Apple Two-Page Mono
Monitor
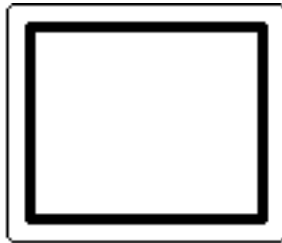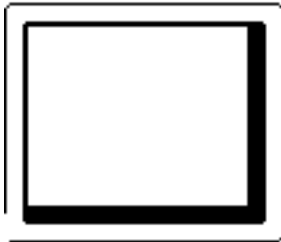
Basics

Two-Page Monochrome Monitor
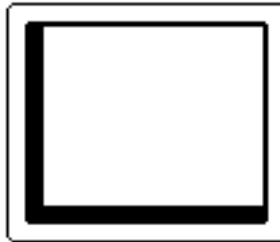
Monitor Distortion

Overview

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

Ideal Raster

Raster Shifted Up
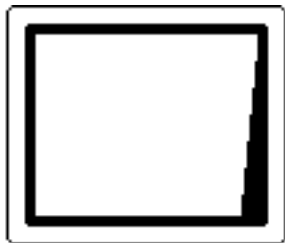and Left

Raster Shifted Right

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 cards. Always check first for environmental causes before attempting to repair or adjust a monitor with a distorted raster.

Right Edge Not Straight
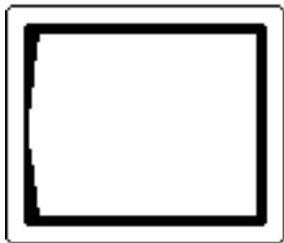
Left Side Bowed Out

Right Side Bowed In

Environmental Influences

The following environmental conditions may distort the raster of a Two-Page Monochrome Monitor:

- 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.
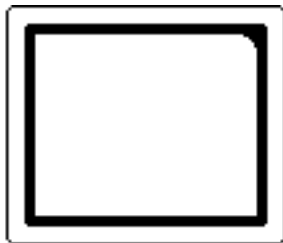
Troubleshooting

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, adjust it using the centering controls. If you then move the monitor, you may need to readjust the centering controls.

Upper-Right Corner Rounded
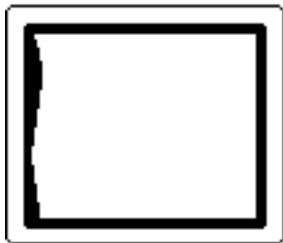
Left Edge S-Shaped

Raster Tilted Right

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.

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 remove the distortion-causing object.

If the display does not change
when you move the monitor
to another location,
continue troubleshooting
the problem (refer to
Troubleshooting/Symptom
Charts).

Specifications

Apple Two-Page Monochrome
Monitor

Characteristics

Picture Tube	21-in. diagonal screen (20-in. viewable image)
	Phosphor EIA Type P4 (white)
	Flat, square, high-contrast, antiglare surface
Screen Resolution	1,152 x 870 lines; 77 dpi
	Displays up to 16 grays with 512K of video RAM
Scan Rates	Vertical refresh rate: 75 Hz
	Horizontal scan rate: 68.7 kHz
	Dot clock: 100 MHz

Active Video   15 in. by 11.3 in.
Display Area   (381 mm by 287 mm)

Input Signal   Video: analog; RS–343 standard

Controls

User Controls   Rear panel: power switch
                           Right side: brightness and contrast controls

Physical and Electrical

Power Supply   Universal power supply
                          Voltage: 90–270 VAC, self-configuring
                          Frequency: 47–63 Hz
                          Power: 95 W maximum

Size and Weight   Height: 15.7 in. (399 mm)—add 3.2 in. (81 mm) for integrated
                             stand
                          Width: 19.5 in. (495 mm)
                          Depth: 17.4 in. (442 mm)
                          Weight: 55 lb. (25 kg)

Monitor Stand   Integrated, tilt-and-swivel stand

Operating Environment

Temperature   50°F–95°F (10°C–35°C)

Humidity   90% maximum, noncondensing

Altitude   10,000 ft. (3,048 m) maximum

Troubleshooting

Apple Two-Page Monochrome Monitor

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 AC power cord connections.
2 Check internal power connectors.
3 Replace blown fuse.
4 Replace power supply.
5 Replace on/off switch filter assembly.
6 Replace deflection board.

