Studio Display (17" CRT, 16" viewable image size)

Basics

Studio Display (17" CRT, 16" viewable image size)

Overview

The Studio Display (17" CRT, 16" viewable image size) supports screen resolutions ranging from 640x480 to 1600x1200.

The Studio Display (17" CRT) complies with TCO 95 as certified by the Swedish Confederation of Professional Employees to meet global safety tests and energy-saving features.
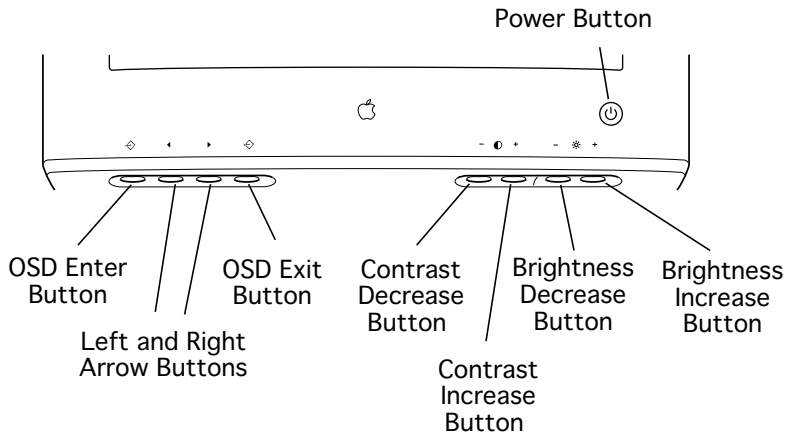
Features

Features of the Studio Display (17" CRT) include
- 17-inch (16.0-inch VIS) Mitsubishi DiamondTron CRT
- 0.25 mm aperture grille pitch
- Multiple resolutions
- Translucent plastic housing and tripod stand
- User controls for brightness, contrast, and On-Screen Display geometry controls
- Compatible with all Power Macintosh computers (except the Duo 2300) running Mac OS version 8.0 or later
- Energy Star compliance

Power Button

OSD Enter
Button

OSD Exit
Button

Contrast
Decrease
Button

Brightness
Decrease
Button

Brightness
Increase
Button

Left and Right
Arrow Buttons

Contrast
Increase
Button

The front panel of the
display includes the
following controls:

• Power button
• Brightness
• Contrast
• On-Screen Display (OSD)
  select/adjust control
• On-Screen Display (OSD)
  enter button

Refer to the Adjustments
chapter for a list of
picture-quality adjustments
that can be made using the
On-Screen Display.

Repair Issues

The new exterior design features of this display include a two-color translucent housing, a tripod monitor stand, and a VGA-style video cable with a VGA-to-Mac adapter.

Protecting the Translucent Housing

Important: Because the housing of this monitor is made of translucent plastic, surface scratches can be more visible than on standard plastic housing. To avoid cosmetic damage and protect the housing during service procedures, please keep in mind the following precautions:

- Use a protective pad that is clean and free of debris whenever you service the display.
- Use caution working with metal tools to avoid scratching the housing.

• Before placing the display face-down on a book or ream of paper, ensure the surface provides protection from scratches.

New Tripod Stand Safety Tips

Because this is a new design, keep in mind the following:
• Lift the display by the hand grips under the left and right sides of the display. Never lift the display by the tripod stand.
• Likewise, do not adjust the position of the monitor by pulling the stand legs. The tripod stand is subject to cracking or breakage if mishandled.
• ⚠ **Warning:** When placing the monitor on a table surface, ensure that all three legs on the tripod stand contact the surface. If one of the legs is too close to the table edge, the weight of the monitor could cause the display to fall off the edge.

VGA-to-Macintosh Adapter

The connector on the display cable is a VGA video connector.

To ensure the proper connection to your computer or video card, click the icon called "Update.pdf" for instructions on using the VGA-to-Macintosh adapter that comes with the Studio Display (17" CRT).

Update.pdf

New Housing Color

In August 1999, a new version of the Studio Display (17" CRT) was introduced. The display performance and internal circuitry remains the same as the original version. However, the new version offers a new housing color.

Unlike the original colors of translucent blue and white, the new version of the display is translucent dark gray and white.

Important: The housing parts (rear housing, intermediate bezel, and front bezel) should be exchanged like for like.

The following table shows the Apple part numbers for the housing parts that differ by color. Finished goods number M6221LL/A represents the original blue

and white version; M6221LL/B represents the new gray and white version.

Part Name	M6221LL/A	M6221LL/B
Rear housing	922-3649	922-3937
Intermed. bezel	922-3647	922-3936
Front bezel	922-3651	922-3938

U.S. Repair Strategy

The Studio Display (17" CRT) is serviced through the service facilitation process. Customers may choose carry-in repair service through an Apple Authorized Service Provider (AASP) who will then facilitate a mail-in repair or customers can receive mail-in service from Apple directly.

Ordering

Apple Service Providers planning to support the Studio Display (17" CRT) may facilitate service by calling 800-919-2775.

For more details on this facilitation process, please refer to the Facilitation Process in the archived service notices section of the Service Source CD. (Open the Notices Archive

folder at the top level of the Main CD. The complete path is
Notices Archive: Service Notices Archive: Service Source
Startup: Service Information: Notices: Service Notices:
Archived List: Facilitation Process.)

Parts

To order replacement parts, use the AppleOrder system and
refer to Studio Display (17" CRT) in the "Service Price
Pages." Large businesses, universities, and K-12 accounts
must provide a purchase order on all transactions, including
orders placed through the AppleOrder system.

Service providers not enrolled in AppleOrder may fax their
orders to Service Provider Support (512-908-8125) or
mail them to the following address:

Apple Computer, Inc.
Service Provider Support
MS 212-SPS
Austin, TX 78714-9125

If you have further questions, please call Service Provider Support at 800-919-2775 and select option #1.

Warranty and AppleCare

The Studio Display (17" CRT) is covered under the Apple One-Year Limited Warranty. The AppleCare Service Plan is also available for this product. Service Providers are reimbursed for warranty and AppleCare repairs facilitated for this display. For pricing information, refer to "Service Price Pages."

Canada Repair Strategy

The service strategy for the Studio Display (17" CRT) is module replacement. However, sometimes replacing modules may not resolve the issue, or a CRT replacement is necessary. For those issues, whole-unit replacements are available. To limit "no fault found" returns on the unit, please use the following procedure when you require a whole-unit replacement:

1   Troubleshoot the unit to ensure the problem isn't with the software or with the computer.

2   After confirming the issue is with the display, refer to Service Source Online or the Service Price Pages to order the modules necessary to repair the display.

3   If the module necessary is not available, or you require a whole-unit replacement, call Technical Service

Provider Support (TSPS) at 1-800-217-9517 (have your 10-digit service account number, beginning with 61, ready). Be prepared to explain the issue, your troubleshooting steps, and the display's serial number to the TSPS phone agent.

4 After verifying the troubleshooting you've performed, the TSPS phone agent will authorize the repair by giving you the whole-unit service replacement part number, and a Vantive case number.

5 Use AppleOrder to place the order for the whole-unit service replacement by manually populating the Part Number field with the part number given to you by the TSPS. Then mark the order for review, and put the Vantive case number in the Comments field. Failure to do so will result in your order being declined.

6 When you receive the whole-unit service replacement, return the old display as you would any service module.

Specifications

Studio Display (17" CRT, 16" viewable image size)

Introduction

Specifications information for the Studio Display (17" CRT) can be found in the Spec Database, which you can access in one of three ways:

- Launch it directly by double-clicking the Apple Spec Database runtime alias at the top level of the Main Service Source CD.
- Select "Apple Spec Database" from the Service Source drop-down main menu.
- Click the Acrobat toolbar icon for the database, which is near the right end of the toolbar with the letters "SP."

Apple Studio Display

Features

Superb screen quality
- 17-inch (16.0-inch viewable image size) Mitsubishi Diamondtron CRT
- Aperture grille technology for vivid colors and sharp text
- Vertically flat screen for reduced glare

Stunning design
- Elegant translucent case that matches Apple's latest Power Macintosh G3 computers
- Storage space under the display for your keyboard

Advanced architecture
- Supports high-resolution display at flicker-free refresh rates
- Includes on-screen controls for easy setup and adjustment to environmental variations
- Meets strict EPA ENERGY STAR and TCO 95 requirements

Looking for a monitor that's big enough to keep you productive, without taking up too much of your desk space—or your budget?

The perfect companion to your new Power Macintosh G3 system, the Apple Studio Display combines a gorgeous screen, a stunning look, and a competitive price. It's a great choice for a wide variety of applications from business to education to science and engineering to the home.

The first thing you'll notice about the Studio Display is its striking appearance. Its elegant translucent enclosure and sleek design complement Apple's newest computer systems. And its unique stand even has room underneath to store your keyboard when you aren't using it.

The high quality of this display comes from a 17-inch (16.0-inch viewable image size) Mitsubishi Diamondtron CRT. These CRTs feature aperture grille technology for vivid colors and sharp text. And their vertically flat screens minimize glare to make your viewing more comfortable.

On-screen controls let you quickly adjust the Apple Studio Display to meet your specific needs and to compensate for changes in environmental conditions. The monitor meets strict worldwide standards for energy consumption, electromagnetic emissions, and recyclability.

Put all those features together and you have a high-quality display for a much lower price than you'd expect. That makes the Apple Studio Display one of the best monitor values available for your Macintosh system—and one you'll enjoy inside and out every day you use it.

Technical Specifications

Picture tube
- 17-inch (diagonal) Diamondtron CRT
- 16-inch (diagonal) viewable image size
- Superfine 0.25-mm aperture grille pitch

Resolutions and refresh rates*
- 640 by 480 pixels at up to 85 Hz
- 800 by 600 pixels at up to 85 Hz
- 832 by 624 pixels at up to 75 Hz
- 1,024 by 768 pixels at up to 85 Hz
- 1,152 by 870 pixels at up to 75 Hz
- 1,280 by 1,024 pixels at up to 75 Hz
- 1,600 by 1,200 pixels at up to 60 Hz

Scanning rates
- 30 to 85 kHz (horizontal)
- 48 to 160 Hz (vertical)

User controls (hardware and software)
- Power on/off
- Brightness
- Contrast
- Degauss
- Horizontal size and centering
- Vertical size and centering
- Horizontal and vertical convergence
- Rotation
- Pincushion
- Keystone
- Parallelogram
- Zoom
- Horizontal moiré
- Color temperature selection

Screen treatment
- High-contrast, antireflective, antistatic coating

Connectors and cables
- 15-pin mini D-Sub VGA connector
- VGA-to-Macintosh adapter

Electrical requirements
- Line voltage: 90V to 264V AC
- Frequency: 47 to 63 Hz, single phase
- Power: 150W (maximum) when operating; less than 15W in standby mode; less than 5W when computer is in energy-saver mode

Agency approvals
- MPR II
- CE Mark
- EPA ENERGY STAR compliant
- IEC 950
- UL1950
- CSA 950
- EN60950
- NUTEK
- TCO 95
- FCC Part 15 Class B; DOC Class B

Environmental requirements
- Operating temperature: 50° to 104° F (10° to 40° C)
- Storage temperature: 32° to 140° F (0° to 60° C)
- Operating humidity: 20% to 95% noncondensing
- Storage humidity: 5% to 95% noncondensing
- Operating altitude: 0 to 10,000 feet (0 to 3,048 m)

Size and weight
- Height: 16.8 inches (42.7 cm)
- Width: 16.2 inches (41.1 cm)
- Depth: 17.6 inches (44.7 cm)
- Weight: 45.9 pounds (20.8 kg)

System requirements
- Power Macintosh G3 computer
- Mac OS 8.0 or later

*Not all computer models and configurations are capable of driving the monitor to the highest display format it supports.

Ordering Information

Studio Display
Order No. M6221LL/A

- Apple Displays software
- Power cord
- VGA-to-Macintosh adapter
- User's manual
- Limited warranty

For More Information

For more information about this product, or to find out where to buy Apple products, visit www.apple.com on the World Wide Web or call 1-800-538-9696. To purchase this product from the Apple Store, go to www.apple.com/store.

Apple stands behind its products with world-class service and support. Offering quality parts, extended hardware service options, phone support, and support via the Internet, we provide you with support choices that meet your needs. For more information, visit www.apple.com/support.

Nothing works and looks better with a new Power Macintosh G3 computer than an Apple Studio Display (sold separately).

Apple Studio Display

Features

Superb screen quality
- 17-inch (16-inch viewable image size) Diamondtron CRT
- Aperture grille technology for vivid colors and sharp text
- Vertically flat screen for reduced glare

Stunning design
- Elegant translucent case that matches Apple's new Power Mac G4 computers
- Storage space under the display for your keyboard

Advanced architecture
- Supports high-resolution display at flicker-free refresh rates
- Includes on-screen controls for easy setup and adjustment to environmental variations
- Meets strict EPA ENERGY STAR and TCO 99 requirements

Looking for a monitor that's big enough to keep you productive, without taking up too much of your desk space—or your budget?

The perfect companion to your new Power Mac G4 system, the Apple Studio Display combines a gorgeous screen, a stunning look, and a competitive price. It's a great choice for a wide variety of applications from business to education to science and engineering to the home.

The first thing you'll notice about the Studio Display is its striking appearance. Its elegant translucent enclosure and sleek design complement Apple's newest computer systems. And its unique stand even has room underneath to store your keyboard when you aren't using it.

The high quality of this display comes from a 17-inch (16-inch viewable image size) Diamondtron CRT. These CRTs feature aperture grille technology for vivid colors and sharp text. And their vertically flat screens minimize glare to make your viewing more comfortable.

On-screen controls let you quickly adjust the Apple Studio Display to meet your specific needs and to compensate for changes in environmental conditions. The monitor meets strict worldwide standards for energy consumption, electromagnetic emissions, and recyclability.

Put all those features together and you have a high-quality display for a much lower price than you'd expect. That makes the Apple Studio Display one of the best monitor values available for your Macintosh system—and one you'll enjoy inside and out every day you use it.

Technical Specifications

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- 1,280 by 1,024 pixels at up to 75 Hz
- 1,600 by 1,200 pixels at up to 60 Hz

Scanning rates
- 30 to 85 kHz (horizontal)
- 48 to 160 Hz (vertical)

User controls (hardware and software)
- Power on/off
- Brightness
- Contrast
- Degauss
- Horizontal size and centering
- Vertical size and centering
- Horizontal and vertical convergence
- Rotation
- Pincushion
- Keystone
- Parallelogram
- Zoom
- Horizontal moiré
- Color temperature selection

Screen treatment
- High-contrast, antireflective, antistatic coating

Connectors and cables
- 15-pin mini D-Sub VGA connector

Electrical requirements
- Line voltage: 90V to 264V AC
- Frequency: 47 to 63 Hz, single phase
- Power: 150W (maximum) when operating; less than 15W in standby mode; less than 5W when computer is in energy-saver mode

Agency approvals
- MPR II
- CE Mark
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- IEC 950
- UL1950
- CSA 950
- EN60950
- NUTEK
- TCO 99
- FCC Part 15 Class B; DOC Class B

Environmental requirements
- Operating temperature: 50° to 104° F (10° to 40° C)
- Storage temperature: 32° to 140° F (0° to 60° C)
- Operating humidity: 20% to 95% noncondensing
- Storage humidity: 5% to 95% noncondensing
- Operating altitude: 0 to 10,000 feet (0 to 3,048 m)

Size and weight
- Height: 19.6 inches (49.9 cm)
- Width: 19.0 inches (48.6 cm)
- Depth: 17.3 inches (43.9 cm)
- Weight: 45.9 pounds (20.8 kg)

System requirements
- A 1999-model Power Macintosh G3 computer or a Power Mac G4 computer
- Mac OS 8.5 or later

Ordering Information

Apple Studio Display
Order No. M6221LL/B

- Apple Displays software
- Power cord
- User's manual

For More Information

For more information about this product, or to find out where to buy Apple products, visit www.apple.com/products on the World Wide Web or call 800-538-9696. To purchase this product from the Apple Store, go to www.apple.com/store.

Apple stands behind its products with world-class service and support. Offering quality parts, extended hardware service options, phone support, and support via the Internet, we provide you with support choices that meet your needs. For more information, visit www.apple.com/support.

Nothing works and looks better with a new Power Mac G4 computer than an Apple Studio Display (sold separately).

Apple Computer, Inc.

1 Infinite Loop
Cupertino, CA 95014
408-996-1010
www.apple.com

Troubleshooting

Studio Display (17" CRT, 16" viewable image size)

General

The "Symptom Charts" section 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, contact Apple Technical Support.

First Checklist

Important: Many display modules returned for repair are found to be fully operational. Read this checklist before you return a module, and prevent needless module replacement and unnecessary time delays.

✔ **The Studio Display (17" CRT) is not compatible with all computers.**

This display works with all Power Macintosh computers (except the Duo 2300) running Mac OS version 8.0 or later.

✔ **The CRT raster will not always resemble a perfect rectangle.**

CRT tolerances allow for some distortion. Additional distortion can be caused by magnetized metal objects (desks, file cabinets, etc.). Move the unit to a different location if you notice raster bowing or bent raster edges. You can also use the geometry controls in the On-Screen Display to optimize the shape of the raster.

✔ **Jitter, faint lines, or screen movement can be caused by external interference such as electronic devices and fluorescent lights.**

Fluorescent lights, other monitors, or electronic appliances such as coffee makers and copy machines can cause raster distortion. Move the unit to another room or building to help determine if external interference is the source of the problem.

Note: If the raster has shifted up/down or right/left only, adjust it using the geometry controls in the On-Screen Display (OSD). However, keep in mind that if you then move the monitor you may need to readjust the display.

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

✔ **A misadjusted screen can mimic the symptoms of deflection board or CRT failures.**

By performing the adjustment procedures, you might determine if one or more of the adjustments is the cause of the problem.

CRTs rarely fail.

✔ Needless CRT replacement can be prevented by checking display adjustments, checking the possibility of other defective modules, and accepting small imperfections in screen display.

If you have any doubts about whether a CRT is defective, contact Apple Technical Support.

Symptom Charts

No Raster

No raster with LED on

1 Check all exterior cable connections. Check for bent pins on the connectors. Tighten thumbscrews. If a video card is used, the video cable must be secured to the card.

2 If LED is amber, verify computer video signal by connecting known-good monitor.

3 Adjust brightness and contrast controls on the front bezel.

4 A screen saver may be activated. Move mouse or press any key to reactivate the screen.

5 Replace main deflection board and CRT/video board module. See "Main Deflection and CRT/Video Board Module" in Take Apart chapter. See Adjustments chapter for diagnostic adjustments that might be necessary after board replacement.

No raster with LED off

1 Press power button on display. Ensure that power cord is plugged in properly.

2 Check power outlet at the wall by plugging in an electronic device that works.

3 If the display is plugged into a computer, ensure that computer is on and power cord firmly connected.

4 Check cable connection between main deflection board and user controls board.

5 Replace main deflection board and CRT/video board module. See "Main Deflection and CRT/Video Board Module" in Take Apart chapter. See Adjustments chapter for diagnostic adjustments that might be necessary after board replacement.

Video

Screen flickers

1 Check monitor cable connections. Tighten thumbscrews. If a video card is used, the video cable must be secured to the card.
2 Check for external interference by moving the monitor to another location—preferably in the center of the room away from other devices. Refer to "First Checklist" in this chapter.
3 If using more than one monitor with a computer, move the monitors so they are at least 18 inches apart.
4 If a video card is used, check the refresh rate. Refresh rates below 60 Hz may cause flicker. See the video card manual to raise the refresh rate above 60 Hz.
5 Double-check items 1 through 4.
6 Replace main deflection board and CRT/video board module. See "Main Deflection and CRT/Video Board Module" in Take

Apart chapter. See Adjustments chapter for diagnostic adjustments that might be necessary after board replacement.

