PIN AMP control until the left and right sides of the raster are as straight as possible.

Using an insulated screwdriver, adjust the PIN BAL control until the left and right sides of the raster are as straight as possible.



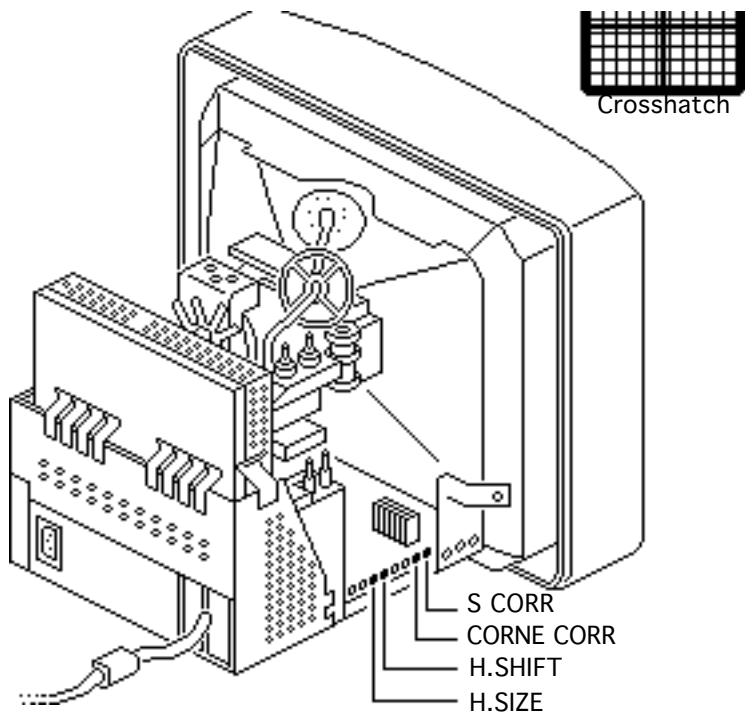


- 5 **Note:** Go back and forth between the CORNE CORR and S CORR controls until the corners of the raster are straight.

Using an insulated screwdriver, adjust the CORNE CORR control until the left and right sides of the raster are as straight as possible.

Using an insulated screwdriver, adjust the S CORR control until the left and right sides of the raster are as straight as possible in the four

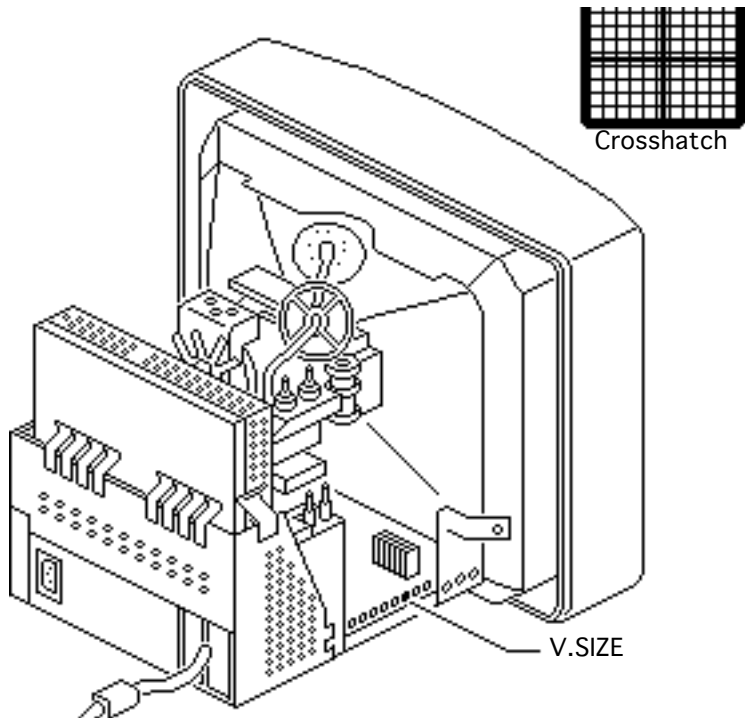




corners of the screen.

- 6 Recheck and (if necessary) repeat the H.SIZE and H.SHIFT adjustments.





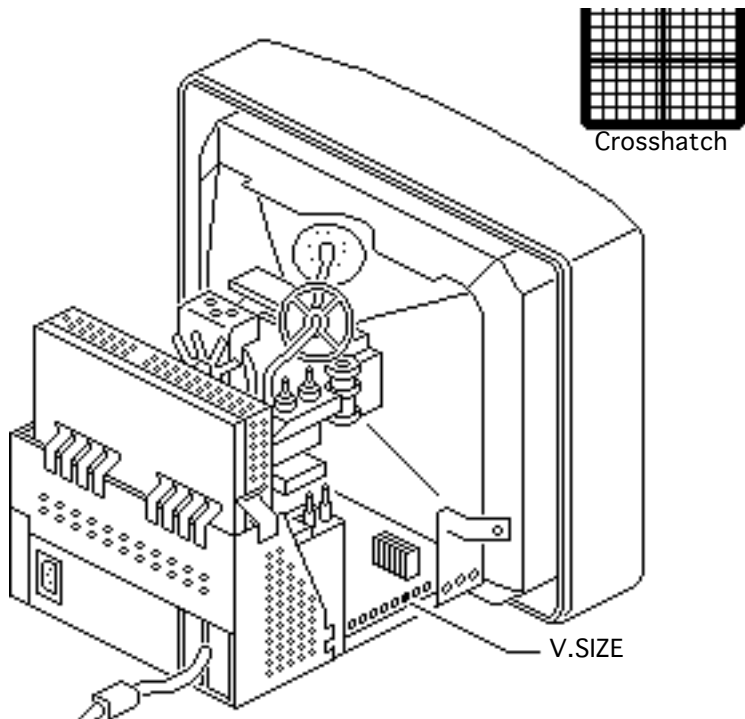
Vertical

Before you begin, perform geometry setup steps.

Note: Perform the vertical adjustment steps in the order presented. Only perform the step if you must to attain the correct alignment.

Important: Take screen measurements with one eye, and keep that eye perpendicular to the line being measured.

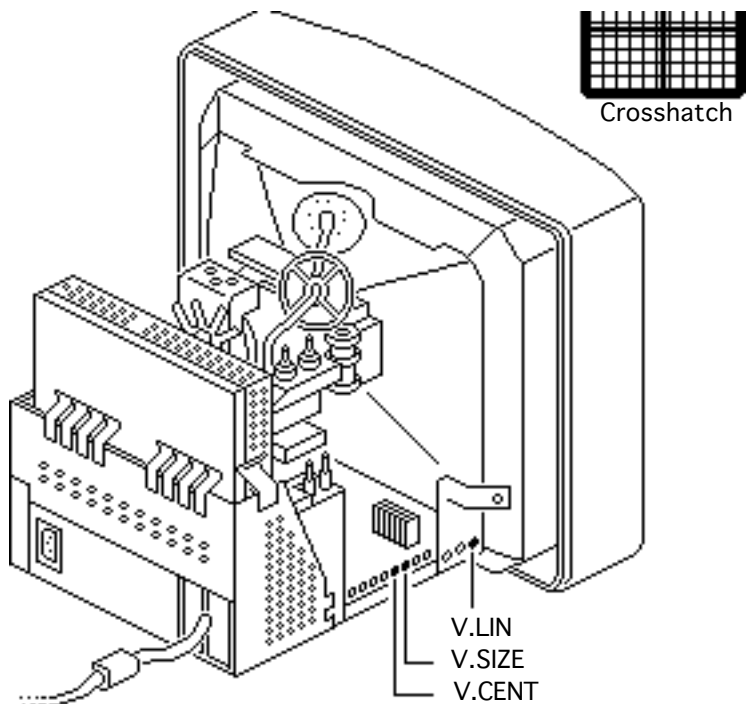




- 1 Using an insulated screwdriver and flexible ruler, adjust the V.SIZE control until the height of the raster is 225 mm (± 3 mm) or 8 7/8 in. ($\pm 1/8$ in.).