No raster, LED on
1 Adjust brightness and contrast knobs.
2 Verify that video card in computer is working properly.
3 Check power supply and deflection board connections.
4 Check CRT socket connectors.
5 Replace video board.
6 Replace deflection board.
7 Replace CRT and yoke assembly.

Geometry

Raster size too short, tall, narrow, or wide
1 Adjust horizontal-size and vertical-size controls.
2 Replace deflection board.
3 Replace CRT and yoke assembly.

Raster not centered
1 Verify that distortion is not due to environmental conditions. Move monitor to another location.
2 Adjust horizontal-shift and vertical-shift controls.
3 Replace video board.

Bad vertical linearity
1 Adjust vertical linearity control.
2 Replace deflection board.

Bad horizontal linearity
1 Adjust horizontal linearity control.
2 Replace deflection board.

Synchronization

Single horizontal or
vertical line appears
on screen

1   Check yoke connectors.
2   Check CRT socket connectors.
3   Replace deflection board.
4   Replace CRT and yoke assembly.

Picture breaks into
diagonal lines

1   Connect another monitor to computer. Switch on monitor to
    verify that computer produces video signal.
2   Check connections between video board and deflection board.
3   Replace deflection board.
4   Replace video board.

Picture rolls
vertically

1   Verify that video card in computer is working properly.
2   Check connections between video board and deflection board.
3   Replace deflection board.
4   Replace video board.

Video

Picture is too dark or too bright

1. Adjust contrast and brightness knobs.
2. Verify that video card in computer is working properly.
3. Check connection between contrast/brightness assembly and video board.
4. Perform video adjustments.
5. Replace video board.
6. Replace contrast/brightness assembly.
7. Replace CRT and yoke assembly.

Contrast/brightness unadjustable

1. Check connection between contrast/brightness assembly and video board.
2. Replace contrast/brightness assembly.
3. Replace video board.
4. Replace deflection board.
5. Replace CRT and yoke assembly.

(Continued)

Out of focus

1 Check CRT socket connectors.
2 Check connections between video board and deflection board.
3 Perform focus adjustment.
4 Check screen brightness with a light meter. If reading is "10" or higher, perform the cutoff and screen luminance adjustments.
5 Replace video board.
6 Replace deflection board.
7 Replace CRT and yoke assembly.

Miscellaneous

Picture jitters or
flashes

1   Check all grounding cable connections.
2   Confirm that adjacent computer equipment is properly
     grounded. Move electrical devices away from the monitor and
     temporarily shut off all fluorescent lights.
3   Check connections between video board and deflection board.
4   Replace deflection board.

At a resolution of
1152x870, jitter or
a wavy image appears
on right side, left
side, or entire screen

Note: This symptom occurs with Power Macintosh 9600
computers using an Apple/IMS video card with any display set at
1152x870 screen resolution. The computer and the display are
working properly. However, video cards with serial numbers
lower than Fx705xxx should be replaced. Apple's service stock
has been inspected and upgraded, so replacement video boards
should not exhibit this symptom.

Check the serial number on the video card. If it is lower than
Fx705xxx, replace the video card with a new one (Apple service
part number 661-1409).

Black spots on screen
(burnt phosphors)

Replace CRT.

Monitor Stand

|	
Monitor stand does not swivel	1 Verify that "Front" indicator on tilt/swivel mechanism aligns with "Front" indicator on base of monitor stand.
	2 Verify that snap lock assembly on bottom of monitor stand is in place.
Monitor stand does not tilt	1 Verify that plastic plug is in snap lock assembly.
	2 Verify that snap lock assembly on bottom of monitor stand is in place.

Take Apart

Apple Two-Page Monochrome
Monitor

Swivel Stand

Swivel Stand

No preliminary steps are required before you begin this procedure.

Note: Remove the tilt-swivel stand before you remove the CRT.