Screen is blurred **Note:** If the monitor is set at the highest screen resolution, some finely-detailed images and small fonts might appear blurry. In this case, try changing the screen resolution.

1 Check external and internal cable connections. Reseat connectors.
2 Adjust the H Convergence and V Convergence as described in "Checking Screen Color and Adjusting Convergence" in the Adjustments chapter.
3 Using the Display Service Utility, select the focus pattern, and adjust Focus (the two top controls on the flyback transformer). Refer to "Adjusting Focus " in Adjustments chapter.
4 Double-check focus and/or readjust if necessary.
5 Replace main deflection board and CRT/video board module.

See "Main Deflection and CRT/Video Board Module" in Take Apart chapter. See Adjustments chapter for diagnostic adjustments that might be necessary after board replacement.

Screen is too bright

1 Adjust brightness and contrast controls. See "User Controls" in Adjustments.

2 Check high voltage as described in "Checking High Voltage" in Adjustments chapter.

3 Check B+ voltage as described in "Checking B+ Voltage" in Adjustments chapter.

4 Adjust screen control on flyback transformer. Refer to "Adjusting Screen Voltage" in Adjustments chapter.

5 Replace main deflection board and CRT/video board module. See "Main Deflection and CRT/Video Board Module" in Take Apart chapter. See Adjustments chapter for diagnostic adjustments that might be necessary after board replacement.

Colors are too green, red, or blue, and the screen is unreadable

1 Check video cable connector and ensure no pins are bent.
2 Ensure that video cable is properly connected; tighten thumbscrews. If a video card is used, the video cable must be properly attached to it.
3 Ensure that the video card or computer video port is good by connecting a known-good monitor.
4 Reseat the cables connected to the CRT/video board.
5 Replace main deflection board and CRT/video board module. See "Main Deflection and CRT/Video Board Module" in Take Apart chapter. See Adjustments chapter for diagnostic adjustments that might be necessary after board replacement.

Rainbow effect when displaying full-white screen

1 Check for external interference by moving the monitor to another location—preferably in the center of the room away from other devices. Refer to "First Checklist" in this chapter.
2 Turn off display. Wait a few minutes and turn on display. Degauss exterior of display with a hand-held degaussing coil. (You can purchase a degaussing coil for about $25 at most larger electronic parts stores.)
3 Replace CRT.
Note: The CRT might have been subjected to severe impact that damaged the aperture grill.

Thin vertical lines on screen

Important: Do not confuse this symptom with horizontal lines on the screen (the next symptom).

Note: The Diamondtron CRT used in the Studio Display (17" CRT) has an aperture grill of very fine, vertical wires to enhance screen sharpness. Exposure to cold and or vibration can cause these fine wires to temporarily adhere to each other. This anomaly is inherent to this display when exposed to lower temperatures.

1 Remove jewelry from your hands and arms. Using the heel of your hand, use moderate force to impact the side of the display under the Apple logo on the right, then left, side.
2 If the lines persist after a few attempts to break the adhesion of the wires, place a soft cloth over the face of the CRT. Use a solid rubber mallet and light force to impact the center of the CRT face. You may increase the force applied with the mallet until you are approximately 12 inches from the face of the CRT.
3 If the lines persist, call Apple Technical Support (in the US, call 1-800-919-2775, option 3) for further troubleshooting instructions. Replacing a main deflection board and CRT/video board module will not resolve the problem.

Thin horizontal lines on screen

Displays larger than 15 inches with tron-style CRTs typically have two stationary 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. The lines cannot be adjusted out or eliminated by repairing or replacing modules in the display.

Geometry

Raster is too short, tall, narrow, or wide

1 Using the On-Screen Display, click the Recall icon. If the screen geometry worsens, refer to "Adjusting Screen Geometry" in the Adjustments chapter to make new geometry settings and save them in factory mode.

2 Adjust the width and height of the screen. See "User Controls" in Adjustments.

3 Replace main deflection board and CRT/video board module. See "Main Deflection and CRT/Video Board Module" in Take Apart chapter. See Adjustments chapter for diagnostic adjustments that might be necessary after board replacement.

Raster is not centered

1 Using the On-Screen Display, click the Recall icon. If the screen geometry worsens, refer to "Adjusting Screen Geometry" in the Adjustments chapter to make new geometry settings and save them in factory mode.

2 Check that the distortion is not due to environmental conditions. Move the monitor.

3 Adjust the horizontal position of screen. See "User Controls" in Adjustments.

4 Adjust vertical position of screen.

5 Replace main deflection board and CRT/video board module. See "Main Deflection and CRT/Video Board Module" in Take Apart chapter. See Adjustments chapter for diagnostic adjustments that might be necessary after board replacement.

Take Apart

Studio Display (17" CRT, 16" viewable image size)

Pictorial Overview–Movie!

This chapter includes a QuickTime VR movie that illustrates removing the major parts and modules of the Studio Display (17" CRT).

Important: The movie is not intended to substitute for the detailed service procedures. Therefore, enjoy the movie as an overview, but refer to the detailed procedures in this chapter for complete instructions for servicing this display.

Movie Tips

Before you begin, note these movie tips:
- From the main menu, click on the numbered tabs for an overview of each of the major Take Apart procedures.
- Use the arrow keys on your keyboard, rather than the mouse, to navigate through each movie.
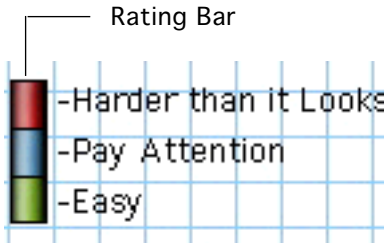
- Some movie clips have no defined ending because they loop back to the beginning. In this case, click the Back button to end the clip and return to the main menu.
- Note the rating bar included with some procedures. This is a vertical bar divided into three colored sections:
  - Red indicates that the service procedure is more difficult than it appears. For service procedures that are rated red, it is especially important to read the Take Apart instructions before attempting the procedure.
  - Blue indicates a somewhat complicated service procedure.
  - Green indicates an easy service procedure.

Rating Bar

-Harder than it Looks
-Pay Attention
-Easy

studio_display_17_QTVR

Click the movie icon at left for a pictorial overview of the main Take Apart procedures.

Important: What do you think? Click on this paragraph to access a feedback form and send comments about the movie.

Safety Guidelines

⚠️**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 and setting up an ongoing ground connection.

⚠️**Warning:** When the rear housing is removed, avoid the sharp sheet-metal edges of the EMI shield, main deflection board chassis, and other metal areas of the display assembly.

⚠️**Warning:** The rear housing helps support the weight of the display assembly. Whenever the rear housing is removed, do not set the display upright.
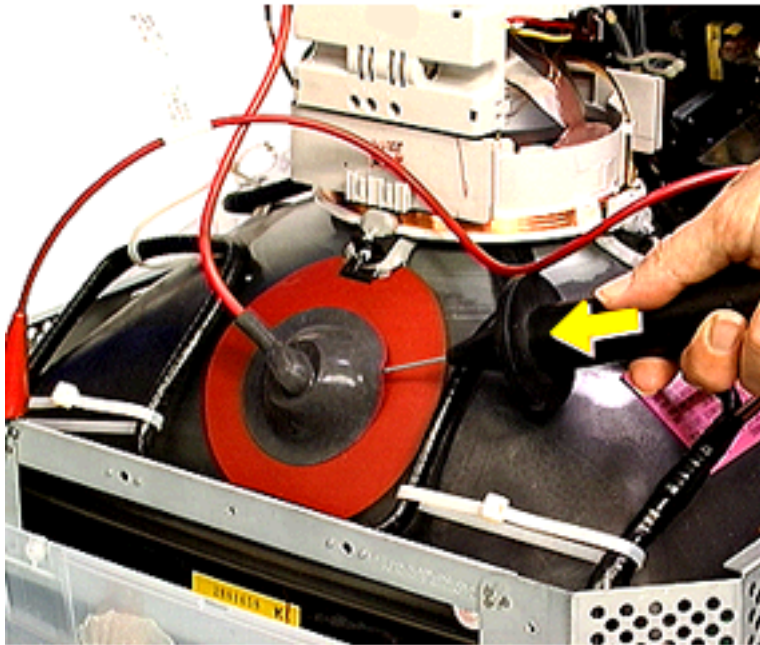
Important: Whenever the EMI shield is removed and before replacing a module, you must do the following:

1 Using the CRT discharge tool (Apple part number 076-0381), connect the clip to the CRT chassis frame and insert the needle underneath the anode cap to discharge the CRT.
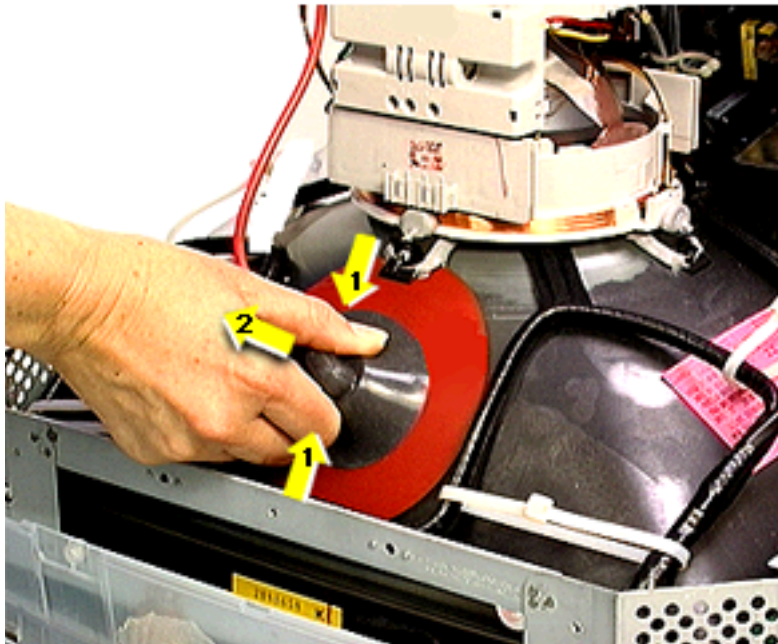
2 Remove the anode cap.

3 For working inside the monitor with the power off, establish an ongoing ground. Connect one end of a cable with alligator clips to the anode aperture, and connect the other end to the ground strap that wraps around the CRT.

   With the CRT discharged and the ongoing ground in place, wear a grounding wriststrap to prevent equipment damage from static electricity.

New Tripod Stand Safety Tips

Important: Because this is a new design, keep in mind the following:

- Lift the display by the hand grips under the sides of the display. Never lift the display by the tripod stand.
- Likewise, do not adjust the position of the monitor by pulling the stand legs. The tripod stand is subject to cracking or breakage if mishandled.
- When placing the monitor on a table surface, ensure that all three legs on the tripod stand contact the surface. If one of the legs is too close to the table edge, the weight of the monitor could cause the display to fall off the edge.

Protecting the Translucent Housing

Important: Because the housing of this monitor is made of translucent plastic, surface scratches can be more visible than on standard plastic housing. To avoid cosmetic damage and protect the housing during service procedures, please keep in mind the following precautions:

• Use a protective pad that is clean and free of debris whenever you service the display.
• Use caution working with metal tools to avoid scratching the housing.
• Before placing the display face down on a book or ream of paper, ensure the surface provides protection from scratches.

List of Tools

Required Tools

- Protective pad and a thick book or ream of paper on which to place the display face down
- Magnetic Phillips screwdriver (electric preferred) with 6-inch extension
- CRT discharge tool (Apple part number 076-0381)
- Flat-blade screwdriver
- Wire cutters (for cutting cable tie)
- Plastic cable tie (for convergence/tilt board cables)

Optional Tools

- Turntable
- Needlenose pliers

Intermediate Bezel

Intermediate Bezel

No preliminary steps are required before you begin this procedure.

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

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

Caution: The plastic tabs are delicate and can be easily

Intermediate
Bezel
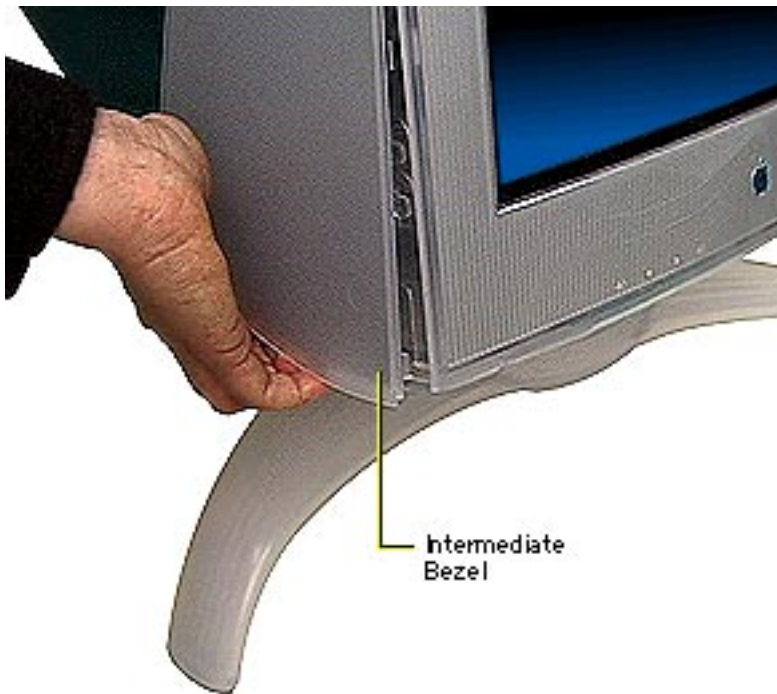
broken if the intermediate
bezel is removed
improperly. Read all of the
instructions for this
procedure before attempting
to remove the intermediate
bezel.

1   With the display
    upright, wedge your
    fingers under the lower
    edge of the intermediate
    bezel to open the seal.

2 On the back edge of the
   intermediate bezel, slide
   your fingers along the
   back and up the sides to
   pop open the back tabs.

Hook

3 Grasping the side and top of the intermediate bezel, use reasonable force to slide the bezel up to release the hook.

4 Repeat steps 1, 2, and 3 on the other side of the intermediate bezel.

Screwdriver
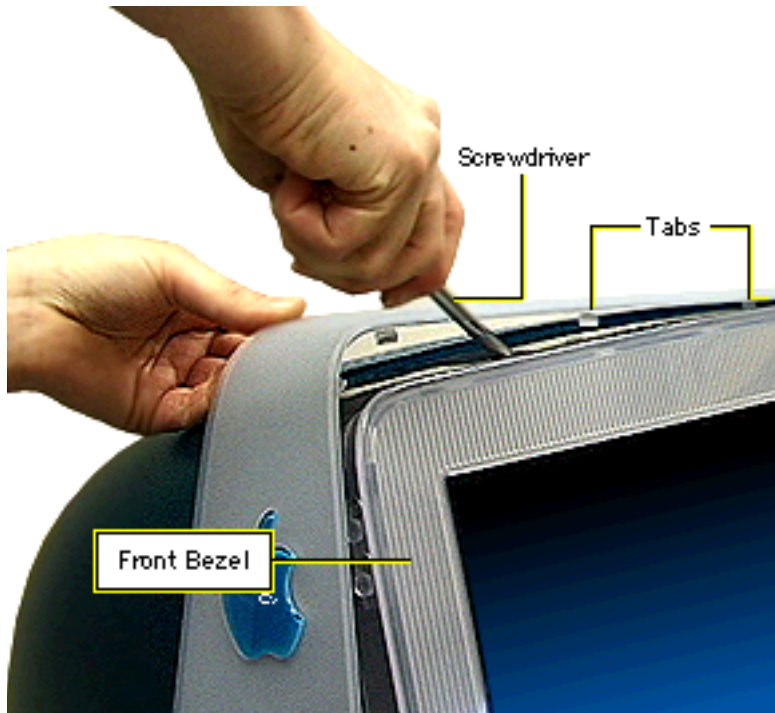
Tabs

Front Bezel

5 **Caution:** Avoid marring the plastic surface.

Using a large (3/8-inch wide) flat-blade screwdriver, slide the screwdriver between the front bezel and the intermediate bezel to release the bezel tabs.

Inner
Shield

Intermediate
Bezel
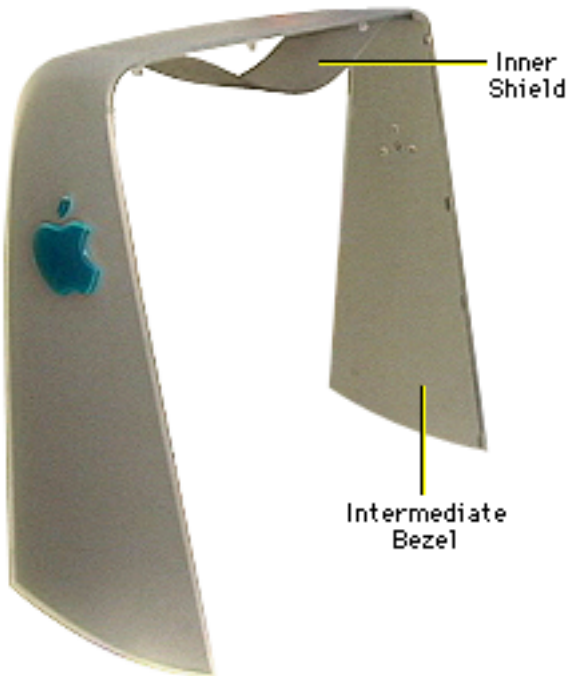
Replacement Note: The intermediate bezel includes an inner shield that is heatstaked to the bezel at the two apple logos. Ensure the shield is securely attached to the intermediate bezel as you reinstall it.

Replacement Note: Follow the steps below to reinstall the intermediate bezel:

1   Reinstall the rear housing and the tripod stand.

2   **Note:** If the intermediate bezel tabs

were bent during removal, they are generally flexible enough to be bent back into place.

With the monitor upright, reinstall the top of the intermediate bezel by tilting it so the front tabs fit into the front bezel, and the top corner hooks fit into the front bezel slots. Then press on the entire top of the intermediate bezel until it is flush with the top of the rear housing and front bezel.

3   Working on one side at a time, hook the front side of the bezel into the slots. Then secure the back tabs. Press on the sides of the intermediate bezel until all tabs snap into place.

4   Check for unseated tabs all around the intermediate bezel. If necessary, use reasonable force to slap the bezel to secure its fit.

Tripod Stand

No preliminary steps are required before you begin this procedure.

⚠️ **Warning:** Refer to "New Tripod Stand Safety Tips" at the beginning of this chapter.