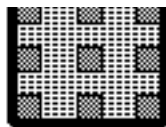
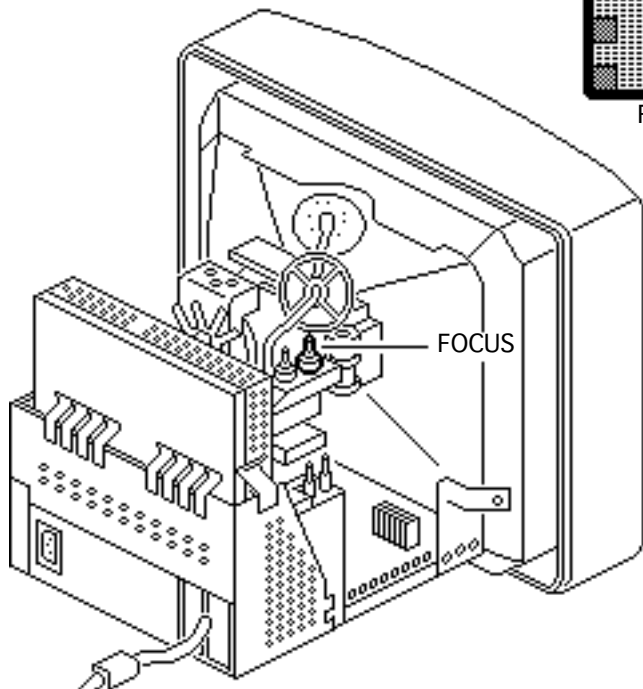
Important: Straight lines may appear bent if viewed from the side. When checking screen geometry, position yourself perpendicular to and about 18 inches from the lines you are checking.





- 2 Using an insulated screwdriver, adjust the V.CENT control until the raster is centered vertically within the bezel.
- 3 Using the insulated screwdriver, adjust the V.LIN control until the rectangles at the top and bottom of the raster are the same size.
- 4 Recheck and (if necessary) repeat the V.SIZE and V.CENT adjustments.





Focus

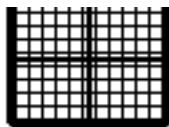
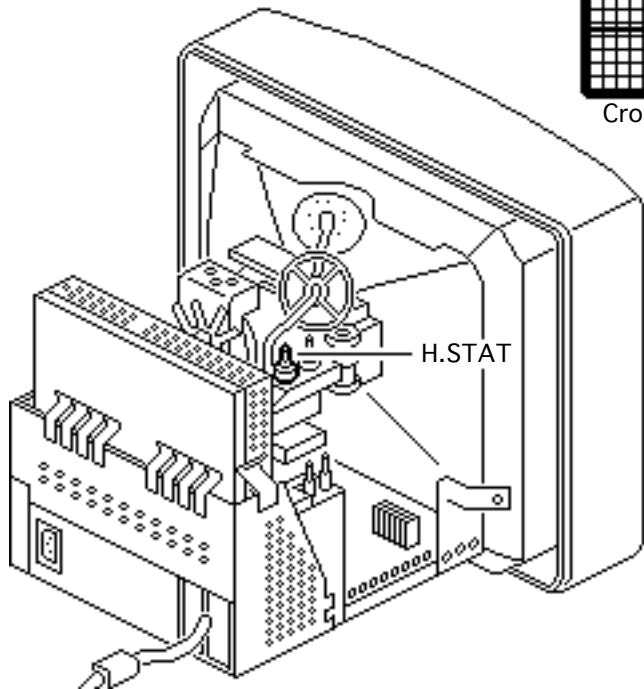
Focus

Before you begin, perform geometry setup steps.

Note: Be sure to check focus at display points over the entire screen.

- 1 Display the Focus test pattern. Use Display Service Utility to display the test pattern.
- 2 Using an insulated screwdriver, adjust the FOCUS control on the focus control board for best overall focus.





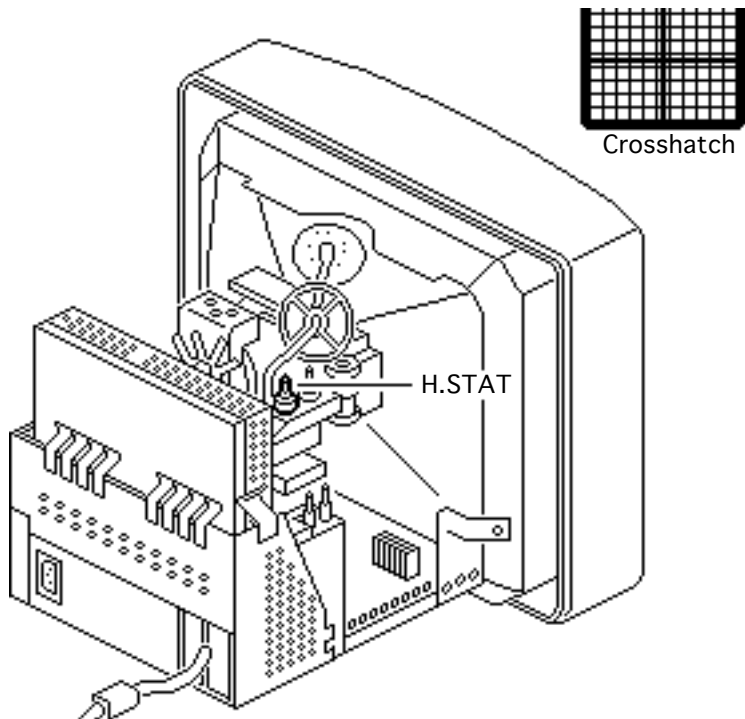
Crosshatch

Convergence

Before you begin, perform geometry setup steps.

Important: Use the H.STAT control on the focus control board to make all convergence adjustments. Do not touch the yoke controls. With large-screen monitors it is not always possible to precisely align convergence at every point on the screen. Rather, try for the best overall alignment with the H.STAT control.





- 1 Use Display Service Utility to display the Crosshatch test pattern.
- 2 Using an insulated screwdriver, adjust the H.STAT control on the focus control board until the red, blue, and green vertical lines are as precisely aligned as possible.