1 Tilt the monitor onto its left side.

2 Slide the monitor stand forward toward the bezel.
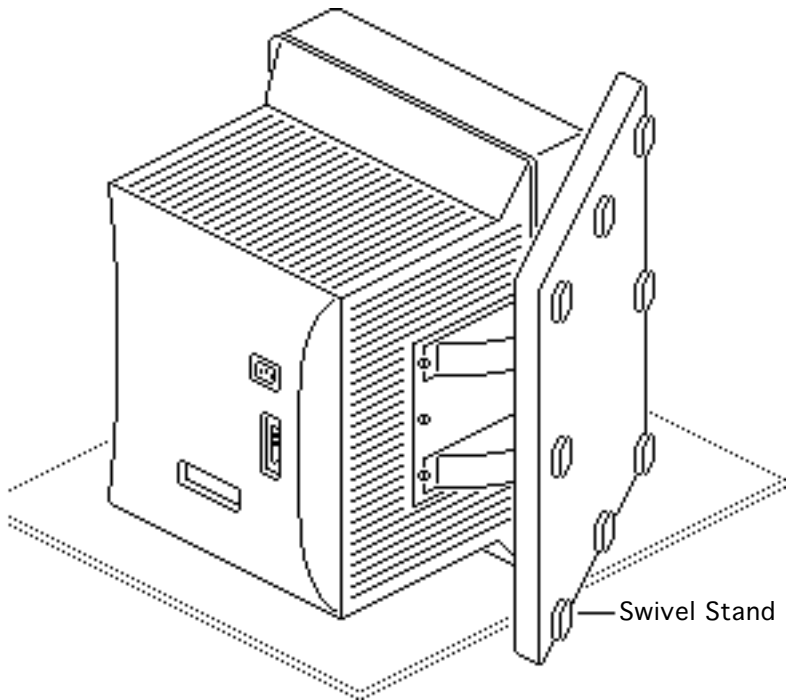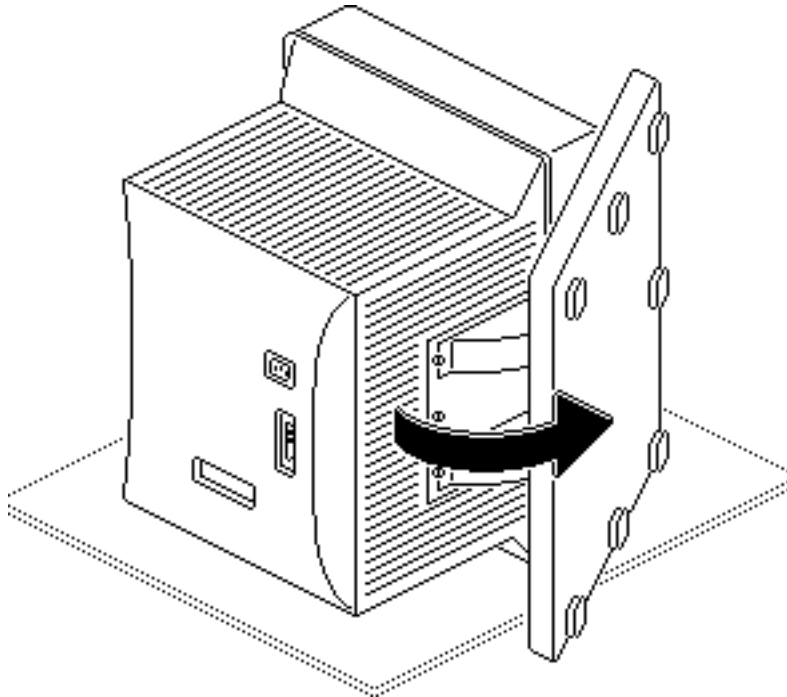
3   With one hand, slightly
    lift up the monitor and
    rotate the base of the
    stand until you can reach
    the three screws that
    secure the stand to the
    chassis.
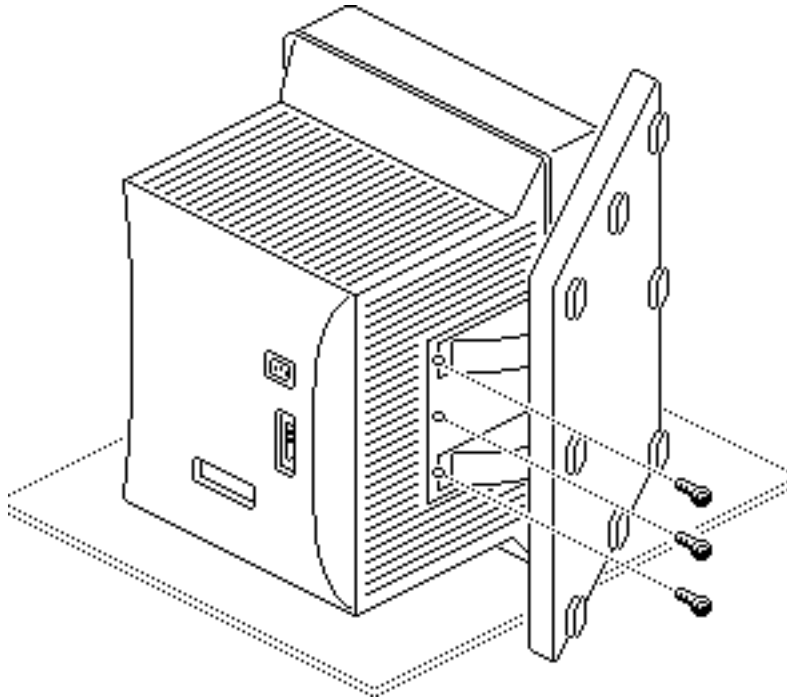
4 Remove the three mounting screws.