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

Tripod Stand
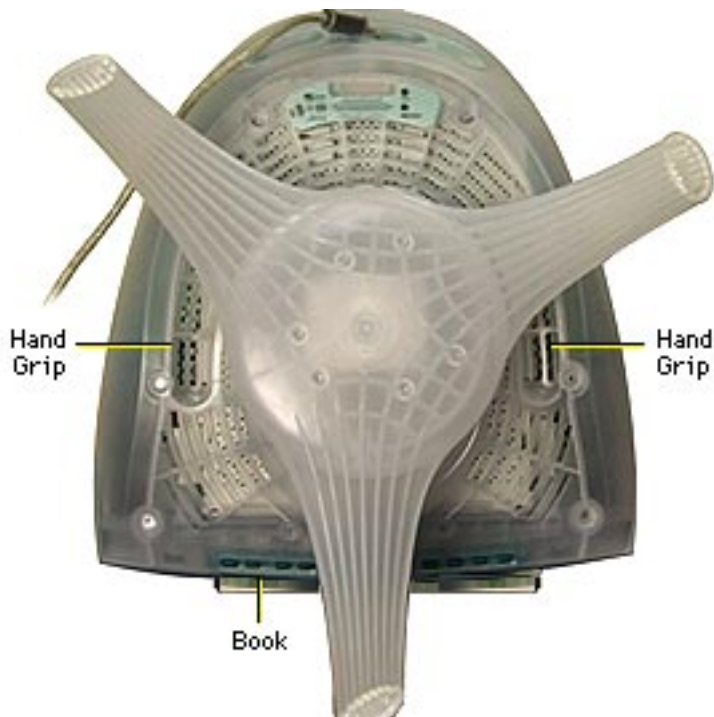
1 Lifting the display by its hand grips, position the display face-down on a protective pad and/or thick book with the tripod stand in front of you.
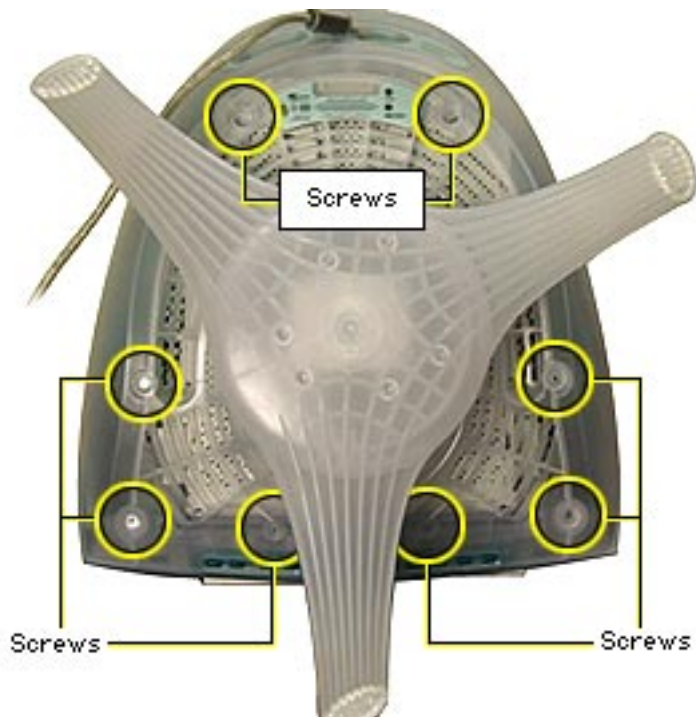
2 **Caution:** To avoid stressing the plastic stand, remove the two screws by the serial number label last.

Remove the eight Phillips screws that secure the stand to the bottom housing.

Rear Housing — Tripod Stand —
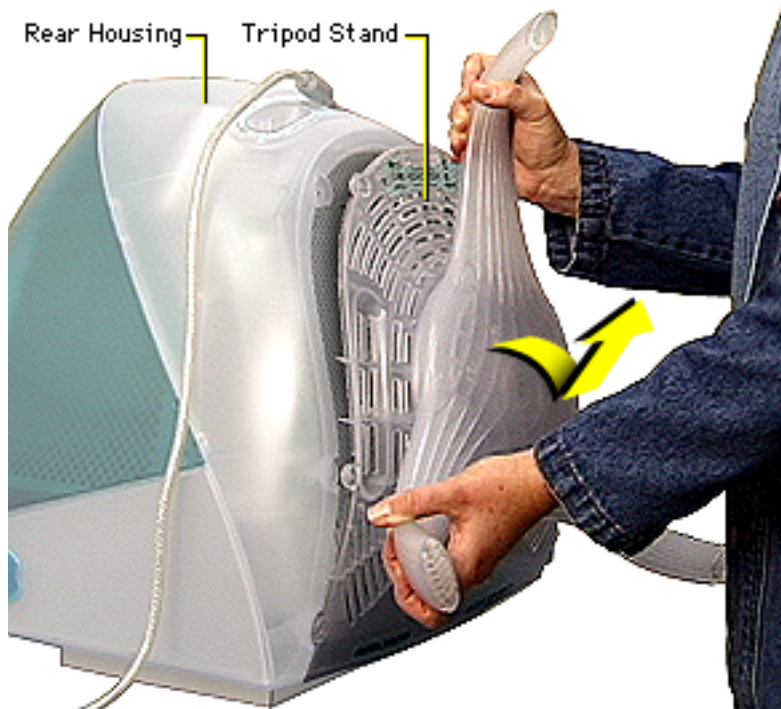
3 Tilt the tripod stand
   away from the rear
   housing to remove it.

Replacement Note: Ensure
the control buttons under
the front bezel align
properly with the holes in
the tripod stand.

For best results, tighten
each screw only half way so
you can slightly adjust the
placement of the stand if you
need to. Finish tightening all
screws when you are sure
the tripod stand fits
correctly.
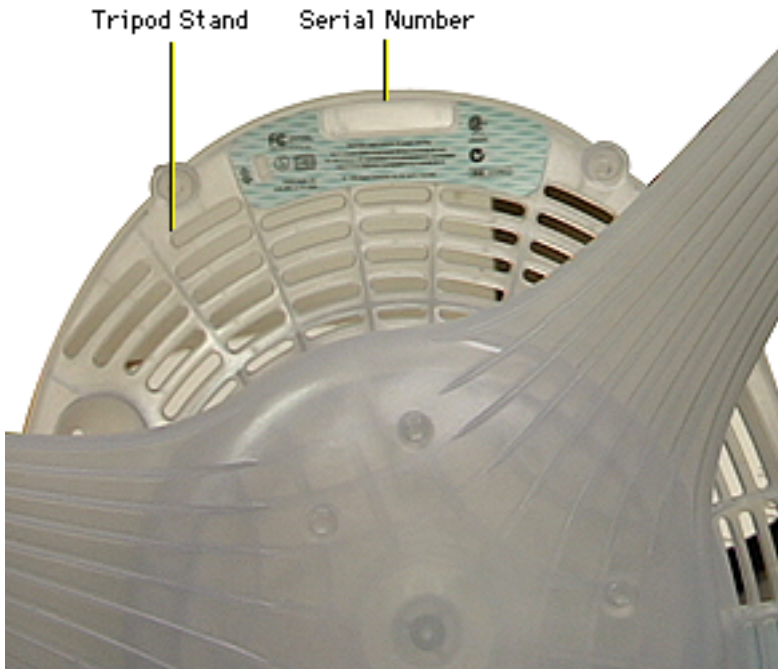
Replacement Caution: The back of the tripod stand carries a product ID label that includes the serial number and manufacturing date for the monitor. When you receive a new tripod stand, the product ID label will show blank lines for the serial number and manufacturing date. **To avoid losing this critical information, copy the serial number and manufacturing date onto the blank lines of the product ID label on the new tripod stand.**

Rear Housing

Before you begin, remove
- Intermediate bezel
- Tripod stand

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

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

Important: The rear housing consists of two molded pieces
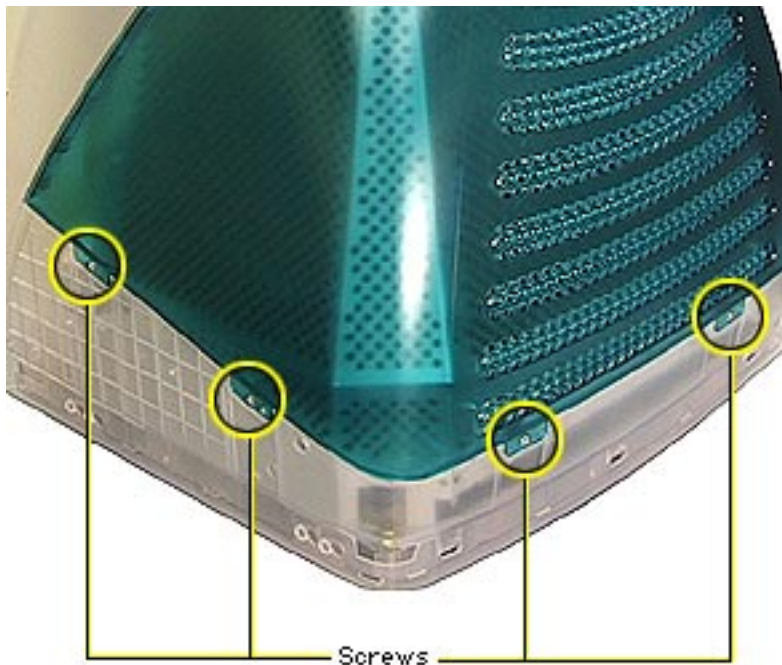
of plastic: blue top and clear bottom. Do not attempt to separate the two pieces of the rear housing.

1 With the monitor face-down, remove the six Phillips screws from the rear housing.

Rear Housing
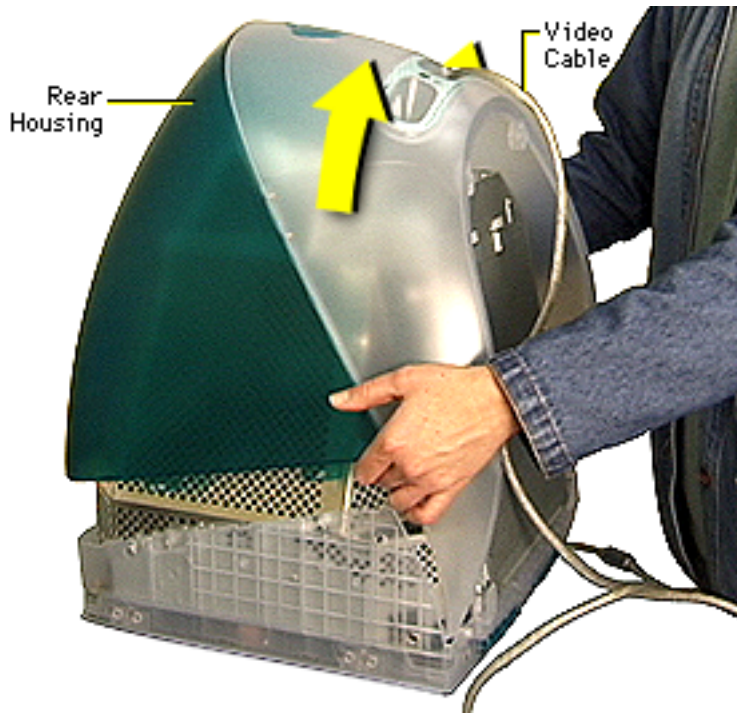
Video Cable

2 Lift the rear housing straight up from the monitor assembly. Feed the video cable through the opening in the rear housing.

Warning: The rear housing helps support the weight of the chassis and CRT. When the rear housing is removed, the monitor assembly is less stable. Avoid moving the monitor assembly when the rear housing is not attached.

EMI Shield

EMI Shield

Before you begin, remove

- Intermediate bezel
- Tripod stand
- Rear housing

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

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

Top of
EMI Shield
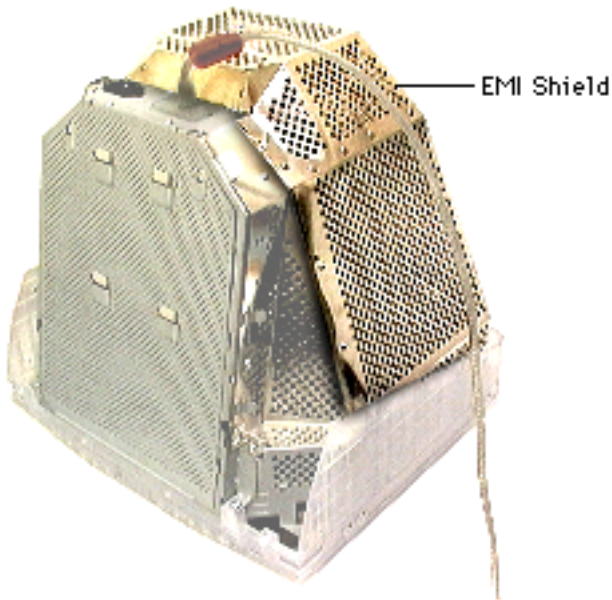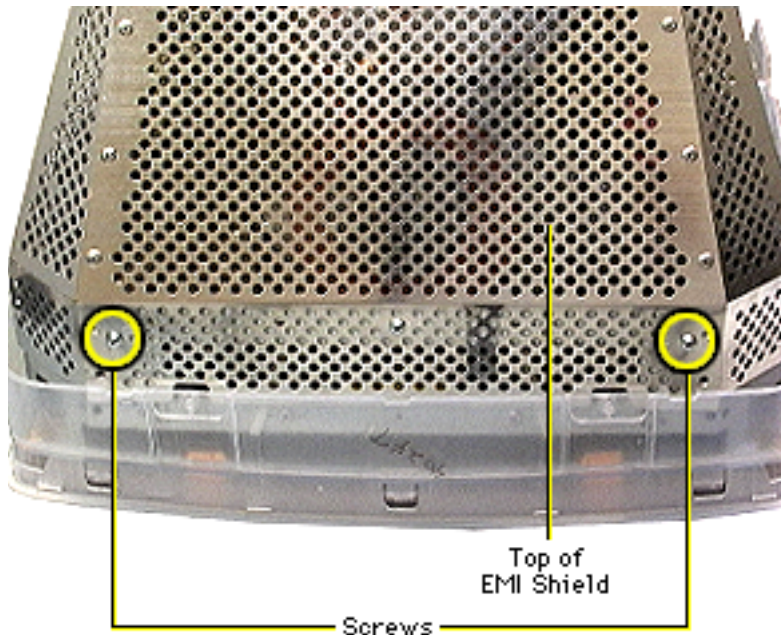
Screws

Note: Avoid jiggling the monitor assembly as you complete this procedure.

⚠ Warning: The metal edges of the EMI shield and chassis are sharp. Use caution when removing screws or modules.

The EMI shield is held in place by 10 Phillips screws (two in the back, three on each side, and two on top).

1   Remove the two Phillips screws from the top of the EMI shield.

Screws

Screw Hole
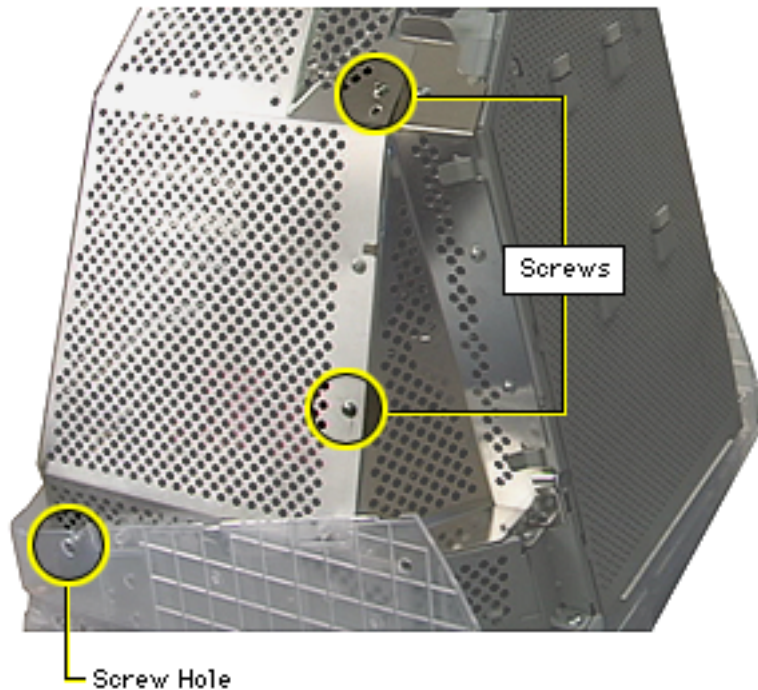
2 Remove the three Phillips screws from the left side of the EMI shield.

Screws

Screw Hole
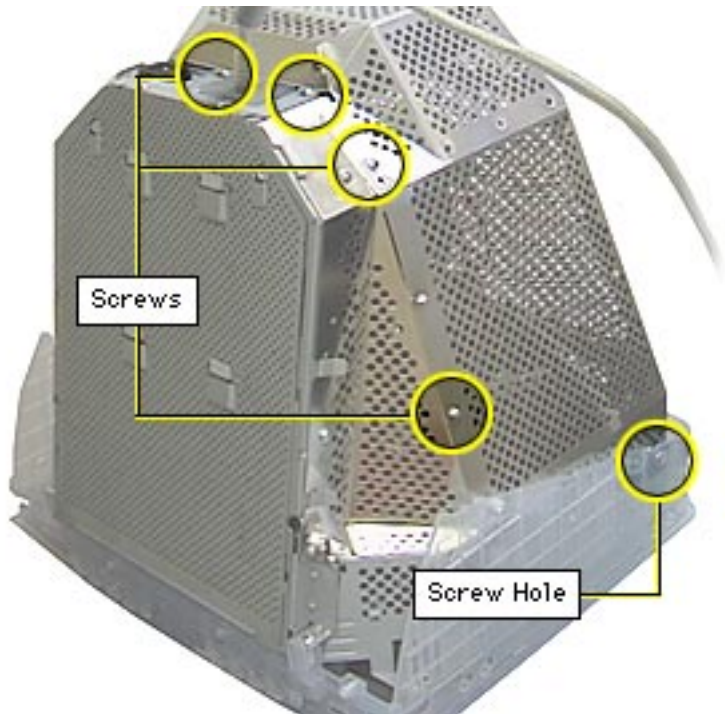
3 Remove the remaining five Phillips screws from the right side and back of the EMI shield.

Tab

4 At each side of the EMI shield, push the shield away from the chassis tab to free it from the chassis.
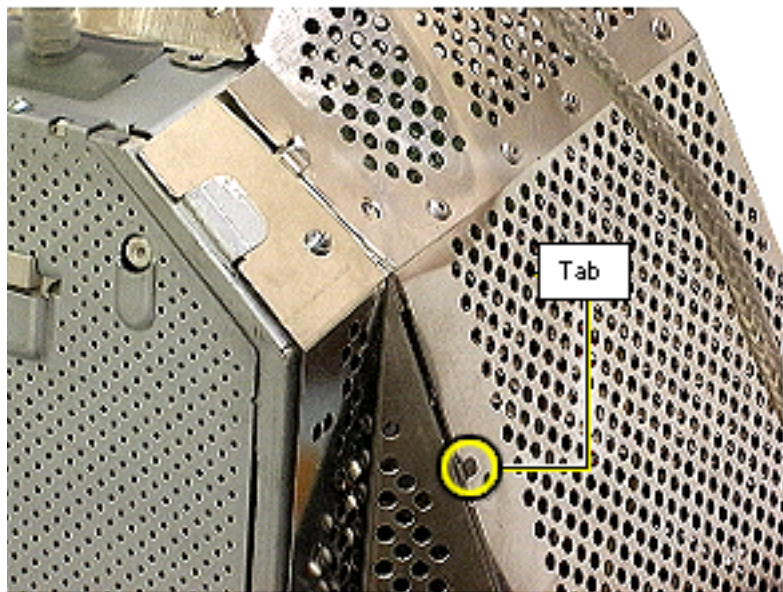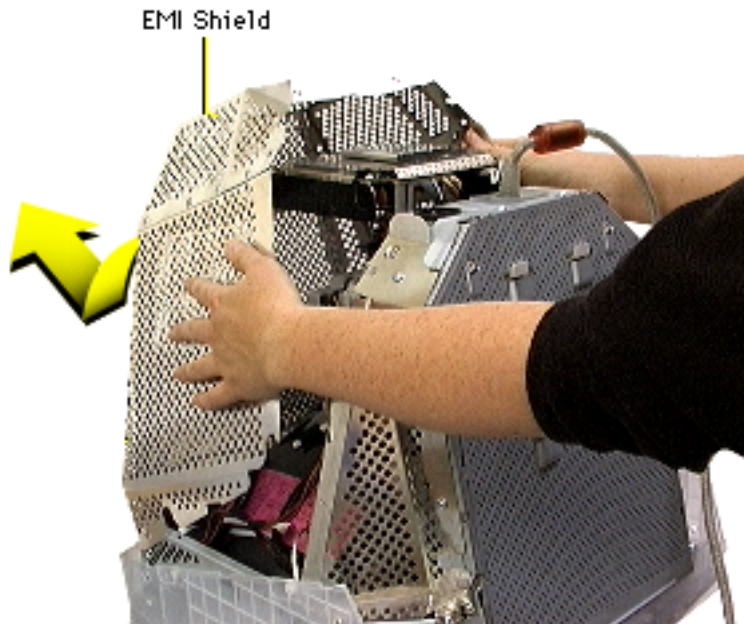
EMI Shield