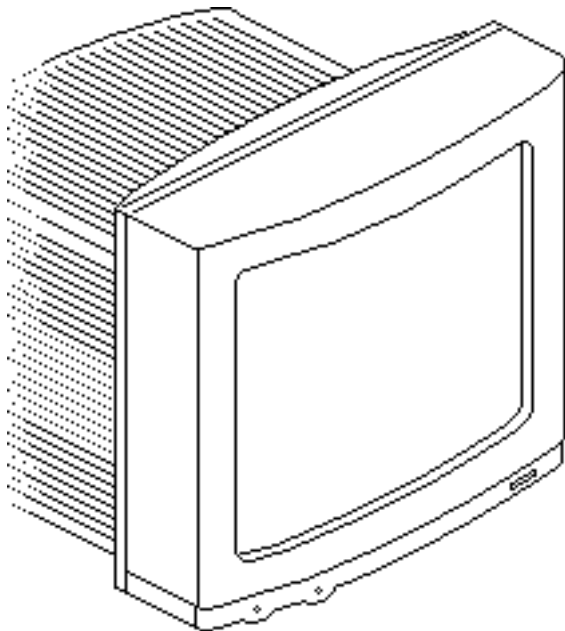


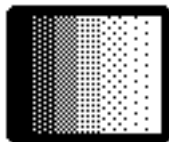
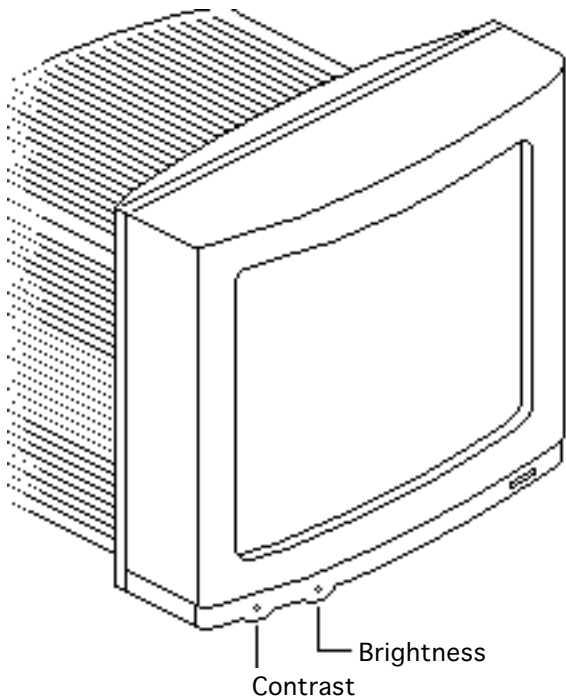


Video Setup

Before you begin,

- Place monitor on level surface
- Switch on monitor power
- Let monitor warm up 15 minutes
- Perform necessary geometry adjustments





Gray Bars

Important: You should perform the video adjustments (cutoff and white balance) only if the color quality is unacceptable. To determine whether the quality of the video display is acceptable, perform the steps in “Checking Display Video.”

Checking Display Video

- 1 Set the external brightness control to detent (midrange) and turn the contrast control

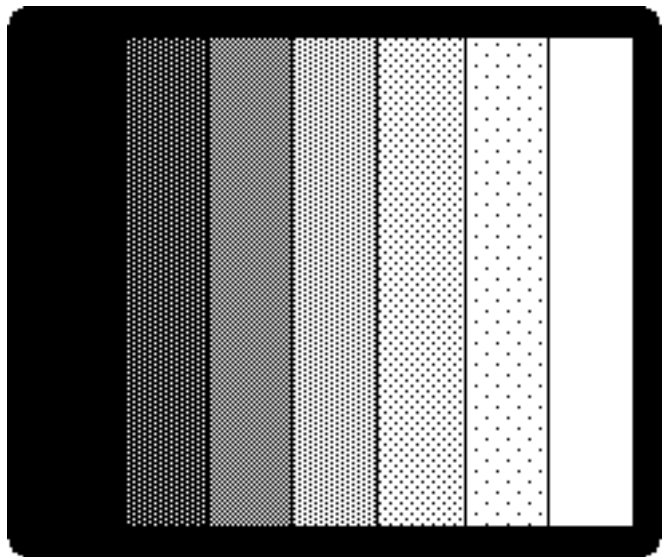




clockwise to maximum contrast.

- 2 Use Display Service Utility to display the Gray Bars test pattern.





Gray Bars

- 3 Check that
 - There is no colored tint in the bars.
 - The leftmost (darkest) three bars are black, barely distinguishable from black, and dark gray, respectively.
- 4 If these conditions are not met, perform “Setup Steps” in this chapter and do the video adjustments.

Note: Performing the video adjustments requires using a fine-

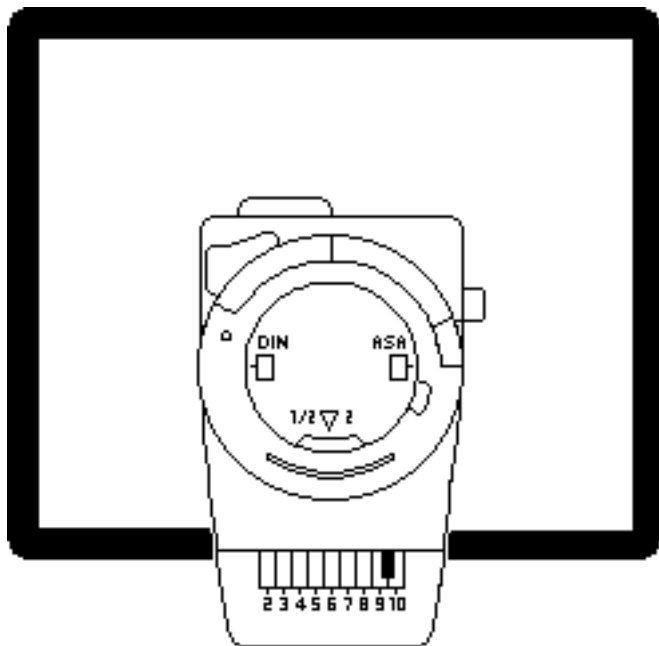




tipped, plastic adjustment tool (part number 949-0386) and a light meter.

Note: Perform the entire video setup procedure before performing any necessary video adjustments.





- 5 **Important:** Readings from light meter models R77, L-248, and 246 differ. Please note which meter you are using before making adjustments. (See “Light Meter Setup.”)

Using Display Service Utility, display the All-White Screen test pattern.





- 6 Measuring screen brightness should provide a reading of 24 foot lamberts (± 3 foot lamberts), which on the light meter is
 - Model R77: 19 on the bottom scale
 - Model L-248: 9 to 10 on the 2-10 scale
 - Model 246: 19 on the red scale





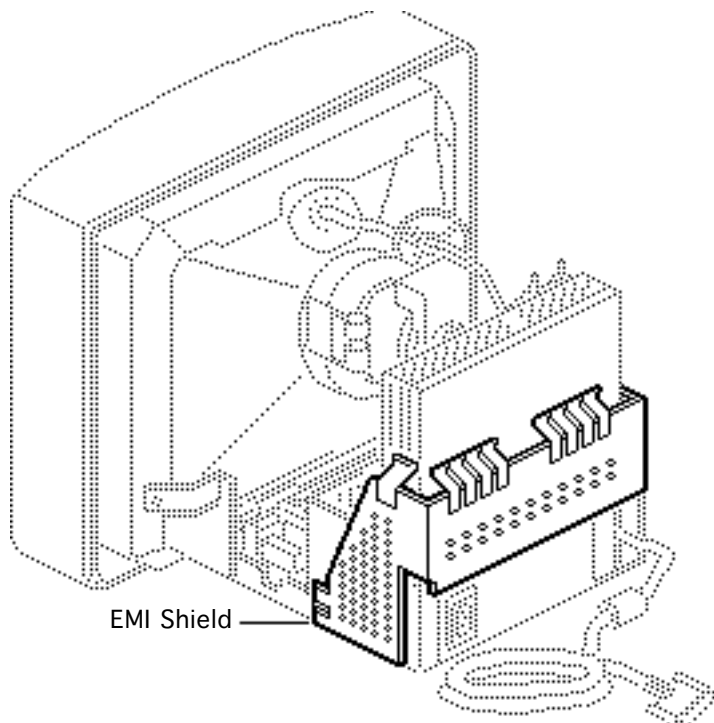
Important: If you do not get one of these readings, complete the setup steps on the next page and then perform the video adjustments in this chapter. If you doubt your meter's accuracy, verify the readings with a known-good light meter or photometer.