5 Slide the monitor stand back and remove it from the chassis.

Rear Cover — Rear Cover
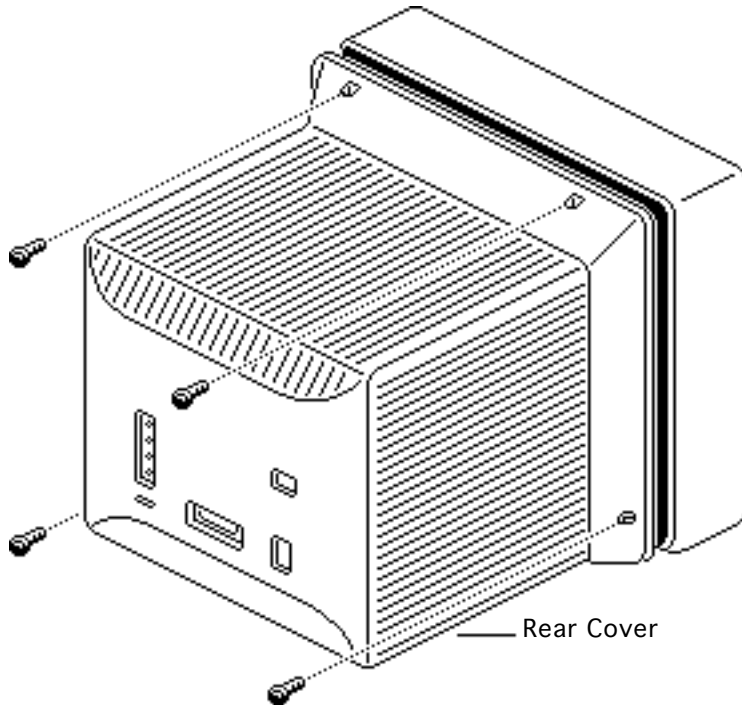
Rear Cover

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.

1 Remove the four cover mounting screws.

2 Pull the rear cover off the bezel.
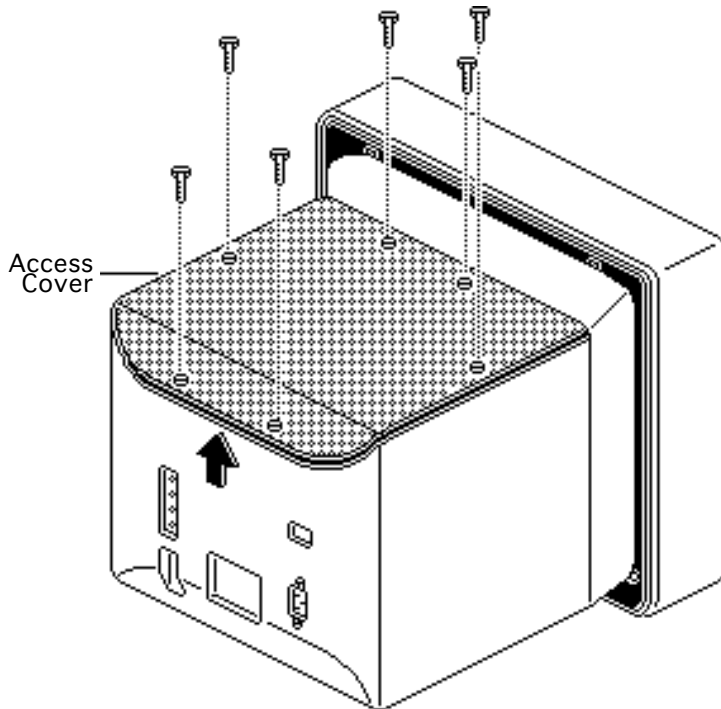
Access Cover

Before you begin, remove the rear cover.