5 Lifting one side of the shield at a time, flex the sides outward and tilt the EMI shield forward and away from the monitor assembly.
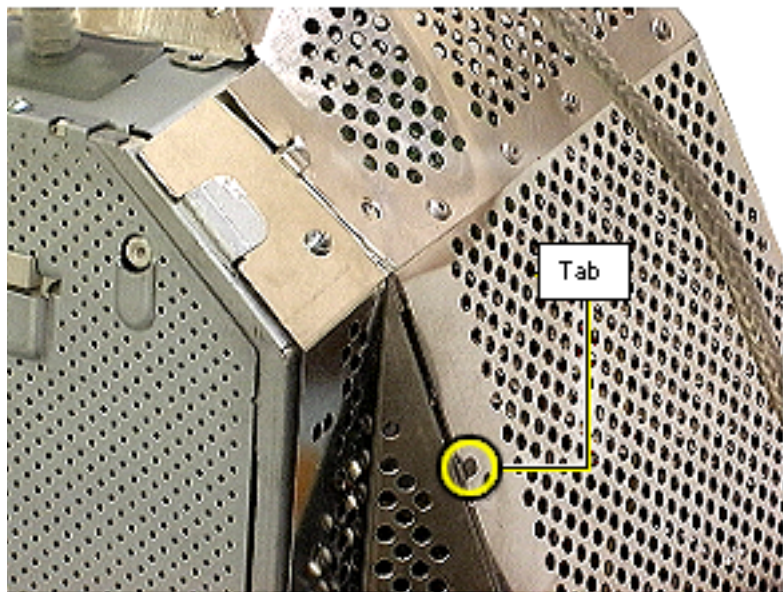
Replacement Note: Before securing the EMI shield screws, ensure

- Tab on each side of the main deflection board chassis is secured in side slot of the EMI shield
- Screw holes on the chassis and the EMI shield are aligned
- No cables are pinched

Convergence/Tilt Board

Convergence/Tilt Board

Before you begin,

- Remove intermediate bezel
- Remove tripod stand
- Remove rear housing
- Remove EMI shield
- Discharge CRT and remove anode cap (see Safety Guidelines)

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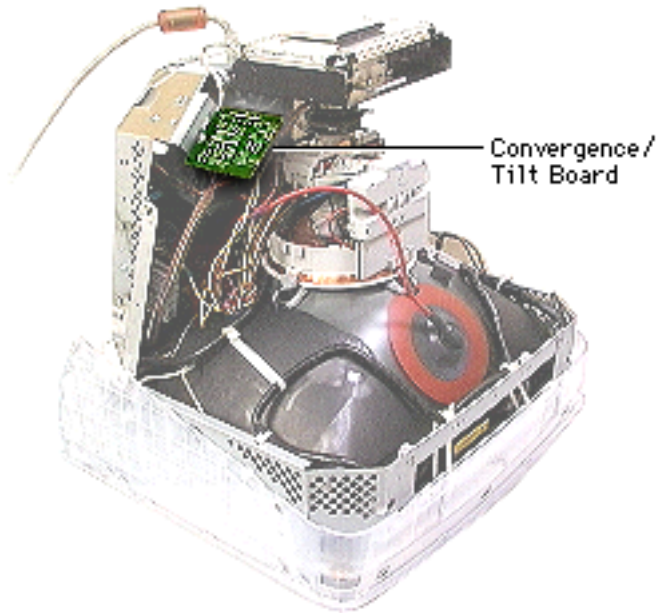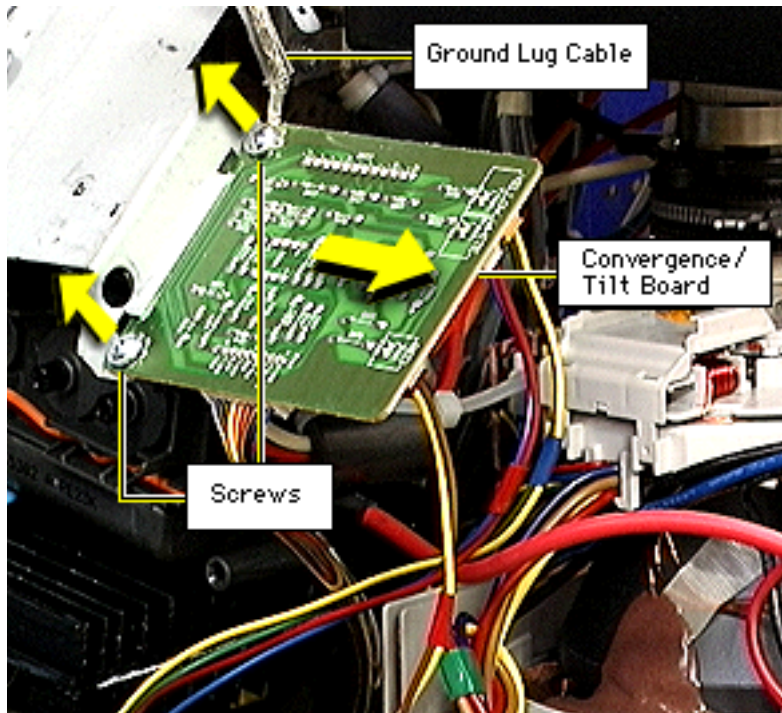
Bulletins/Safety.

**Caution:** Never use a grounding wriststrap until after discharging the CRT.

1 Remove the two Phillips screws and the ground lug cable.

   Replacement Note: Secure the ground lug connector from the CRT/ video board to the screw closest to the board.

2 Pull the board out from the chassis holder.

P201   P203

P204   P205
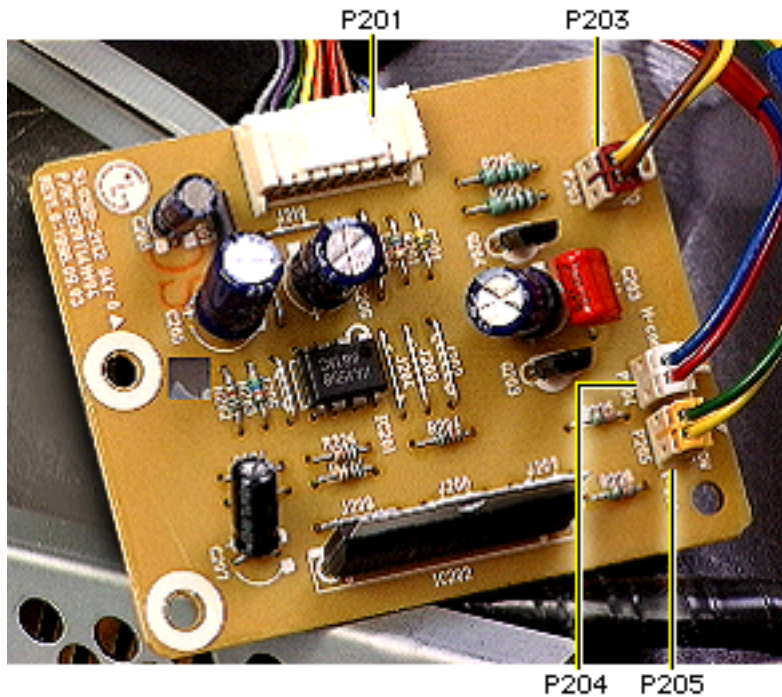
3   Flip the board over and disconnect the three small connectors:
    • Tilt (red P203)
    • H-Con (white P204)
    • V-Con (yellow P205)

4   Press the connector tab on keyed connector P201 to remove the cable from the board.

5   If you are continuing to the next procedure, cut the tie wrap that secures the four connector cables.
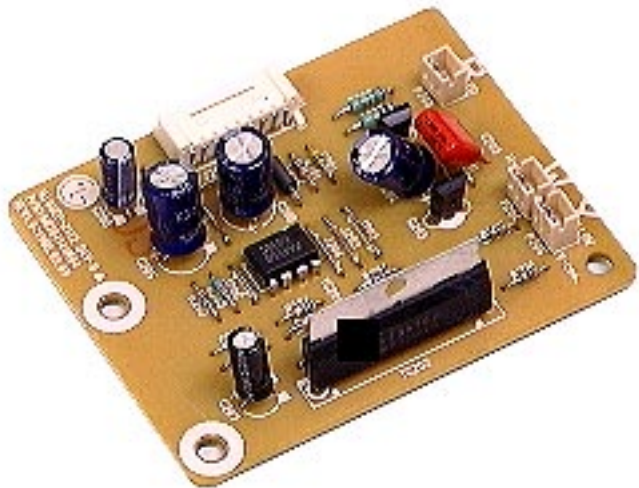
Replacement Note: The convergence/tilt board part can be ordered separately. However, it is also included with the main deflection board and CRT/video board module. Although the convergence/tilt board is packaged with the module, it does not come attached to the main module. If ordering the module, you need to attach the included convergence/tilt board to the chassis holder with the screws provided.

CRT/Video Board

Main Deflection Board
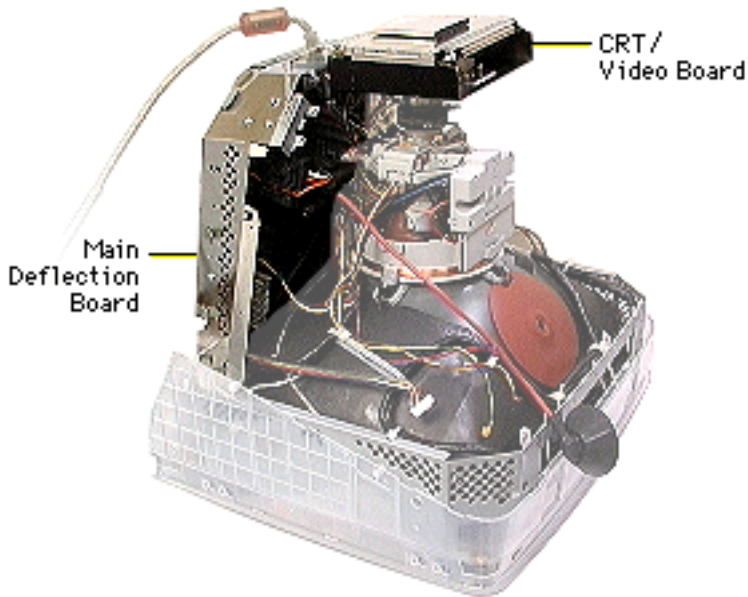
Main Deflection Board and CRT/Video Board Module

Before you begin,

- Remove intermediate bezel
- Remove tripod stand
- Remove rear housing
- Remove EMI shield
- Discharge CRT and remove anode cap (see Safety Guidelines)
- Remove convergence/tilt board

Yoke Cable P704   Main Deflection Board
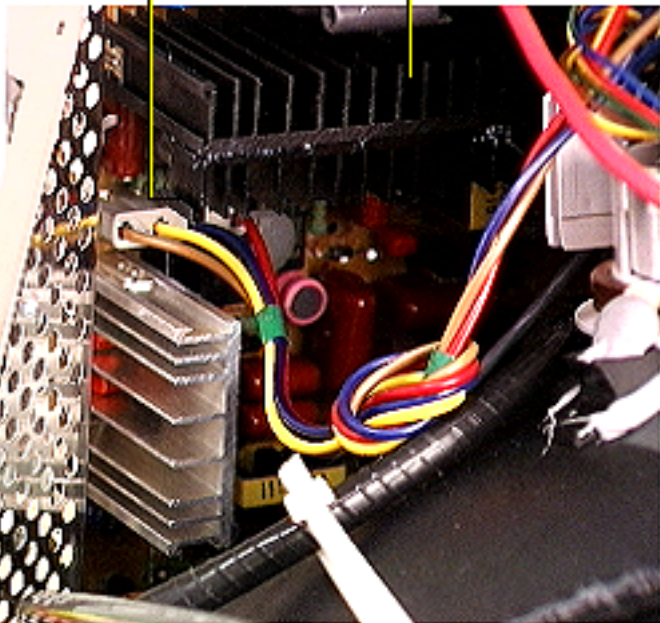
⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.

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

1   From the left side of the display assembly, disconnect the large 4-pin yoke cable (P704) from the main deflection board.

Main Deflection Board
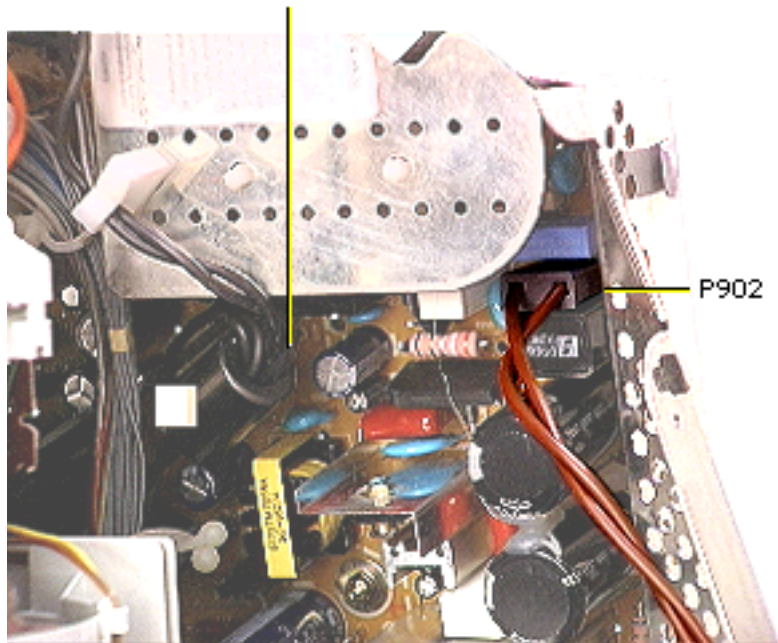
P902

2 From the right side of the display assembly, disconnect P902 (two twisted brown wires) from the main deflection board.

Replacement Caution: The connectors for cables P902 and P303 are nearly identical. To prevent board damage, ensure that the cables are reconnected at their proper locations.
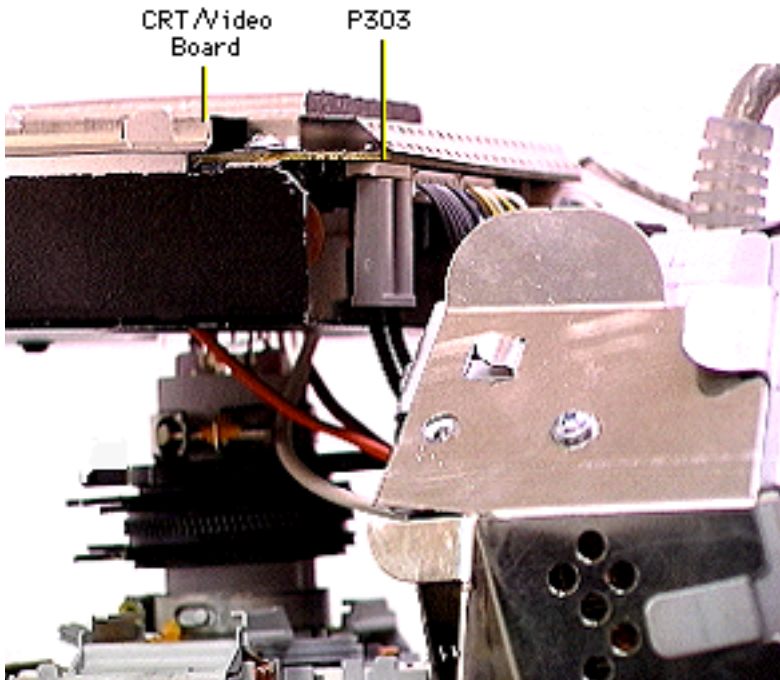
3 Disconnect P303 (two twisted black wires with the ferrite bead) from the CRT/video board.

Replacement Caution: The connectors for cables P303 and P902 are nearly identical. To prevent board damage, ensure that the cables are reconnected at their proper locations.
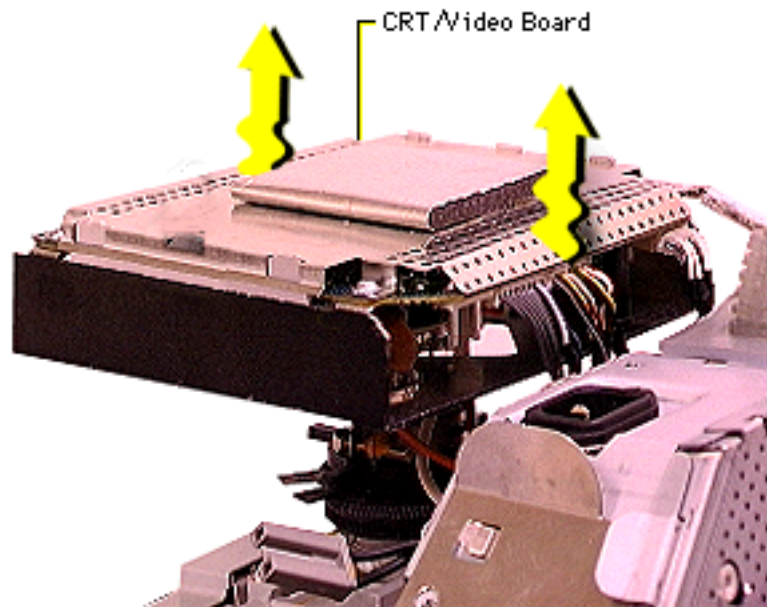
CRT/Video Board

4 Gently rock the CRT/
video board as you pull it
straight up from the
neck of the CRT.

Side Shields

Main Deflection Board Chassis
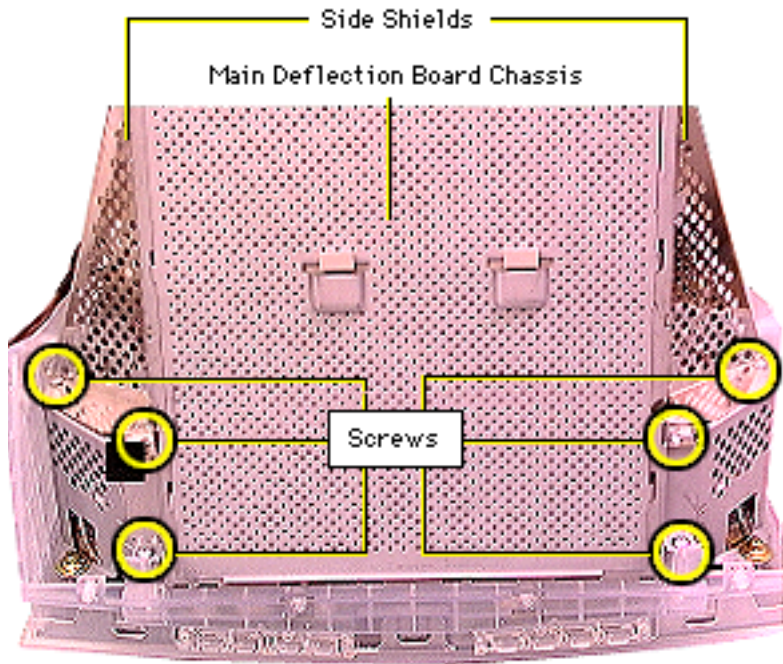
Screws

5　Support the main
deflection board chassis
as you remove
- Four screws from the
side shields
- Two screws from the
end of the chassis

Ground Cable
P303
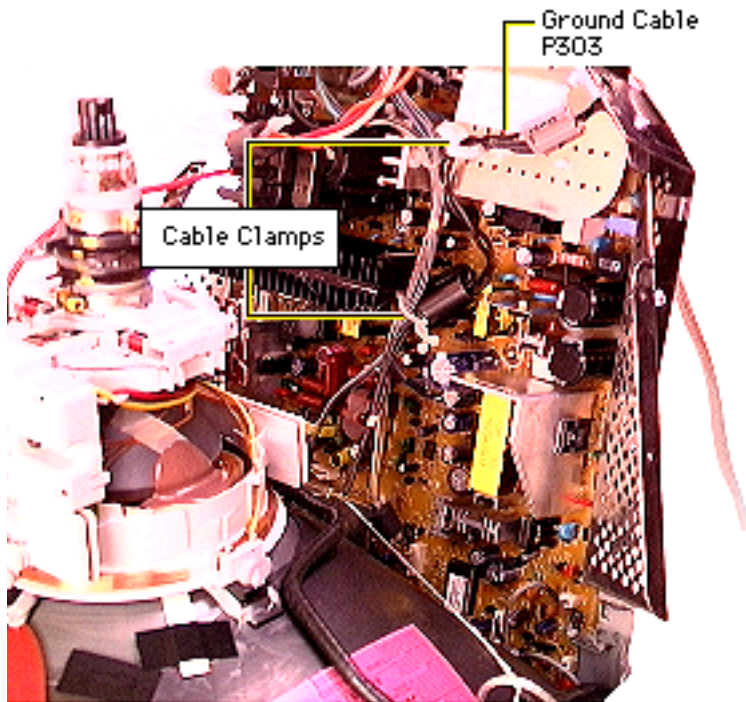
Cable Clamps

6   Without straining the
     remaining connected
     cables, slightly tilt the
     main deflection board
     chassis back. Remove
     ground cable P303 (two
     twisted black wires with
     the ferrite bead) from
     the cable clamp(s).