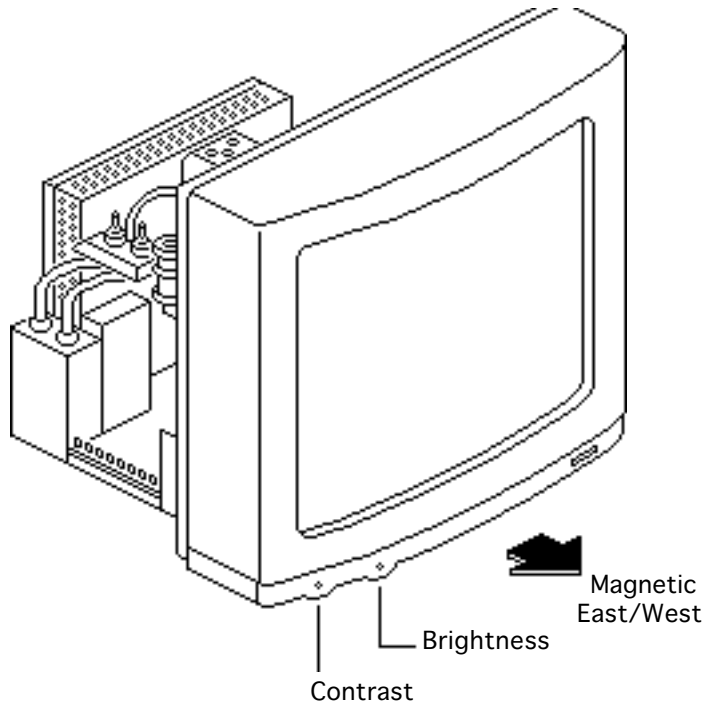




Setup Steps

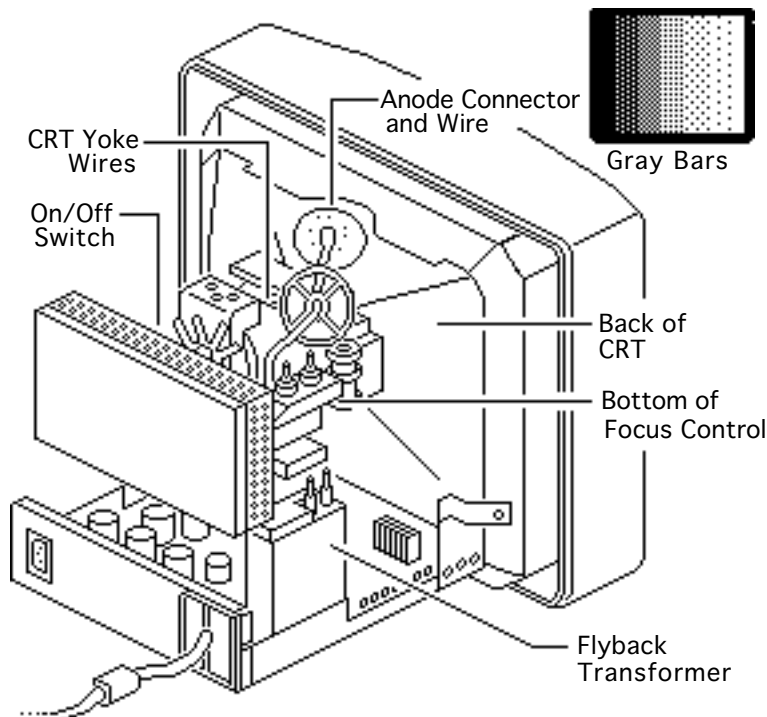
- 1 Switch off monitor power and remove the rear cover and the EMI shield (see Take Apart).





- 2 Switch on the monitor and let it warm up for 15 minutes.
- 3 Swivel the monitor so that it faces magnetic east/west.
- 4 Make sure the external brightness control is set to detent (midrange) and the contrast control is turned clockwise to maximum contrast.





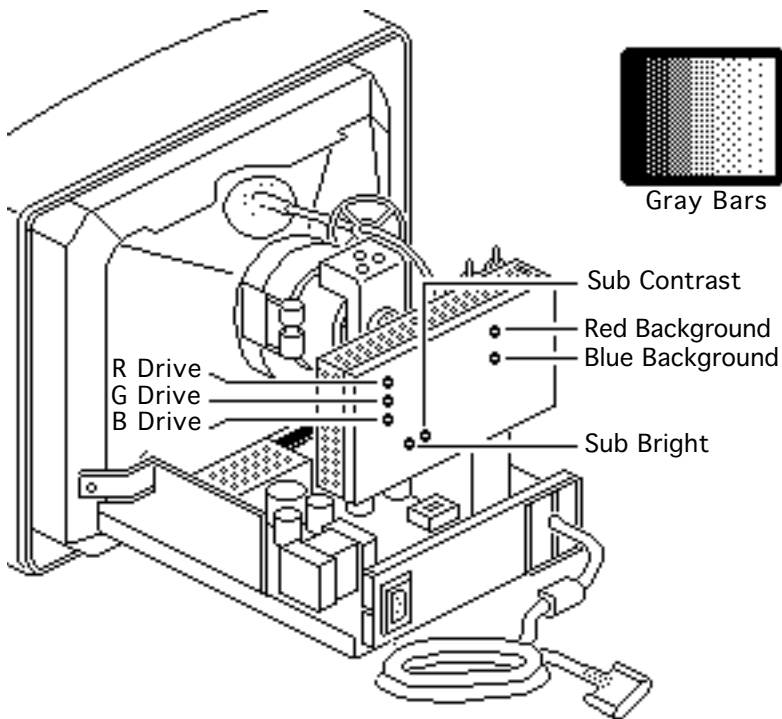
Cutoff

Before you begin, perform the video setup steps.

⚠ Warning: This product contains very high voltages. When performing live adjustments, be careful not to touch the high-voltage components shown at left.

Note: Perform the cutoff adjustment steps in the order presented.

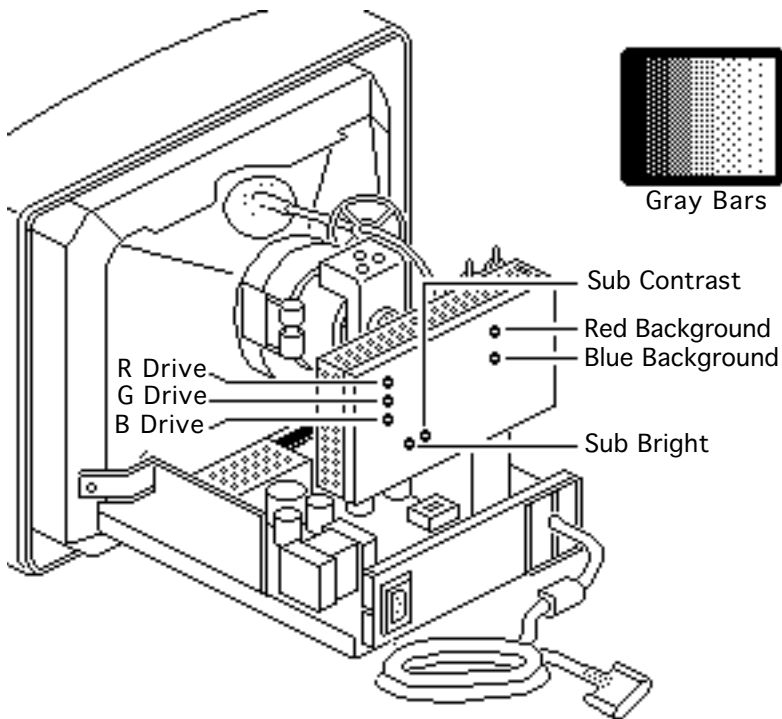




- 1 Use Display Service Utility to display the Gray Bars test pattern.
- 2 Using the fine-tipped insulated screwdriver, preset the following CRT video board controls to the middle of their adjustment range:
 - Sub Bright
 - Sub Contrast
 - Red, Green, and Blue Drive