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

1 Remove the six mounting screws and lockwashers that hold the access cover in place.

2 Lift the access cover off the chassis.

Access Cover

Video Board

Before you begin, do the following:

- Remove the rear cover
- Remove the access 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.
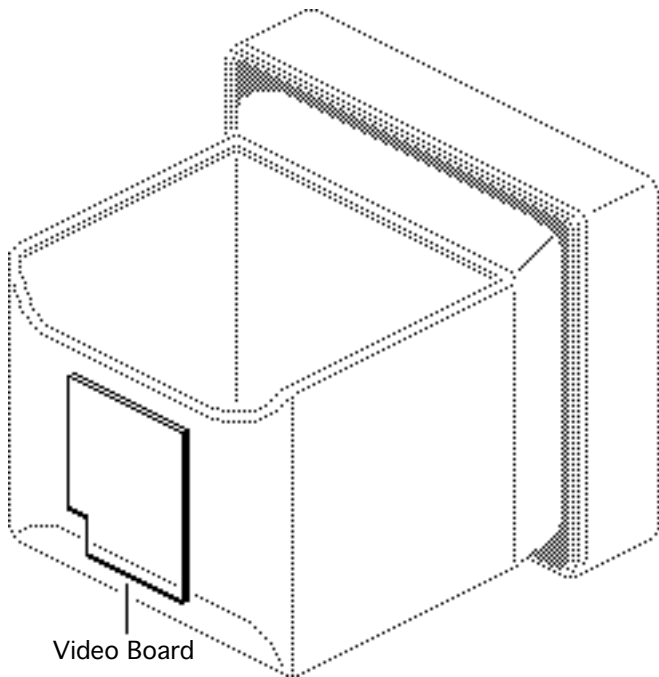
Video Board

Disconnect the following cable connectors from the video board:

- 13-wire (white) cable from J601
- 11-wire (white) cable from J602
- 6-wire (white) cable from J603
- 2-wire (red/orange) cable from J604
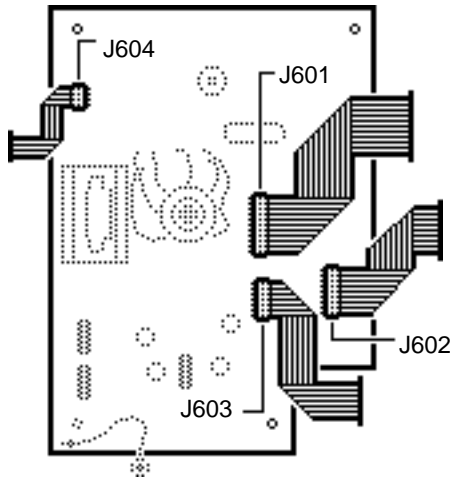
Caution: Do not remove the connectors by pulling on the connector cables. If the connectors are difficult to disconnect, slip a jeweler's screwdriver between the two halves of the connector and carefully pry the halves apart.
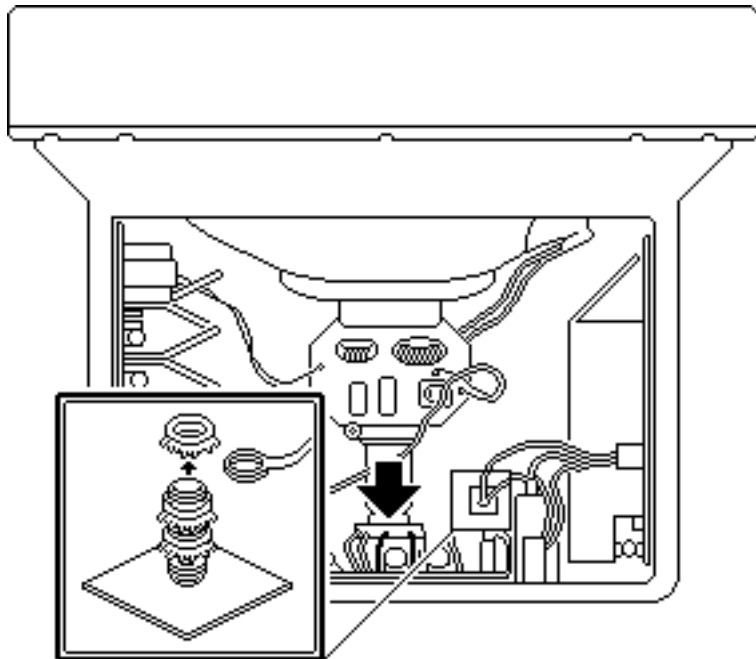
1 Remove the hex nut, washer, and green grounding wire from the metal post on the floor of the monitor.