     Note: Your unit may
     have either one or two
     cable clamps that secure
     ground cable P303.
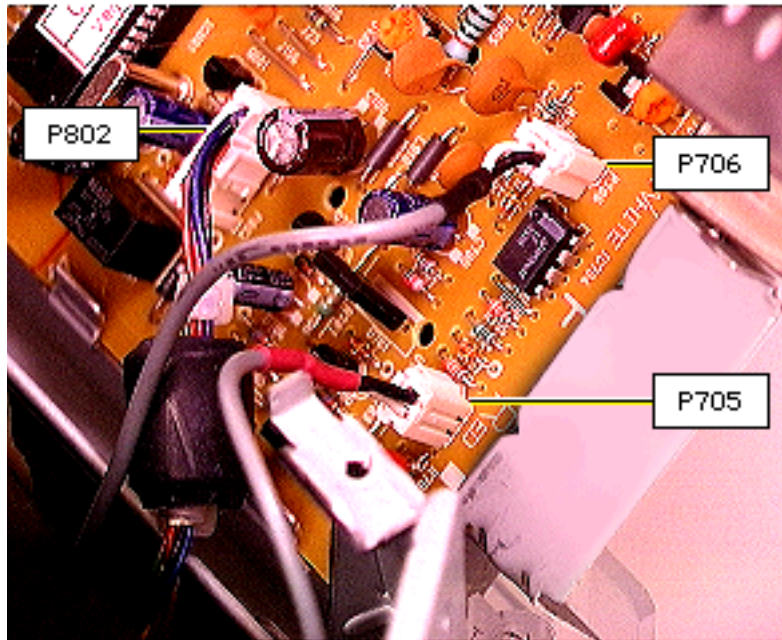
7 **Caution:** Avoid pressure on nearby components as you remove these locking connectors.

From the lower corner of the main deflection board, use a flat-blade jeweler's screwdriver to disconnect locking connectors:

- P705 (red shrink tubing)
- P706 (black shrink tubing)
- P802

P706

Black Shrink Tubing

P705
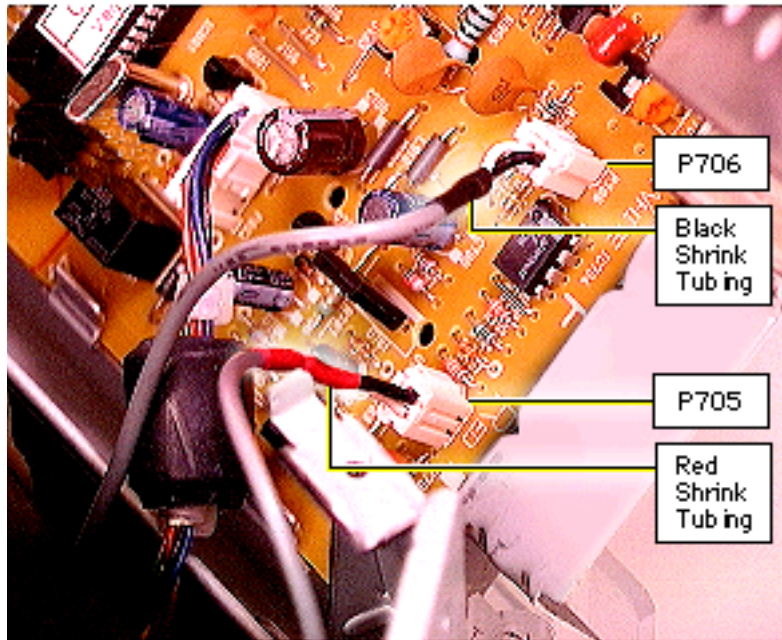
Red Shrink Tubing

Replacement Caution:
The connectors for P705 and P706 are the same size, but never swap their locations. To prevent damage to the board, ensure
- Cable with red shrink tubing is connected to P705 (labeled "Red" on board)
- Cable with black shrink tubing is connected to P706 (labeled "White" on board)
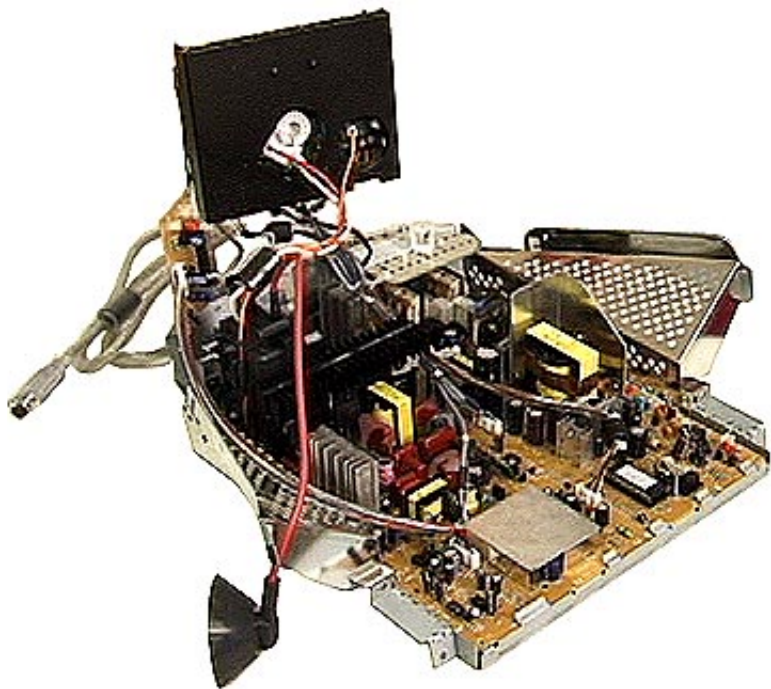
Replacement Note: The main deflection board and CRT/video board module includes the chassis, side shields, video cable, convergence/tilt board, and all soldered cables.

Important: To protect it from damage during shipping, the convergence/tilt board is not secured to the main deflection board chassis. Refer to "Convergence/Tilt Board" in this chapter to secure the board to the chassis before installing the module.
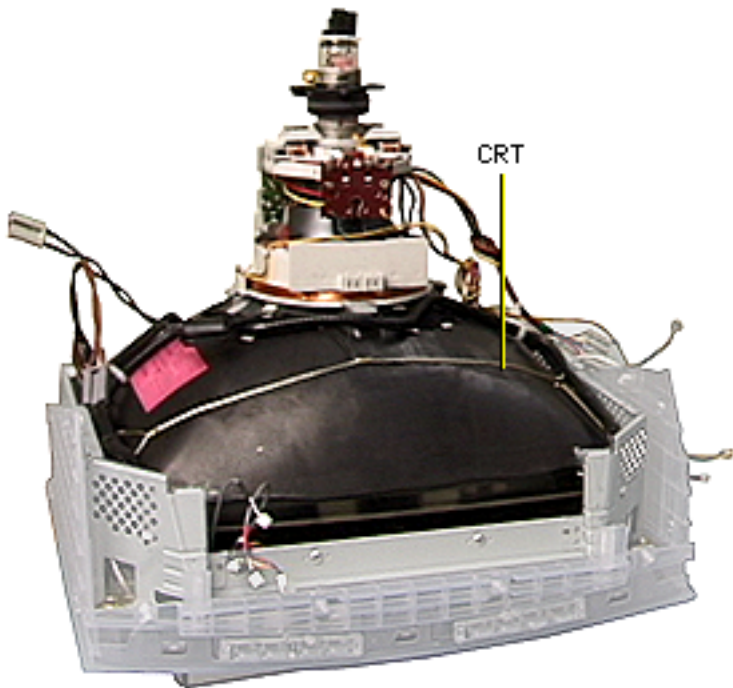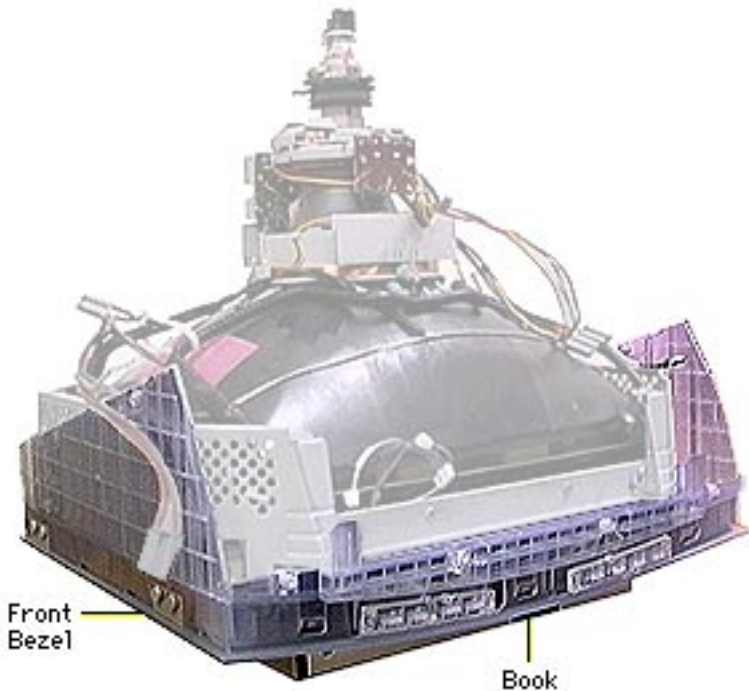
CRT

Before you begin,

- Remove intermediate bezel
- Remove tripod stand
- Remove rear housing
- Remove EMI shield
- Discharge CRT and remove anode cap (see Safety Guidelines)
- Remove main deflection board and CRT/video board module

⚠**Warning:** This product contains high voltage and a high-vacuum picture tube.

Front Bezel

Book

To prevent serious injury, review CRT safety in Bulletins/Safety.

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

1 Select a thick book (about two inches thick) that it is slightly smaller than the display face. Place the display assembly face down over the book so that the bezel is not touching the book, but the book supports the CRT.
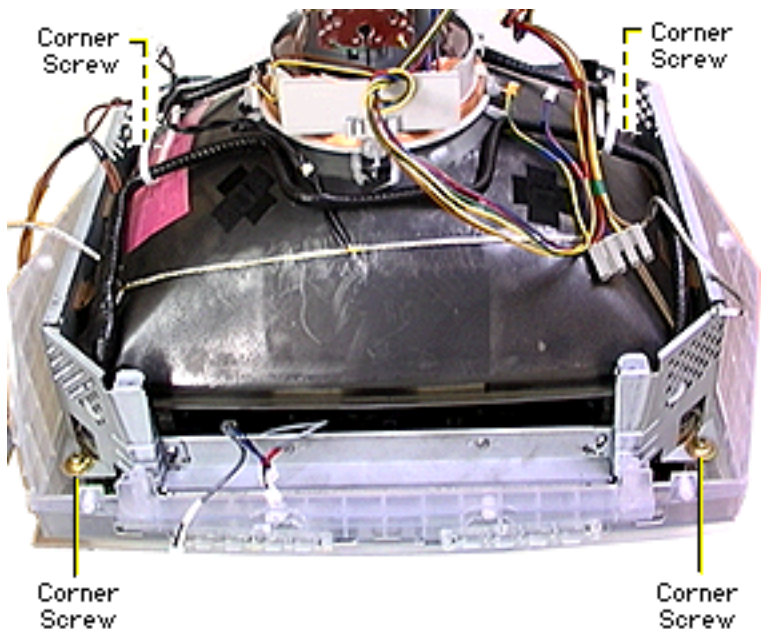
2 Remove the four Phillips screws and lock washers securing the CRT corner brackets to the bezel.

3 Support the front bezel as it lowers past the book and onto the tabletop.

User Control
Cables

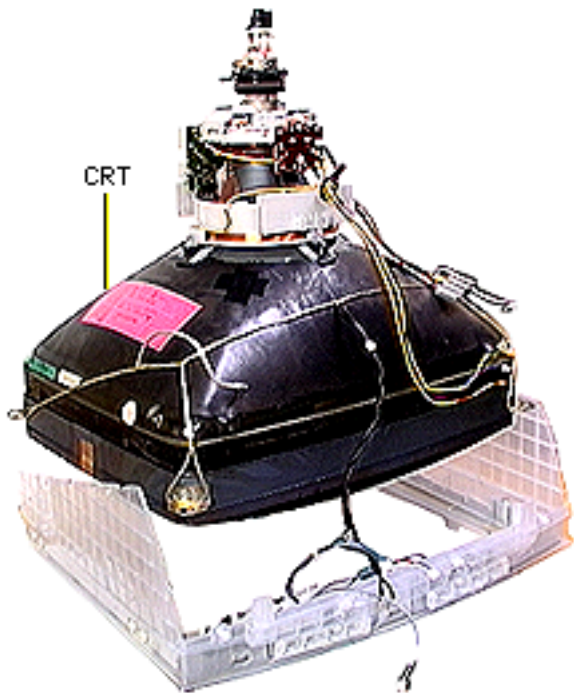4 Route the three user control cables from between the CRT and the CRT frame to the bottom of the bezel.
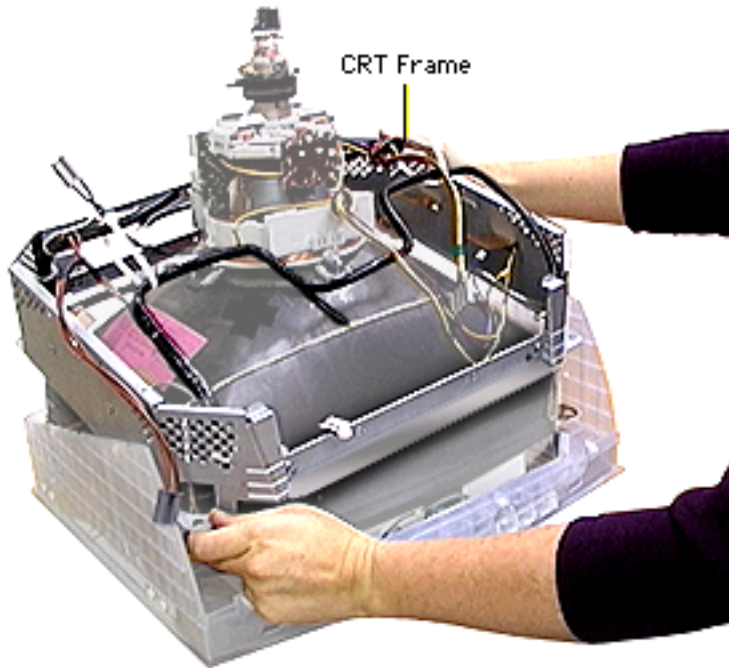
CRT Frame

5 Tilt the CRT frame up from the top to clear the user control cables. Lift the CRT frame over the yoke of the CRT.

CRT

6 **⚠ Warning:** Never lift a CRT by the neck.

With both hands, grasp the opposite corner brackets of the CRT, and lift the CRT away from the front bezel.

User Control

User Control Board

Before you begin,

- Remove intermediate bezel
- Remove tripod stand
- Remove rear housing
- Remove EMI shield
- Discharge CRT and remove anode cap (see Safety Guidelines)
- Remove main deflection board and CRT/video board module
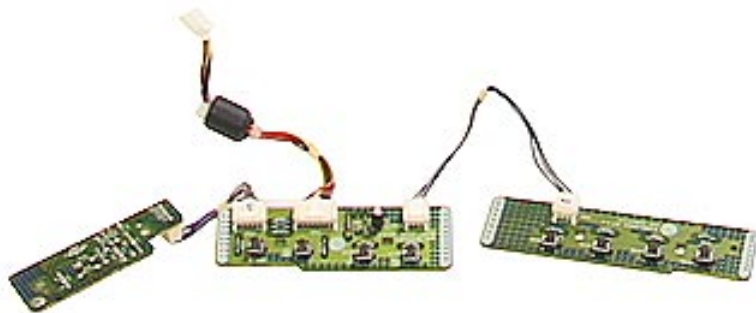- Remove CRT

⚠ **Warning:** This product

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

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

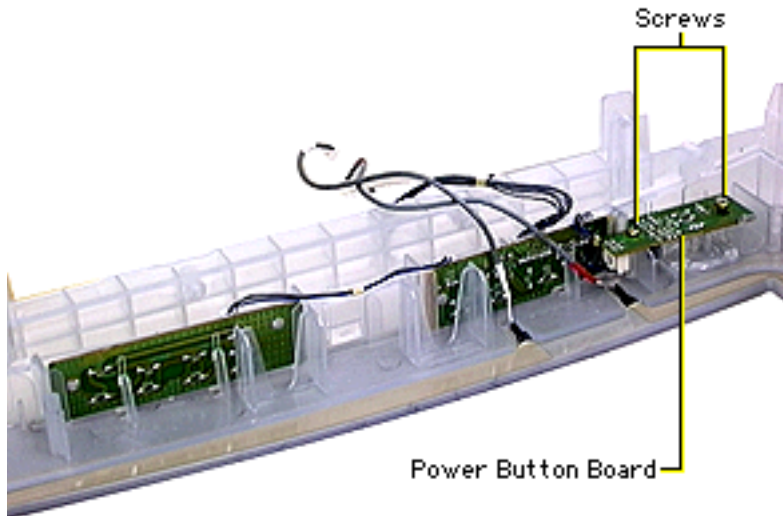**Note:** The user control board module includes three boards:

- Power board
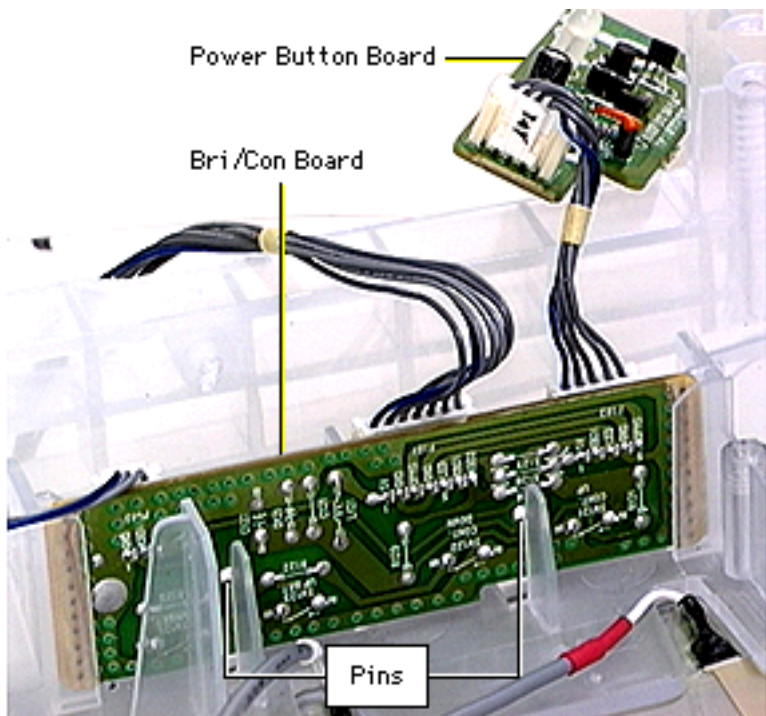- Brightness/Contrast board
- Navigation board

1 Using a Phillips
screwdriver, remove
the two screws from the
power button board.

Screws

Power Button Board
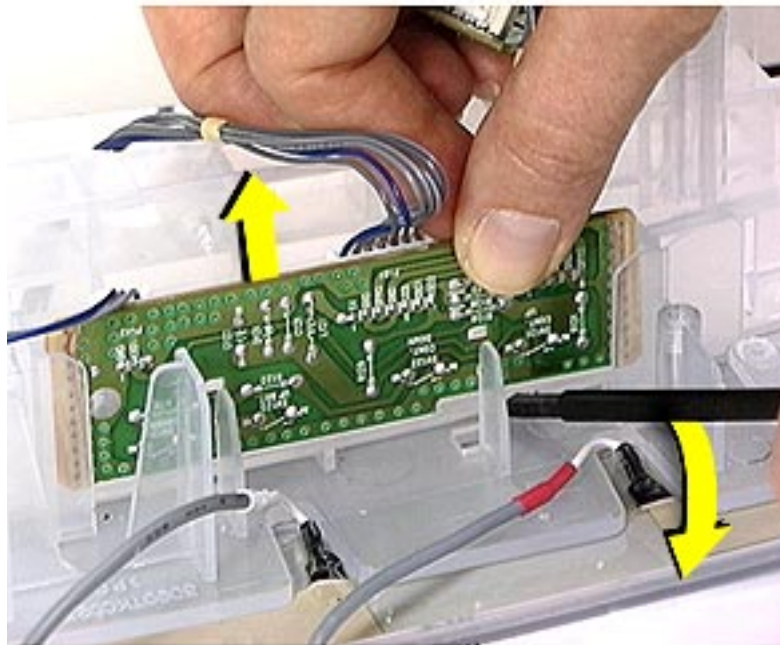
Power Button Board

Bri/Con Board

Pins

Caution: The brightness/contrast board and the navigation board are each secured by two plastic pins and two channels in the front bezel. Using too much force could damage the bezel or board.