Note: To locate midrange, turn the control clockwise and counterclockwise to its

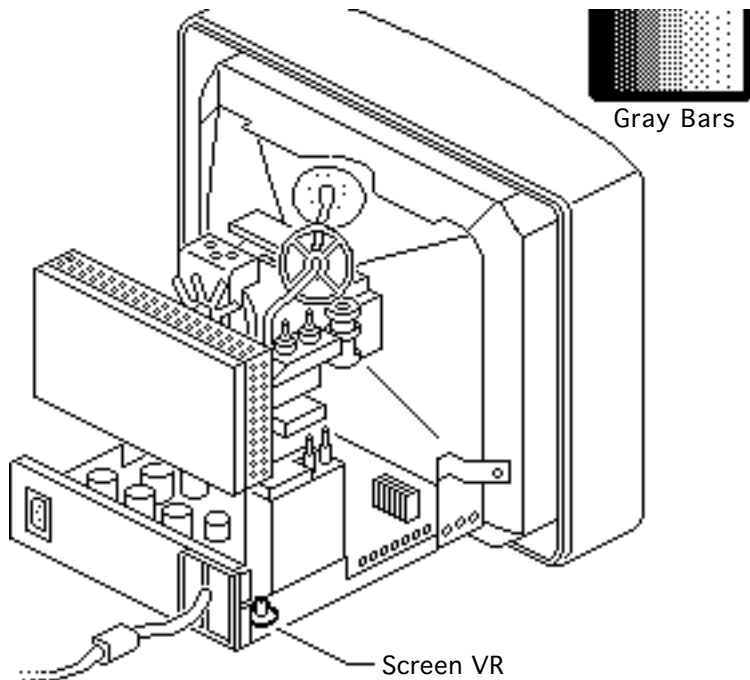




limits, and then position the control midway between these limits.

- 3 **Note:** Setting cutoff is easier if you first dim the overhead lights.

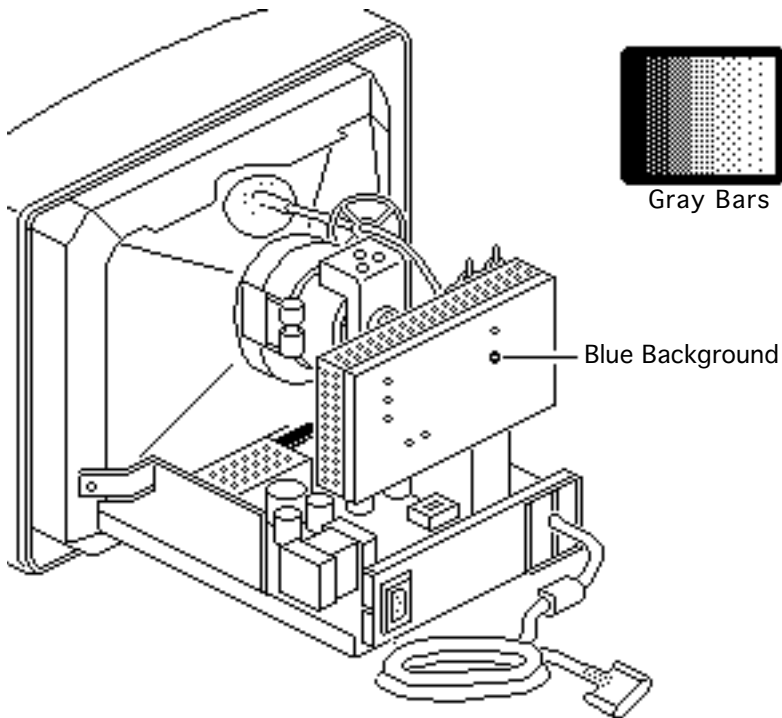
Using the fine-tipped insulated screwdriver, preset the Red and Blue Background controls to minimum (turn fully clockwise).



- 4 Using the fine-tipped insulated screwdriver, adjust the Screen VR (RV508) control on the main board until the first (darkest) bar is completely black. The screen should also display a predominant green tint.

Note: If the first bar is black but the screen does not have a green tint, recheck the settings made in step 2.





White Balance

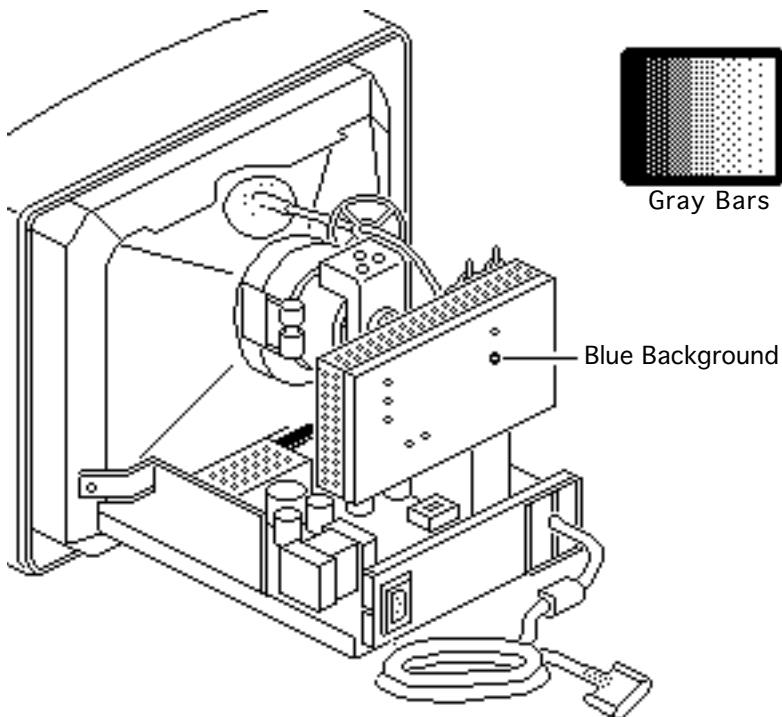
Before you begin,

- Perform video setup steps
- Set cutoff

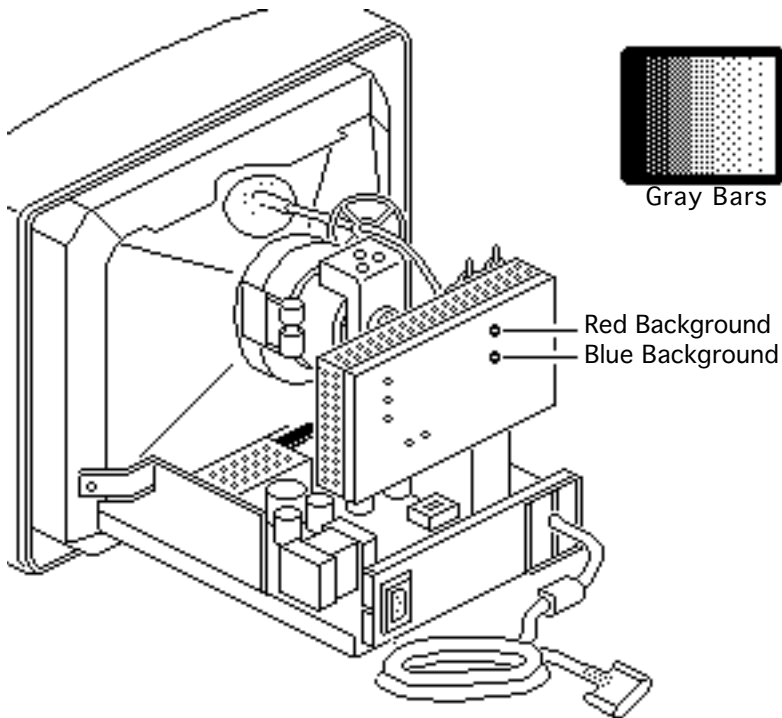
⚠ Warning: This product contains very high voltages. When performing live adjustments, be careful not to touch high-voltage components.

Note: Make sure cutoff is set before continuing. Use the Gray Bars test pattern.



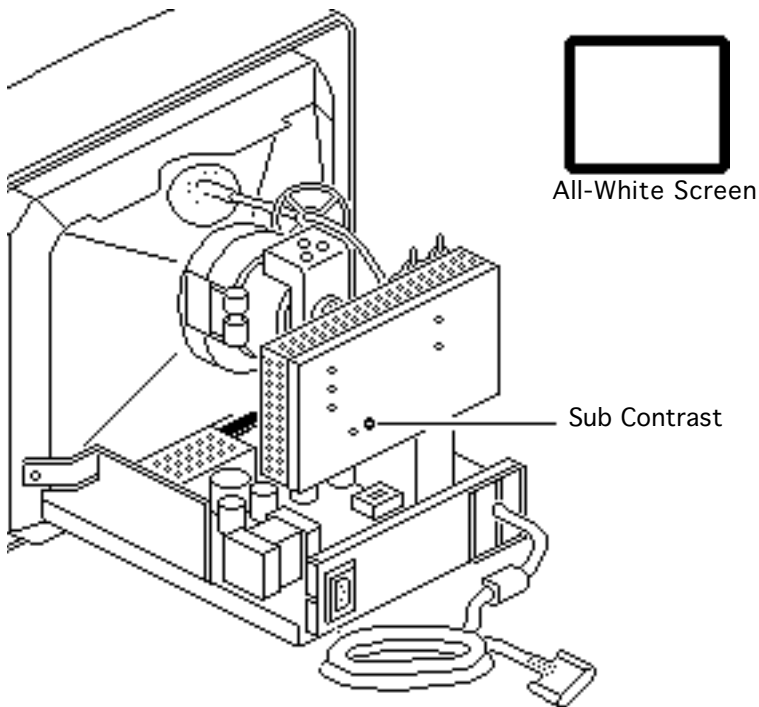


- 1 Using the fine-tipped insulated screwdriver, slowly turn up (turn counterclockwise) the Blue Background control until the darkest 6 bars display a blue-green tint.



- 2 Using the fine-tipped insulated screwdriver, slowly turn up (turn counterclockwise) the Red Background control until the darkest 6 bars display different shades of gray.
- 3 Repeat the previous two steps, alternately adjusting the Blue and Red Background controls, until there is no colored tint in the bars.





Important: Readings from light meter models R77, L-248, and 246 differ. Please note which meter you are using before making adjustments. (See “Light Meter Setup.”)

- 4 Use Display Service Utility to display the All-White Screen test pattern.





- 5 Measuring screen brightness should provide a reading of 24 foot lamberts (± 3 foot lamberts), which on the light meter is
 - Model R77: 19 on the bottom scale
 - Model L-248: 9 to 10 on the 10-18 scale
 - Model 246: 19 on the red scale

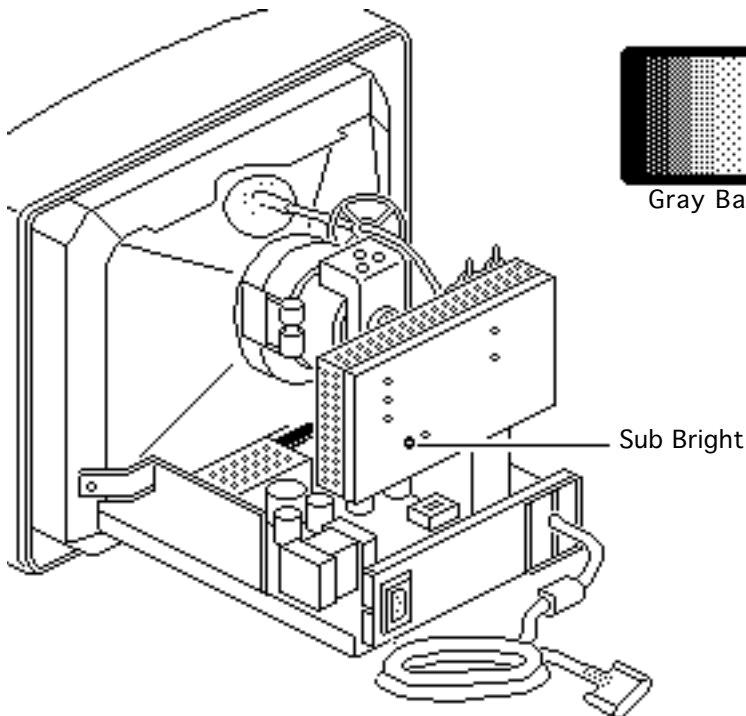




Note: If you get the correct light meter reading, there is no predominant color in the Gray Bars test pattern, and the first bar is black, stop here. Otherwise continue this procedure.

- 6 Perform the corrective steps for one of the following four sets of conditions. Display the Gray Bars test pattern.



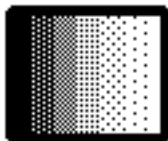
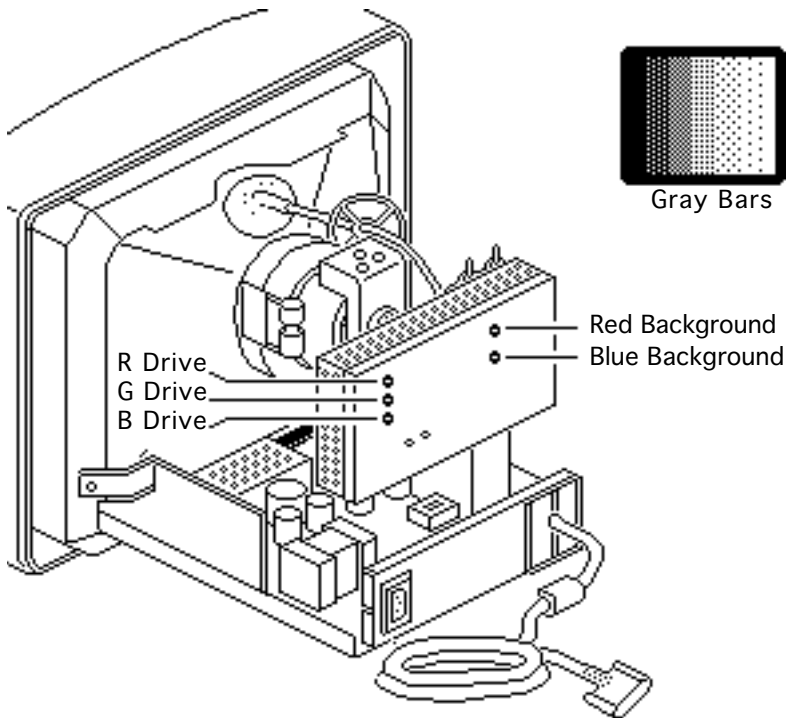


Condition One

If there is no predominant color in the gray bars, but screen luminance is too high and the first bar is not completely black,

Adjust the Sub Bright control slightly until the first bar is black.