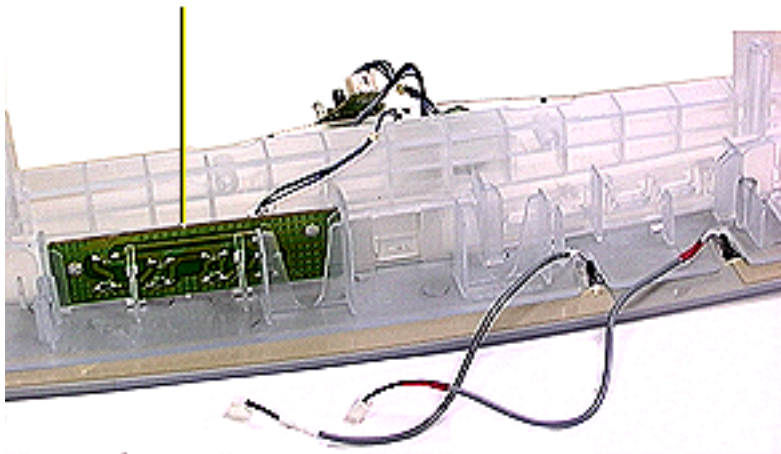**Caution:** Do not tug on the cables or connectors.

2 Use a plastic or nylon
   flat-blade screwdriver
   to gently pry up each
   side of the brightness/
   contrast board from the
   front bezel channels.
   Grasp the board, not the
   connectors, to pull it up
   from the channels.

Navigation Board

3 Use a flat-blade screwdriver or nylon tool underneath the navigation board to pry up one end of the board. Repeat on the other end of the board.

Replacement Note: After securing the boards, try pressing the front panel controls to ensure proper placement of the boards in the bezel. Adjust the boards, if necessary.

CRT Ground Strap

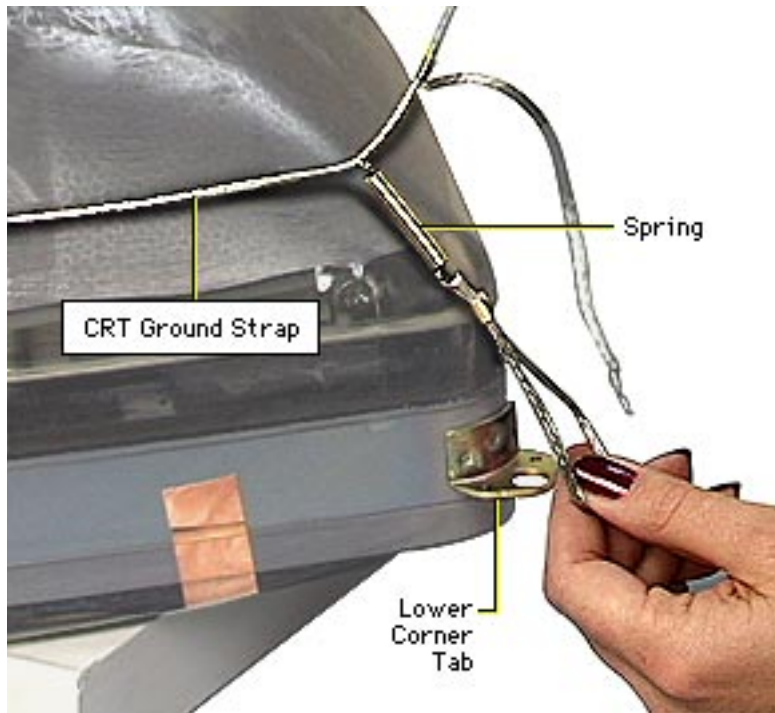# CRT Ground Strap

Before you begin,

- Remove intermediate bezel
- Remove tripod stand
- Remove rear housing
- Remove EMI shield
- Discharge CRT and remove anode cap (see Safety Guidelines)
- Remove main deflection board and CRT/video board module
- Remove CRT

**Warning:** This product contains high voltage and a

high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.

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

1 Starting at one of the top corners of the CRT, remove the end loop.

2 Remove the spring loop that wraps around the lower corner tab and the remaining two loops from the other CRT corner tabs.

Lower Corner Tab

Lower Corner Tab

Book

Spring
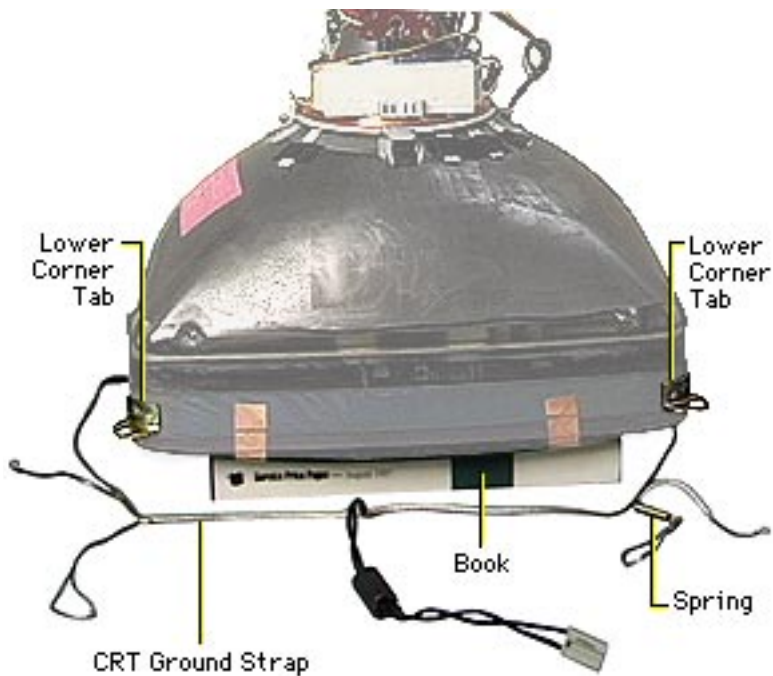
CRT Ground Strap

3 **Replacement Note:** Arrange the CRT ground strap in front of the CRT as shown. Ensure the spring loop is positioned by the lower right corner tab before securing the ground strap to the CRT.
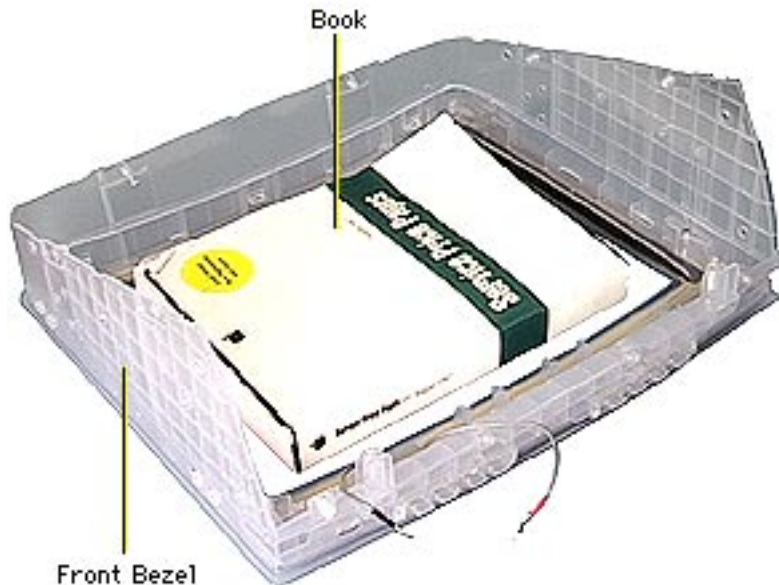
Front Bezel

Front Bezel

To remove the front bezel,

- Remove intermediate bezel
- Remove tripod stand
- Remove rear housing
- Remove EMI shield
- Discharge CRT and remove anode cap (see Safety Guidelines)
- Remove main deflection board and CRT/video board module
- Remove CRT
- Remove user control board

Replacement Note: The front bezel module includes the front outer bezel, inner sides, screws holding the inner and outer bezels together, the control buttons, the Apple logo, and the two cables that run along the bezel perimeter and end with two connector cables.

Replacement Note: Ensure a book is centered in the front bezel before placing the CRT in the front bezel.
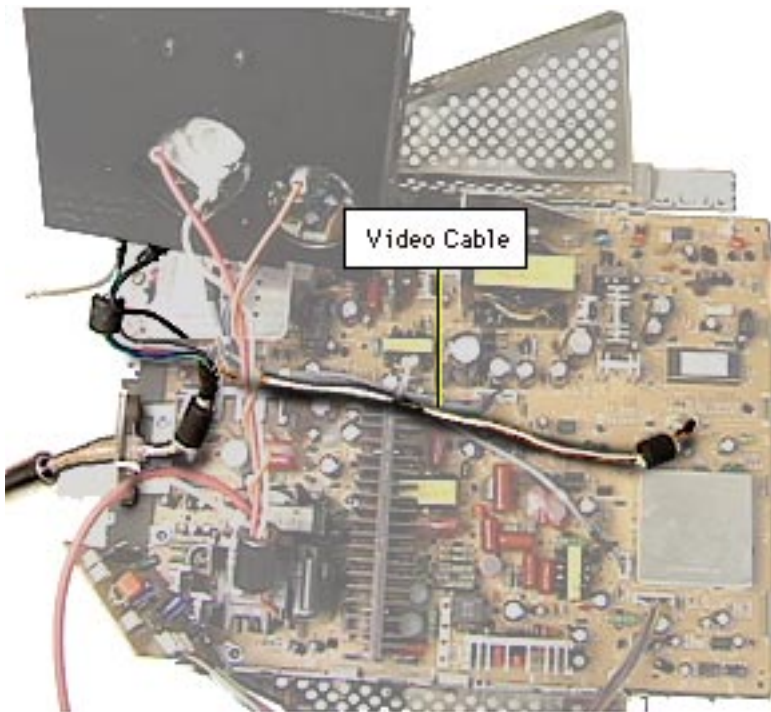
User Control
Cables

Replacement Caution: Be careful not to pinch or strain any wires when positioning the CRT into the front bezel.

Replacement Note: With the user control board in place, position the CRT inside the front bezel. Ensure that the three user control cables are routed between the CRT and CRT frame.
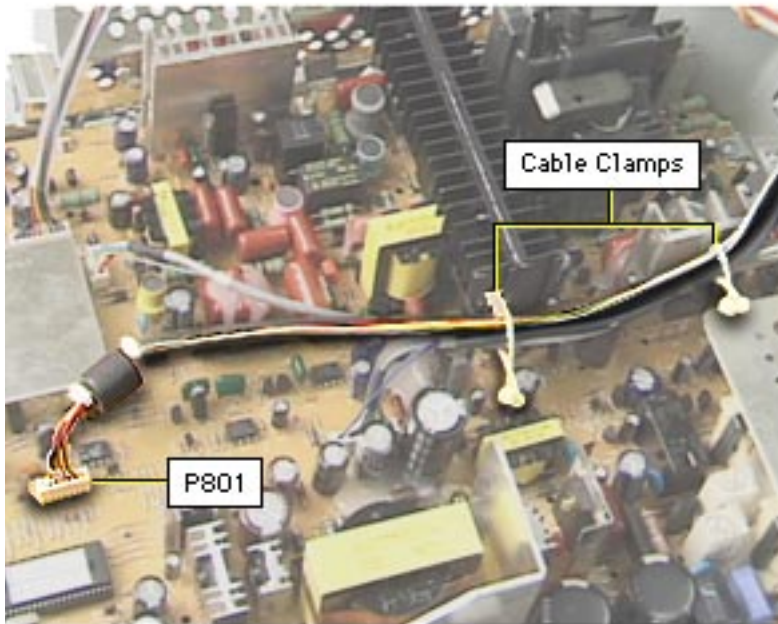
Video Cable

Video Cable

Before you begin,

- Remove intermediate bezel
- Remove tripod stand
- Remove rear housing
- Remove EMI shield
- Discharge CRT and remove anode cap (see Safety Guidelines)
- Remove main deflection board and CRT/video board module

⚠Warning: This product contains high voltage and a high-vacuum picture tube.
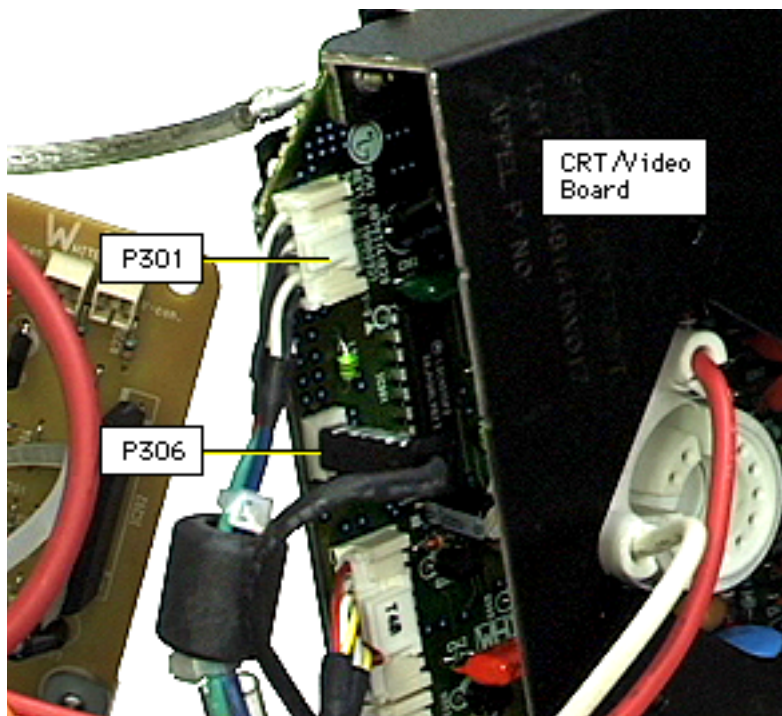
◀▎▎▎▶

Cable Clamps

P801

To prevent serious injury, review CRT safety in Bulletins/Safety.

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

1 Disconnect the 7-pin locking-tab connector at P801 from the main deflection board.

2 Release the P801 cable from both cable clamps.

3   Remove the following
    connectors from the
    CRT/video board:
    • Single pin P306
    • Locking tab 5-pin
      P301
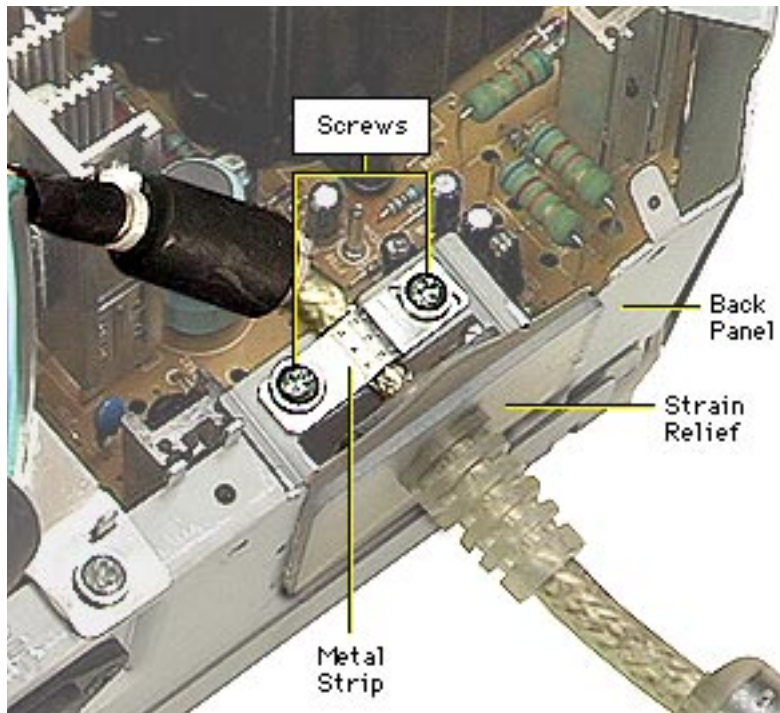
4 Remove the two Phillips screws and the metal strip that secures the video cable strain relief to the back panel.

5 Slide the strain relief up and out of the back panel slot.

Replacement Note: Reserve the two screws and metal strip from the back panel; use them when replacing the video cable.

6   Lift the video cable away
    from the main deflection
    board and CRT/video
    board.

Tell Us What You Think: Studio Display (17" CRT) QTVR

After viewing the QuickTime VR movie in the Take Apart chapter, please send us your feedback via the Internet. To do so, copy this form, and paste it into an Internet mail document. Type in your responses and send the document to:

service_tools@apple.com.

Or you can print a copy of this form, fill it out, and mail to:
Apple Computer, Inc.
Service Source Project Mgr.
MS 35-2W
1 Infinite Loop
Cupertino, CA 95014

Or fax to (408) 974-2358.

Please rate the features listed below on the following scale:

5 = Very Satisfied   4 = Satisfied   3 = Neutral   2 = Dissatisfied   1 = Very Dissatisfied

Studio Display (17" CRT) QTVR Pictorial Overview

___Content
___Ease of Use
___Performance/Speed
___Graphic Clarity
___Overall Satisfaction

I would like to see QTVRs for other products too! ___(Yes/No)

Comments and Suggestions:
_____
_____
_____
_____

Please describe the system you are using:
CPU Mode: _____   Amount of RAM: _____
Version of MacOS: _____   Monitor Size: _____
Web Browser: _____   Modem: _____

Optional
Your Name   _____
Employer   _____
Address   _____
City, State, Zip _____
Internet Address_____   Phone _____

7/28/99

Adjustments

Studio Display (17" CRT, 16" viewable image size)

Adjustment Tools

To perform the adjustment procedures in this chapter, you need the following tools:

- Adjustment adapter (Apple part number 077-0168) to save adjustment settings to factory space
- Multimeter
- Voltmeter
- Test leads and alligator clips
- Power Macintosh computer with Mac-OS 8.0 or later
- High-voltage probe
- Magnetic Phillips screwdriver
- Plastic or nylon screwdriver (for adjustments with power on)

WARNING!
Shock hazard
Do not touch. Refer to
CRT Safety for more
details

Safety

⚠️**Warning:** This product contains high voltage. To prevent serious injury, review CRT safety in Bulletins/Safety.