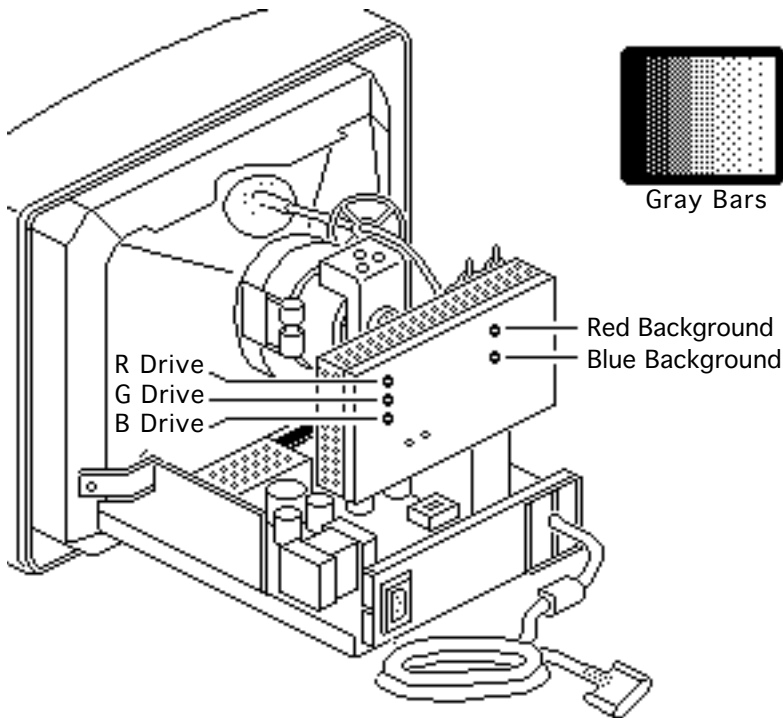
Gray Bars

Condition Two

If there is no predominant color in the gray bars and the first bar is completely black, but screen luminance is too high,

- 1 Alternately turn the R, G, and B Drive controls counterclockwise to reduce screen luminance yet retain even shades of gray in the six brightest bars.





- 2 If necessary, adjust the Red and Blue Background controls until the six brightest bars display even shades of gray.

Condition Three

If there is no predominant color in the gray bars, but screen luminance is too low,

- 1 Alternately turn the R, G, and B Drive controls clockwise to increase screen luminance yet retain even shades of

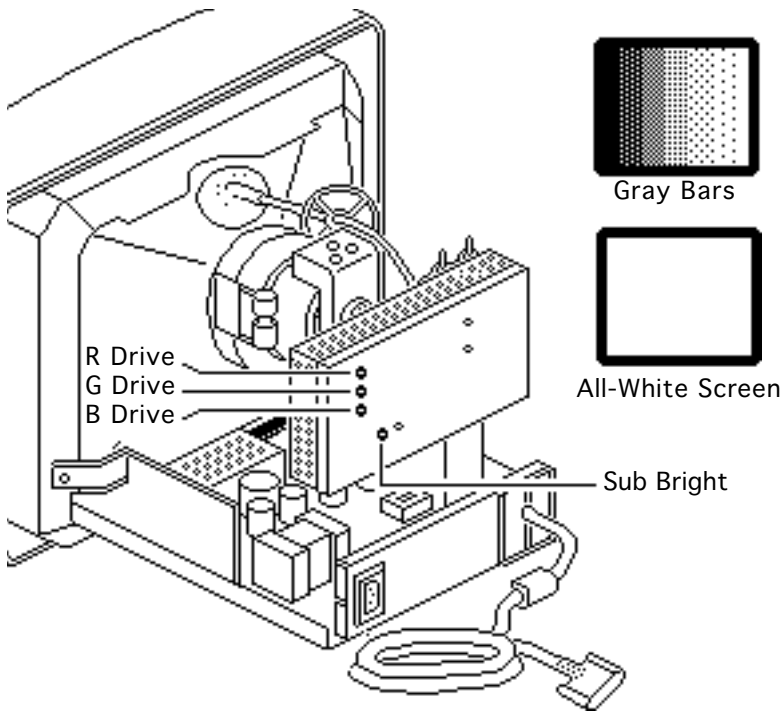




gray in the six brightest bars.

- 2 If necessary, adjust the Red and Blue Background controls until the six brightest bars display even shades of gray.





Condition Four

If the six brightest bars have a predominant color tint,

- 1 Alternately adjust the R, G, and B Drive controls until there is no predominant color.
- 2 Select the All-White Screen test pattern and recheck screen luminance. If necessary, adjust the Sub Bright control until you get 24 foot lamberts (± 3 foot





lamberts), which on the light meter is

- Model R77: 19 on the bottom scale
- Model L-248: 9 to 10 on the 10-18 scale
- Model 246: 19 on the red scale



Light Meter Setup

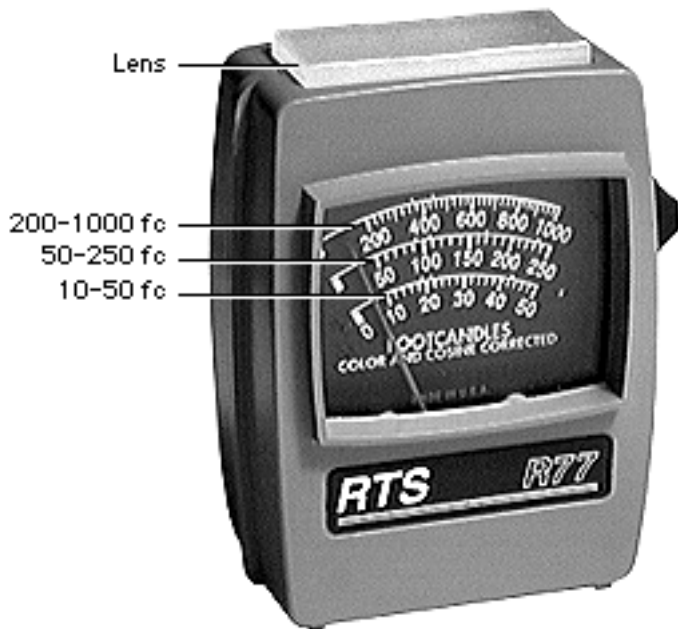
This topic covers setup for three light meter models: R77, L-248, and 246. Model R77 (Apple part number 076-0310) is the newest model available.

Model R77

The R77 light meter is capable of reading luminance from 10 to 1,000 footcandles (fc).

Before you begin, remove the 10X multiplier plate





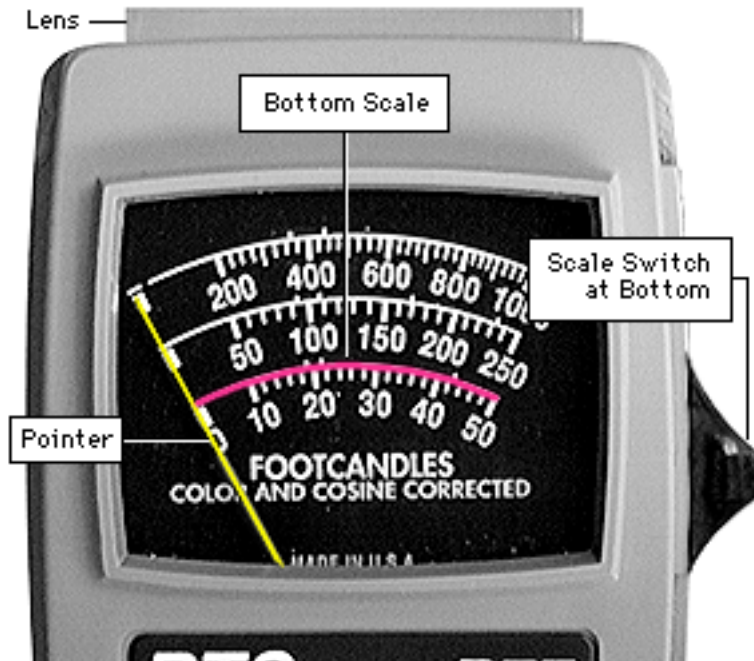
from the lens.

Three scales are shown on the light meter:

- 200-1000 fc
- 50-250 fc
- 10-50 fc

Because display screen luminance typically ranges from 10 to 50 fc, take readings from the bottom scale only.





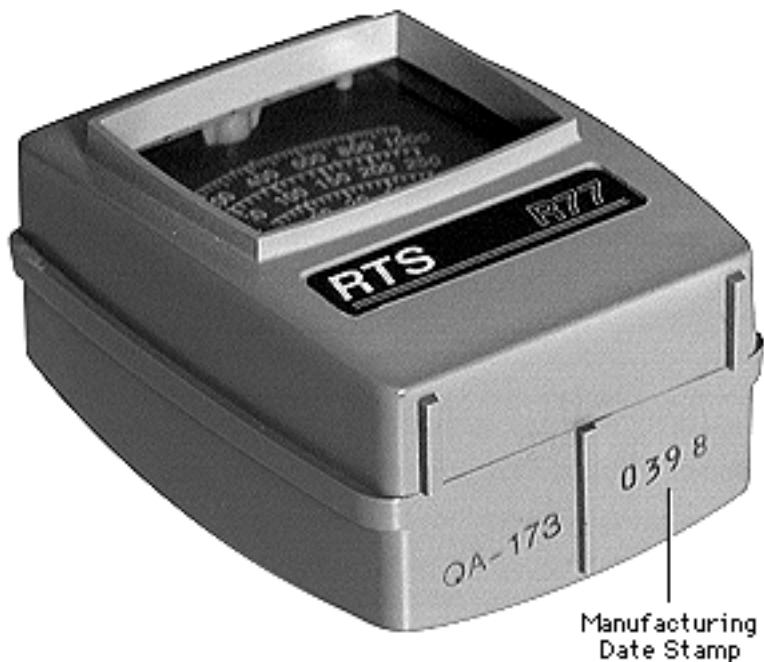
To measure a display screen's luminance,

- 1 Set the scale switch to the bottom position (to set up the 10-50 fc scale).
- 2 Place the lens against the middle of the screen and read the bottom scale.

Note: When the light meter is not in use, slide the scale switch to its top position, and store the meter in its protective case.

Important: If you suspect the light meter is giving false

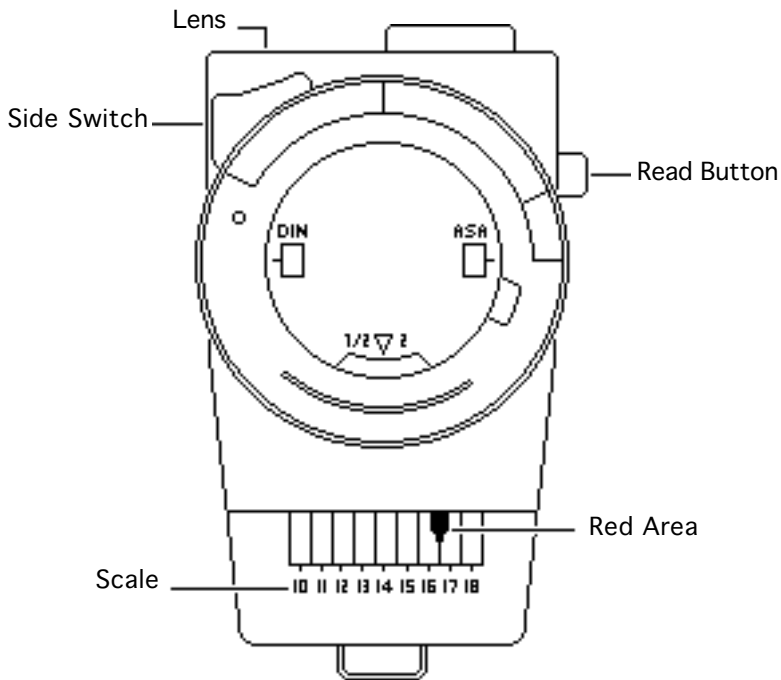




readings, verify the readings with a known-good light meter or photometer. Also check the age of the R77 light meter by its four-digit manufacturing date stamp (such as 0398 for March 1998).

Caution: Dropping the meter can permanently damage its accuracy. A shock-damaged meter might read incorrectly or its pointer may not drop to zero.

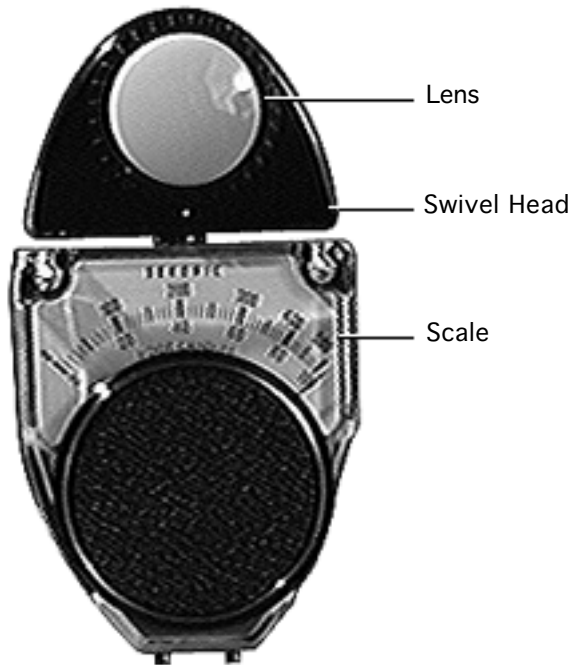




Model L-248

- 1 Press the red button on the back of the light meter. If the reading is out of the red area, replace the battery.
- 2 Move the side switch to its upper position so that the scale reads 10 through 18.
- 3 Uncover the lens of the meter.
- 4 Place the lens against the middle of the screen and press the read button to read the scale.





Model 246

- 1 Remove the metal slide, if installed, from the top of the light meter.
- 2 Install the white lens with the red dot.
- 3 Rotate the swivel head so the lens of the meter faces the monitor.

Place the lens against the middle of the screen and read the scale.





Exploded View

Macintosh 16 Color Display