⚠️**Warning:** Avoid the areas shown. To prevent electric shock, never touch components or reach inside the display when the power is on.
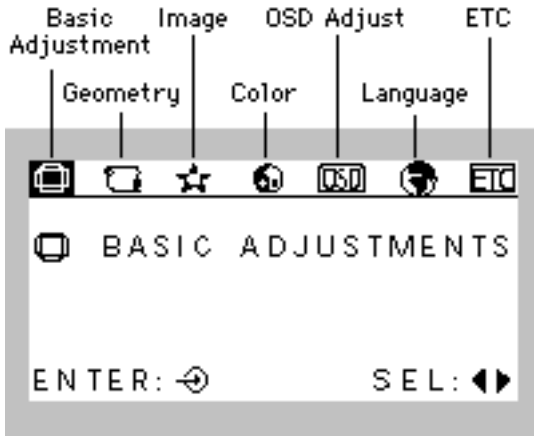
◀■▶

Introduction to the On-Screen Display

You can adjust the screen image using the buttons on the front of the display or you can use the controls in the On-Screen Display (OSD). The On-Screen Display lets you fine-tune the screen image.

You can access the On-Screen Display with the front panel user controls.

User Controls

The user controls include:
- Power button
- Contrast increase and decrease
- Brightness increase and decrease
- On-Screen Display (OSD) enter button—turns on the OSD and enters adjustment choices
- Left and right arrow buttons—highlights adjustment choices and selects levels
- OSD exit button—returns to normal screen display

Power Button

OSD Enter Button

Left and Right Arrow Buttons

OSD Exit Button

Contrast Decrease Button

Contrast Increase Button

Brightness Decrease Button

Brightness Increase Button
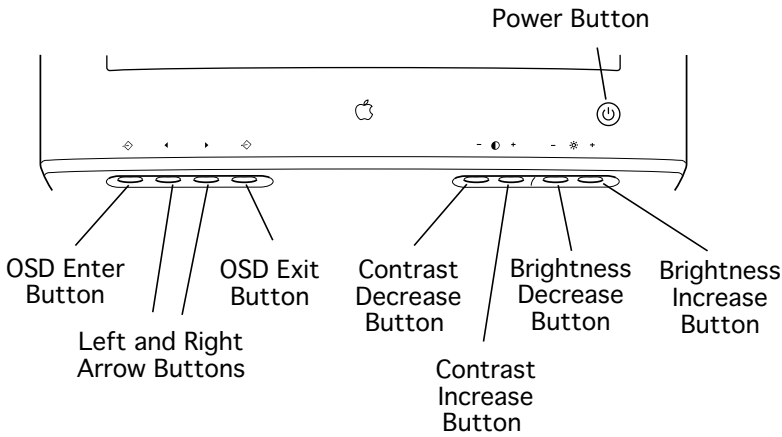
This chapter covers only the adjustments that are necessary as part of troubleshooting the display.

For a complete description of the adjustments you can make using the On-Screen Display, click the linked user's document called "Setup.pdf" at left. Refer to the section "Using Manual Controls and the On-Screen Display."

Setup.pdf

Diagnosing A Suspected Hardware Problem

After ruling out other possible cures (that is, you have already checked cable connections, power, Apple Display software, and other possible front-of-screen cures), use the following procedure to help determine and resolve hardware problems.

Note: See the flowchart that follows this section for a simplified depiction of this process.
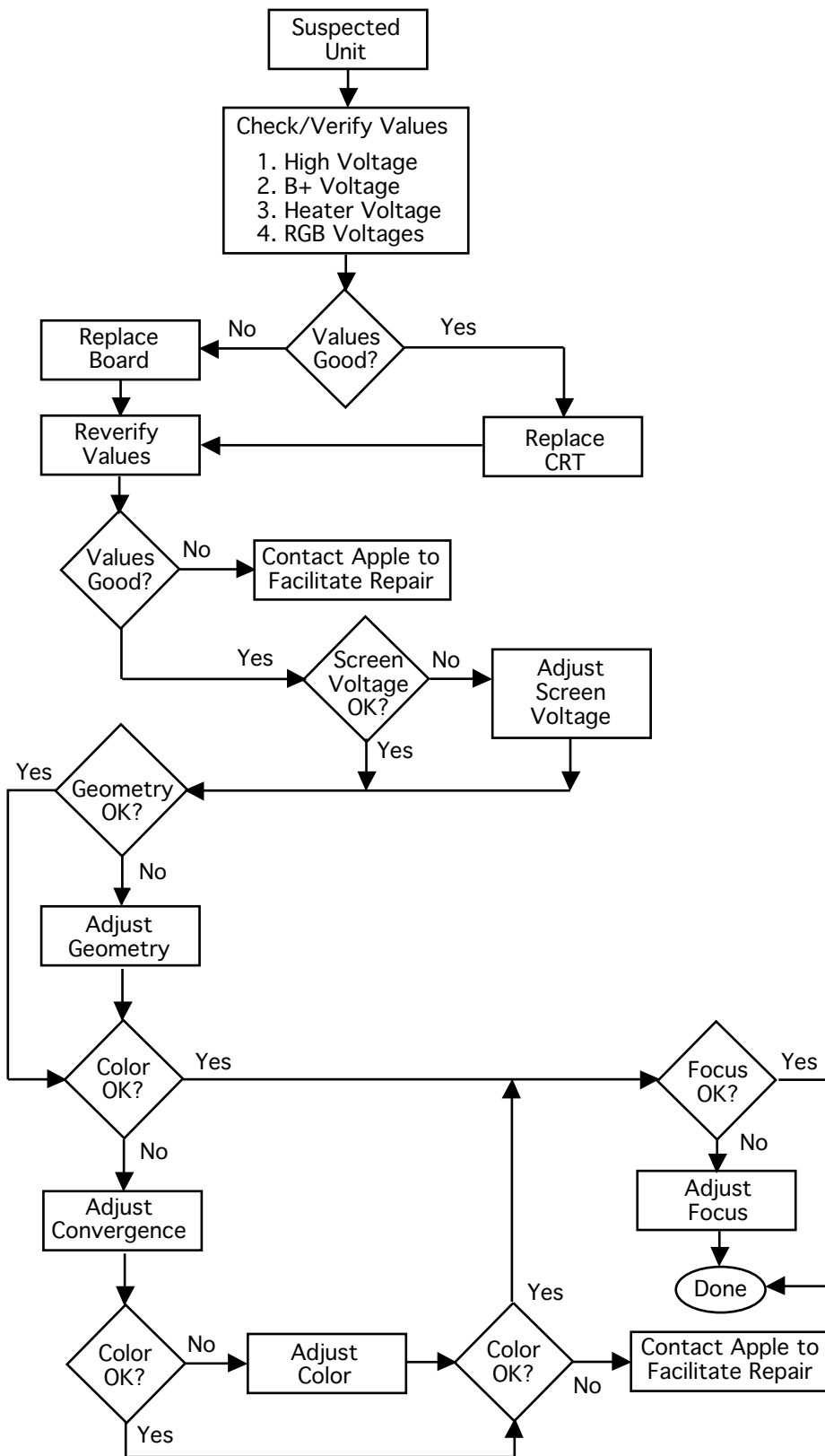
1 In this order, perform the referenced procedures in this chapter to check the following voltage measurements:
   - High voltage (27 kV ± 0.2 kV): See "Checking High Voltage."
   - B+ voltage (180 V ± 2.0 V): See "Checking B+ Voltage."
   - Heater voltage (6.3 V ± 0.63 V): See "Checking Heater Voltage."
   - RGB voltages (65 to 85 V): See "Checking RGB Voltage."

2 If the voltage measurements from step 1 are all within range, replace the CRT and re-verify the voltage measurements.
   - If the re-verified voltage measurements are out of range, replace the old CRT in the display and contact Apple to facilitate a repair through the designated repair vendor in your region. (In the US, call 1-800-919-2775; for Canada, refer to "Canada Repair Strategy" in the Basics chapter).
   - If the re-verified voltage measurements are all within range, check the screen voltage (go to step 4).

3 If the high-voltage, heater voltage, or RGB voltage measurements from step 1 are out of range, replace the main deflection and CRT/video board module. With the new board module in place, check the voltage measurements from step 1.
   - If the voltage measurements are within range, go to the next step.
   - If the voltage measurements are out of range, replace the old board module in the display and contact Apple to facilitate a repair through the designated repair vendor in your region. (In the US, call 1-800-919-2775; for Canada, refer to "Canada Repair Strategy" in the Basics chapter).

4 Check the screen voltage by observing the screen display.
   - If diagonal trace lines are visible, go to "Adjusting Screen Voltage."
   - If no diagonal trace lines are visible, go to the next step to check the screen geometry.

5 Check the screen geometry.
   - If no adjustments are needed, go to the next step to check the screen color.
   - If any adjustments are needed, go to "Adjusting Screen Geometry."

6 Check the screen color.
   - If color is okay, go to the next step to check screen focus.
   - If color needs adjustment, go to "Checking Screen Color and Adjusting Convergence" in this chapter.

7 Check screen focus and adjust it, if necessary. Go to "Adjusting Focus."

Flowchart: Diagnosing A Suspected Hardware Problem

Suspected Unit

↓

Check/Verify Values
1. High Voltage
2. B+ Voltage
3. Heater Voltage
4. RGB Voltages

↓

Values Good?
— No → Replace Board
— Yes → Replace CRT

Replace Board → Reverify Values
Replace CRT → Reverify Values

↓

Values Good?
— No → Contact Apple to Facilitate Repair
— Yes → Screen Voltage OK?

Screen Voltage OK?
— No → Adjust Screen Voltage
— Yes → Geometry OK?

Adjust Screen Voltage → Geometry OK?

Geometry OK?
— Yes → Color OK?
— No → Adjust Geometry

Adjust Geometry → Color OK?

Color OK?
— Yes → Focus OK?
— No → Adjust Convergence

Focus OK?
— Yes → Done
— No → Adjust Focus

Adjust Focus → Done

Adjust Convergence → Color OK?

Color OK?
— No → Adjust Color
— Yes → (loop)

Adjust Color → Color OK?

Color OK?
— Yes → (up)
— No → Contact Apple to Facilitate Repair

Checking High Voltage

This high-voltage check is a required procedure for the flowchart in this chapter. After checking high voltage, return to the flowchart for the next step.

Caution: Do not attempt this procedure without the Apple high-voltage probe (Apple part number 076-0392). Use only the Apple high-voltage probe; other high-voltage probes will not give accurate readings for this procedure.

⚠**Warning:** Read all of the warnings, notes, and steps of this procedure before beginning.

⚠**Warning:** Voltage at the anode, with the power on, can cause serious injury. Double-check all multimeter connections before taking the reading.

⚠**Warning:** Probe the anode carefully. Serious damage and injury may occur if the anode is knocked off while the CRT is charged.

1   Turn off the monitor and computer. Disconnect the power cords and video cable. Wait at least two minutes for the CRT to discharge.
2   Refer to the Take Apart chapter to remove the following:
      • Intermediate bezel
      • Rear housing
      • EMI shield
3   Attach the Apple high-voltage probe to a multimeter and attach the ground wire to the chassis.
      ⚠**Warning:** Verify that the ground wire connection to the chassis is secure.
4   With the power switches off, connect the power cords and video cable.
5   From the rear of the CRT—away from the CRT frame—carefully insert the probe under the anode cap.
6   Turn on the computer and monitor.
7   Note the reading on the meter. The reading should be 27 VDC (± 0.2 VDC). This is actually 27 kV. Most of the voltage is across the high-voltage probe.
      ⚠**Warning:** Do not remove the probe from under the anode cap until power is turned off. Injury or damage to equipment may occur.
8   Turn off the monitor.
9   Unplug the monitor.
10 Remove the probe from under the anode cap.
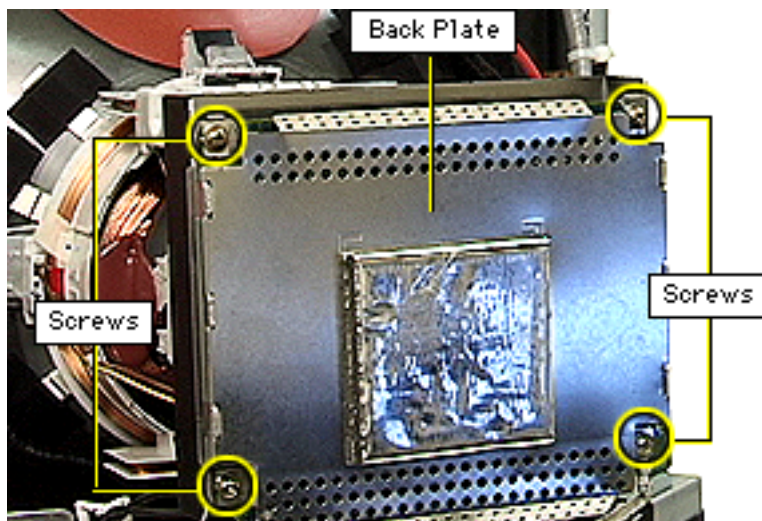11 Return to the flowchart for the next procedure.

Checking B+ Voltage

1   Turn off the monitor and computer. Disconnect the power cords and video cable. Wait at least two minutes for the CRT to discharge.

Caution: Avoid jiggling the neck of the CRT as you continue this procedure.

2   With the power off, remove the four Phillips screws on the back plate of the CRT/video board.

3   Connect the negative probe of a voltmeter to chassis ground at an area that you are sure measures 0 volts. Ensure the probe connection is secure.
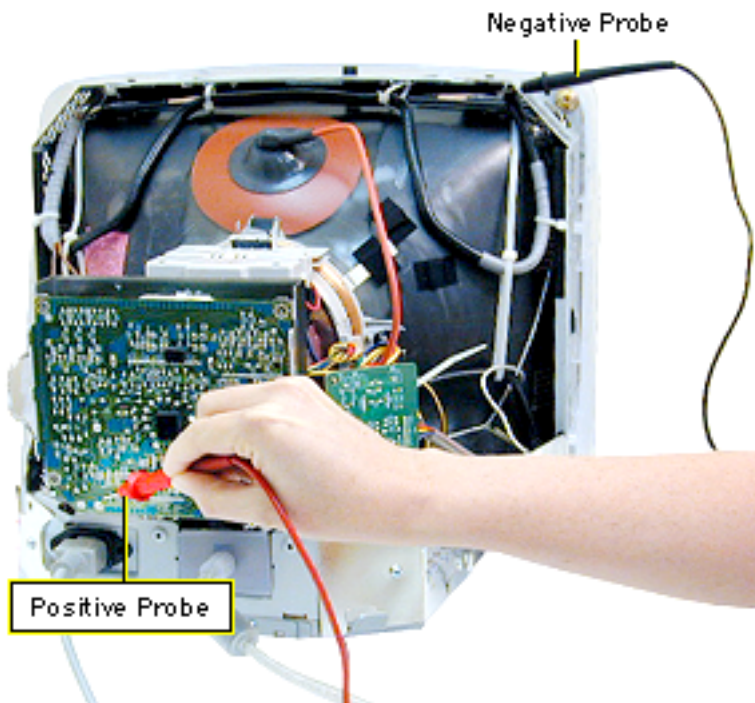
4 Connect the positive probe to pin 180V at P305 on the solder side of the CRT/video board. Ensure the probe connection is secure.

⚠ **Warning:** Keep your hand away from the solder pins on the CRT/video board. When the power is on, never touch components or reach inside the display.

Pin 180V at P305
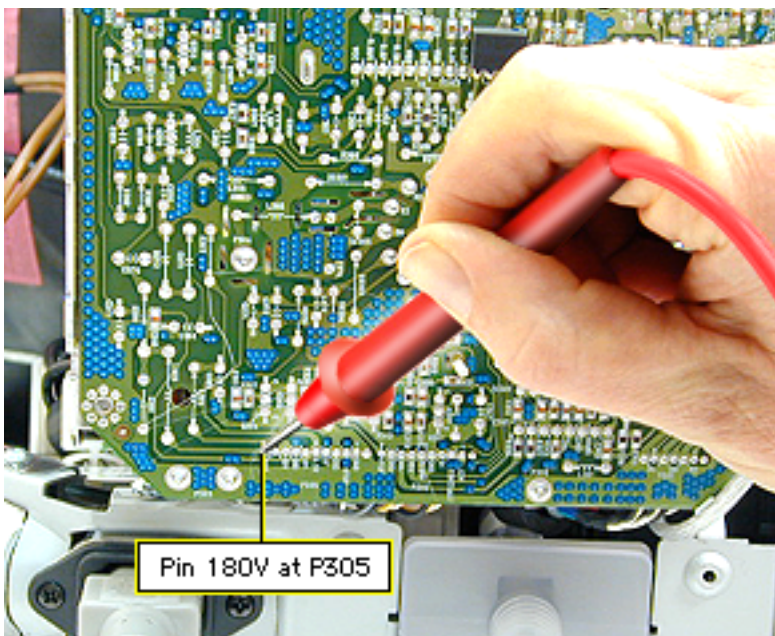
⚠ **Warning:** Do not remove the probes while power is on. Injury or damage to equipment may occur.

5 Turn on the computer and monitor.
6 Note the reading on the voltmeter. The reading should be 180 V ± 2.0 V.
7 Turn off the monitor.
8 Unplug the monitor.
9 Remove the probe from the pin.
10 Return to the flowchart for the next procedure.

Checking Heater Voltage

1 Turn off the monitor and computer. Disconnect the power cords and video cable. Wait at least two minutes for the CRT to discharge.

Caution: Avoid jiggling the neck of the CRT as you continue this procedure.

2 With the power off, remove the four Phillips screws on the back plate of the CRT/video board.

3 Connect the positive probe of a voltmeter to pin H on the solder side of the CRT/video board (solder side of the CRT socket on the CRT/video board). Ensure the probe connection is secure.

⚠Warning: Keep your hand away from the solder pins on the CRT/video board. When the power is on, never touch components or reach inside the display.
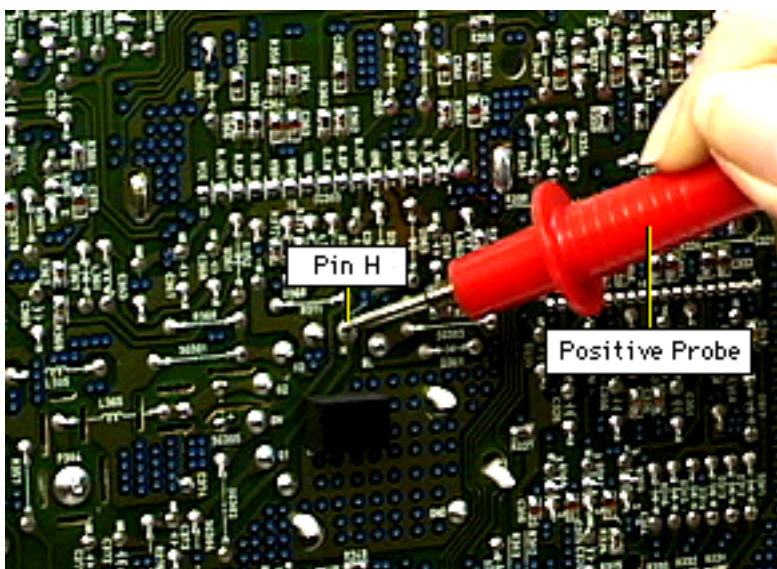
4 Connect the negative probe to chassis ground.
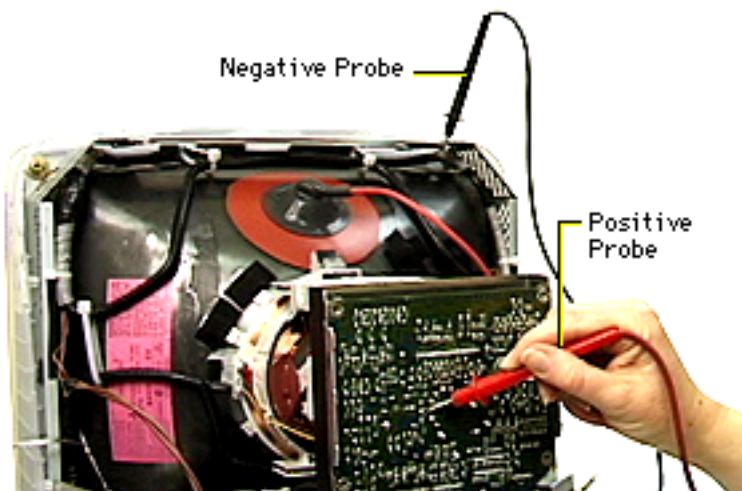
⚠️ **Warning:** Do not remove the probe while power is on. Injury or damage to equipment may occur.

5   Turn on the computer and monitor.
6   Note the reading on the voltmeter. The reading should be 6.3 V (± 0.63 V).
7   Turn off the monitor.
8   Unplug the monitor.
9   Remove the probe from pin H.
10 Return to the flowchart for the next procedure.

Checking RGB Voltages

This procedure involves taking voltage measurements at three locations:

- RD = red
- GN = green
- BL = blue

Read the entire procedure before beginning.

1   Turn off the monitor and computer. Disconnect the power cords and video cable. Wait at least two minutes for the CRT to discharge.

Caution: Avoid jiggling the neck of the CRT as you continue this procedure.

2   With the power off, remove the four Phillips screws on the back plate of the CRT/video board.

3   Connect the positive probe of a voltmeter to pin RD on the solder side of the CRT/video board (solder side of the CRT socket on the CRT/video board). Ensure the probe connection is secure.

⚠️**Warning:** Keep your hand away from the solder pins on the CRT/video board. When the power is on, never touch components or reach inside the display.
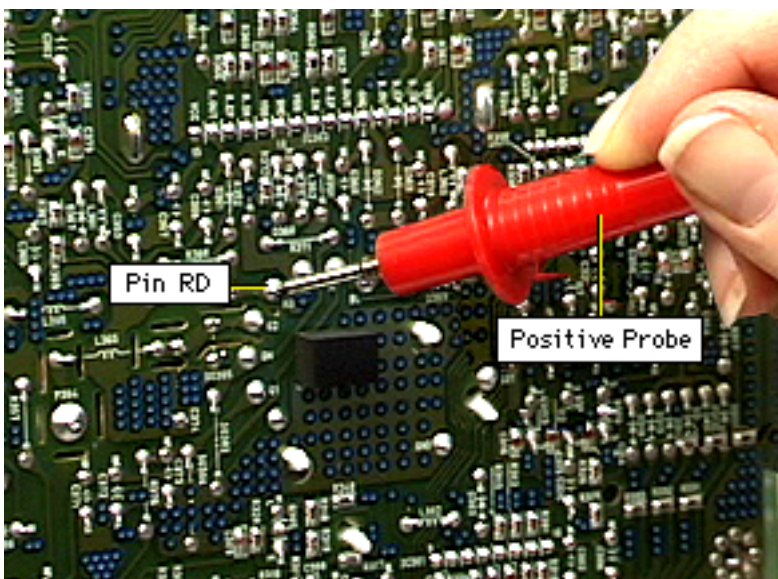

4   Connect the negative probe to chassis ground.

⚠️**Warning:** Do not remove the probe until power is turned off. Injury or damage to equipment may occur.

5   Turn on the computer and monitor.

6   Note the reading on the voltmeter. The reading should be between 65 V and 85 V.

7   Turn off the monitor.

8   Unplug the monitor.

9   Remove the probe from the pin.

10 Repeat steps 3 through 9 for pins GN and BL. Compare the voltage readings for all three pins. They should be nearly equal.

11 Return to the flowchart for the next procedure.

Pin GN

Positive Probe

Pin BL

Positive Probe
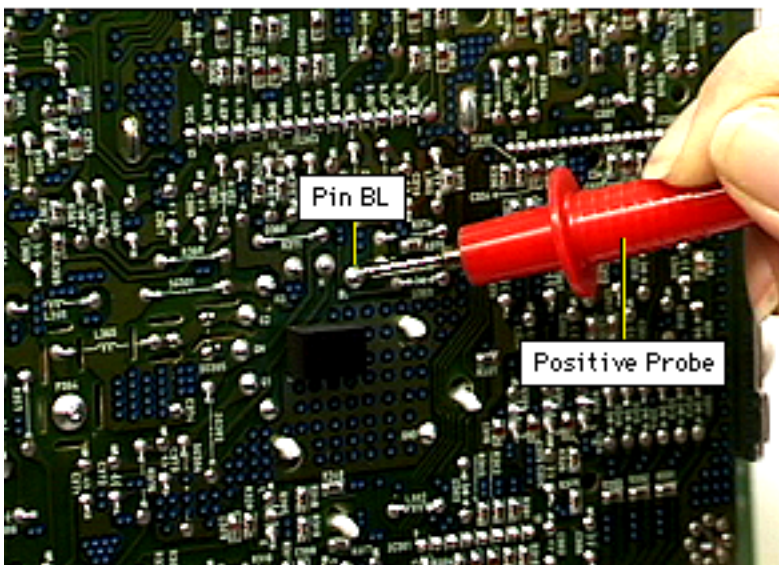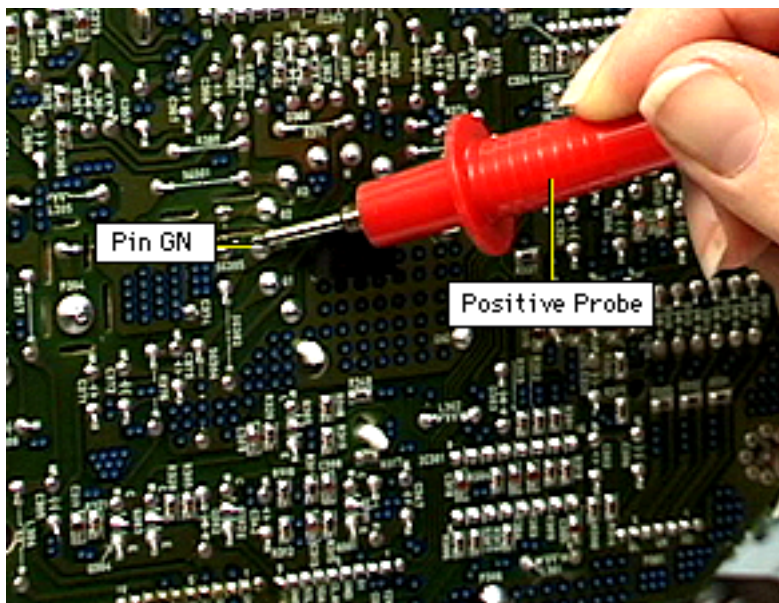
Adjusting Screen Voltage

Before you begin, refer to the Take Apart chapter to remove the rear housing.

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

⚠️**Warning:** Because you make adjustments from the rear of the monitor, position a mirror to view the monitor screen. Do not reach around the monitor to adjust the controls.

1   Turn on the display and let it warm up for five minutes.
2   Using the control strip, set the screen resolution to 1024x768 at 75 Hz.
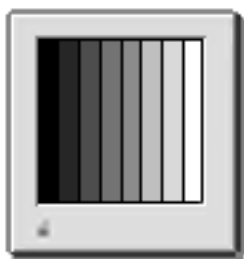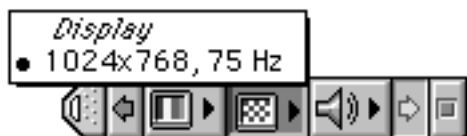
3   Using the Display Service Utility, select the gray bars display pattern.

4   With the front panel control buttons, set
    • Brightness control to detent
    • Contrast control to maximum
5   With the room lights dimmed, use a plastic screwdriver to slowly adjust the Screen control (lowest control on the flyback transformer) so that the leftmost bar is completely black.
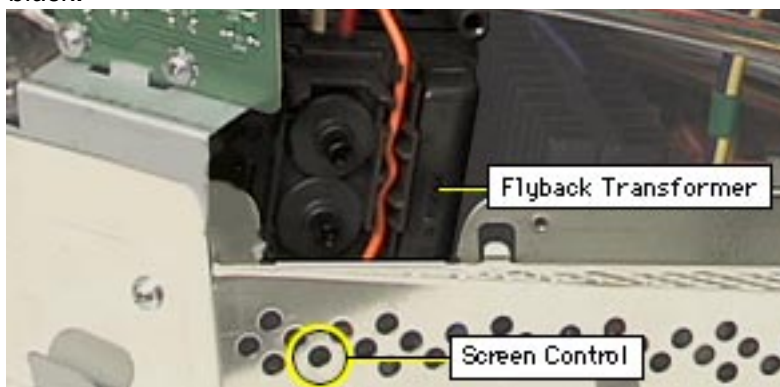
6   Adjust the Screen control so the second bar appears as black as the leftmost bar. Then adjust so the second bar can be distinguished from the leftmost bar, but the leftmost bar remains black. Only the leftmost bar should be completely black.

Adjusting Screen Geometry

1   Connect the adjustment adapter (Apple part number 077-0168) between the computer's monitor port and the monitor's video cable.

Connects to video cable

Connects to monitor port on computer

2   Use the adjustment adapter to set the OSD to factory mode, as follows:
    • Open the OSD by pressing the OSD enter button on the front control panel.
    • Press the red button on the adjustment adapter once. The screen will go blank momentarily.
    • When the screen reappears, press the OSD enter button and select Geometry. A ♫ symbol is displayed in the lower left corner of the window. This music note symbol indicates factory mode is turned on. From this point any changes you make to the geometry adjustments will be saved in factory mode.

Use to Adjust Geometry Settings
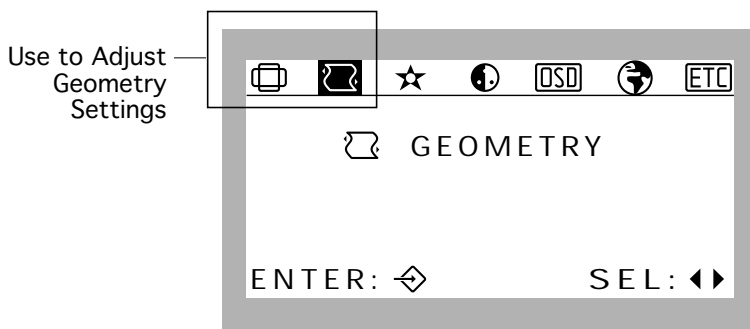
3   Using the left and right arrow buttons, select a geometry icon and press Enter. Use the arrow buttons to adjust the level for optimum screen performance. Accept the changes by pressing Enter.
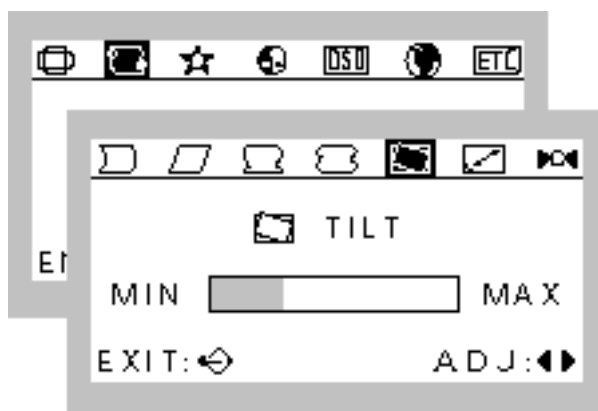
4   Repeat step 3 for all of the geometry icons that need correction. The geometry icons
     include
     • Side Pincushion Balance

     • Parallelogram

     • Pin S Adjust

     • Pin W Adjust

     • Tilt

     • Zoom

5   Exit the OSD by pressing the OSD exit button.

6   When you are satisfied with the screen geometry, press the display's power button off
   and on to reset the monitor so the OSD is no longer in factory mode.

Checking Screen Color and Adjusting Convergence

1   Turn on the monitor and let it warm up for five minutes.
2   Using the control strip, set the resolution to 832x624 at 75 Hz.
3   Using the Display Service Utility, select Pattern Selections: Standard Patterns. Select the full-white screen.
4   Check the overall screen color.
    • If the screen color is good, go to "Adjusting Focus" in this chapter.
    • If the screen appears red at any of the edges, go to the next step.

5   Connect the adjustment adapter (Apple part number 077-0168) between the computer's monitor port and the monitor's video cable.

Connects to video cable

Connects to monitor port on computer

6   Use the adjustment adapter to set the OSD to factory mode, as follows:
    • Open the OSD by pressing the OSD enter button on the front control panel.
    • Press the red button on the adjustment adapter once. The screen will go blank momentarily.
    • When the screen reappears, press the OSD enter button and select Image. A ♪♪ symbol is displayed in the lower left corner of the window. This music note symbol indicates factory mode is turned on. From this point any changes you make to the convergence adjustments will be saved in factory mode.

7   With the OSD open, select Image and then Moire (Convergence).

Selection Bar

Description of Highlighted Control
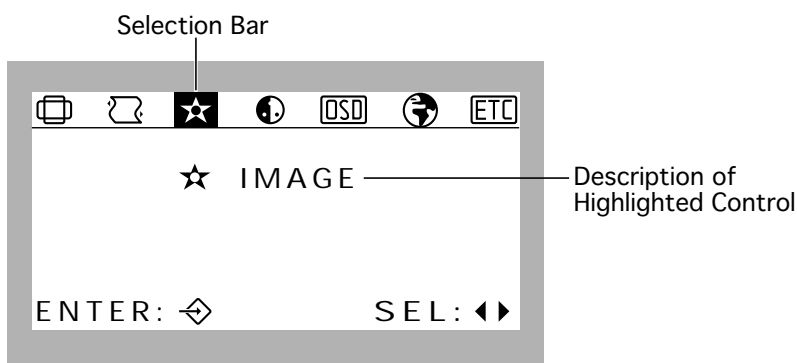
8   If the red color is at the left or right sides of the screen, adjust the H Convergence ⊟. The adjustment will be saved in factory space.

9   If the red color is at the top or bottom edges of the screen, adjust the V Convergence ⊞. The adjustment will be saved in factory space.

10 If the screen still appears red at the edges, select Color and Custom Color K . Then
   adjust the color bar to balance the overall color at the edges of the screen.

Color Selection

9300 6500 5000 K

E N   K CUSTOM COLOR

ENTER : ◈   SEL : ◀ ▶
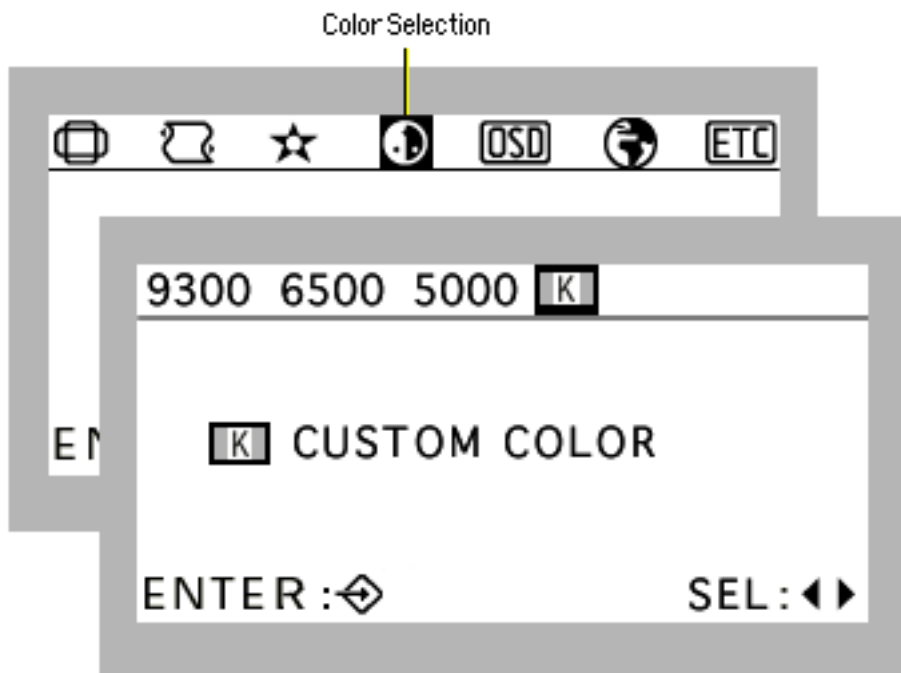
11 Exit the OSD by pressing the OSD exit button.

12 When you are satisfied with the screen color, press the display's power button off and on
   to reset the monitor so the OSD is no longer in factory mode. Then check the screen focus.
   If it needs adjustment, see "Adjusting Focus" in this chapter.

13 If the screen color is still poor, replace the old parts (board module and/or CRT) in the
   display and contact Apple to facilitate a repair through the designated repair vendor in
   your region. (In the US, call 1-800-919-2775; for Canada, refer to "Canada Repair
   Strategy" in the Basics chapter).

Adjusting Focus

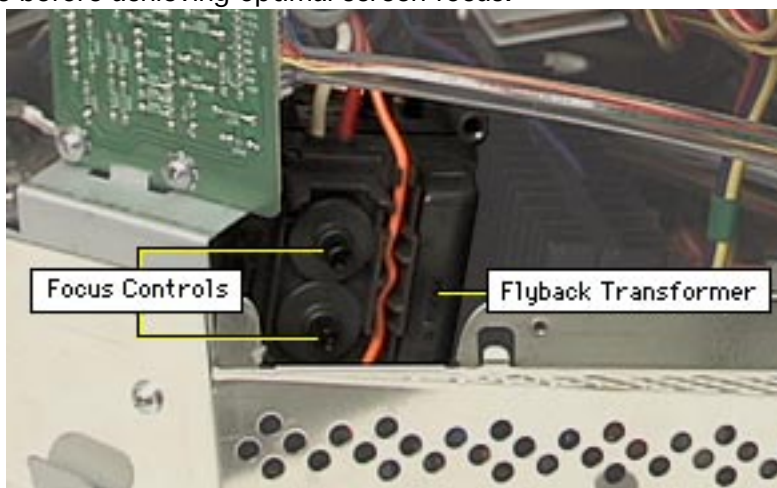Before you begin, refer to the Take Apart chapter to remove the rear housing.

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

⚠️**Warning:** Because you make adjustments from the rear of the monitor, position a mirror to view the monitor screen. Do not reach around the monitor to adjust the controls.

1 Turn on the display and let it warm up for five minutes.

2 With the front panel control buttons, set
   • Brightness control to maximum
   • Contrast control to maximum

3 Using the control strip, set the display to 1280x1024 at 75 Hz.Using the Display Service Utility, select the focus pattern (% signs).

4 Use a plastic screwdriver to adjust the two Focus controls on the flyback transformer for best center screen focus. You might need to alternate between the two focus controls a few times before achieving optimal screen focus.

Exploded View

Studio Display (17" CRT, 16" viewable image size)

Studio Display (17" CRT)

Rear Housing
922-3649
922-3937 (Ser.2)

CRT Ground Strap
922-3655

CRT Frame
(not offered)

Intermediate
Bezel
922-3647
922-3936 (Ser.2)

EMI Shield
(not offered)

Convergence/
Tilt Board
922-3653

Main Deflection
and CRT/Video
Board
661-2100

Front
Bezel
922-3651
922-3938
(Ser.2)

CRT
Assembly
922-3656 (N)
922-3657 (S)

User
Controls
Board
922-3650

Video
Cable
922-3654

Tripod Monitor Stand
922-3648