2 Pull the CRT socket off the neck of the CRT.
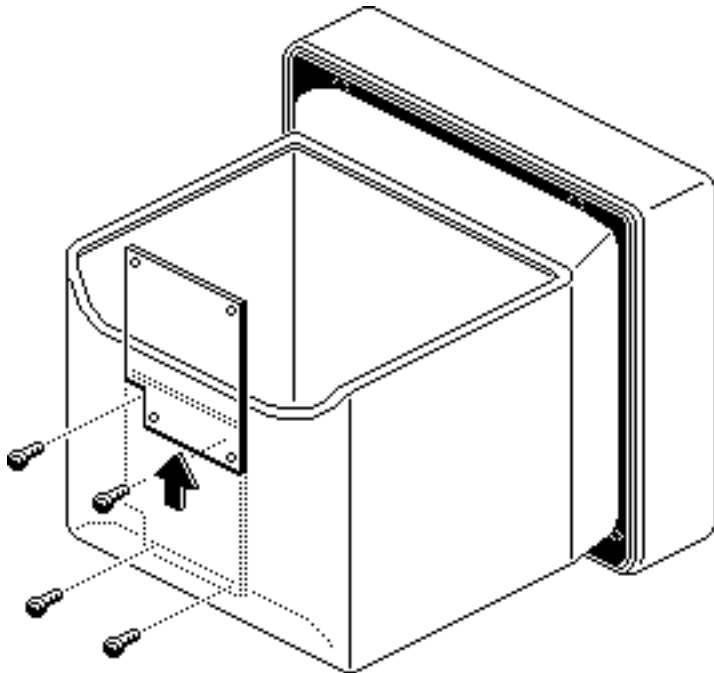
3 Remove the four screws that secure the video board to the chassis.

4 Carefully lift the video board up and out of the chassis.

Deflection Board

Before you begin, do the following:

- Remove the rear cover
- Remove the access cover
- Discharge the CRT
- Remove the anode cap

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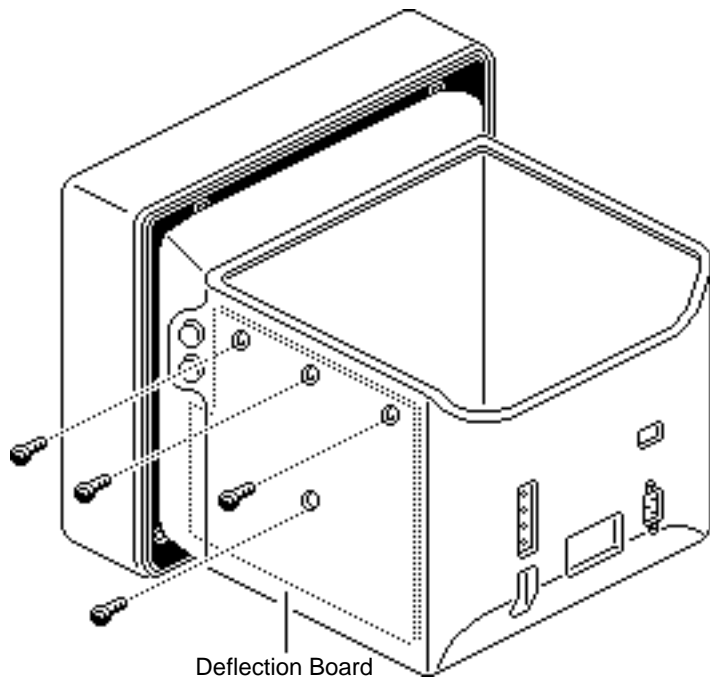
Deflection Board

1 Remove the four screws that secure the deflection board to the chassis.
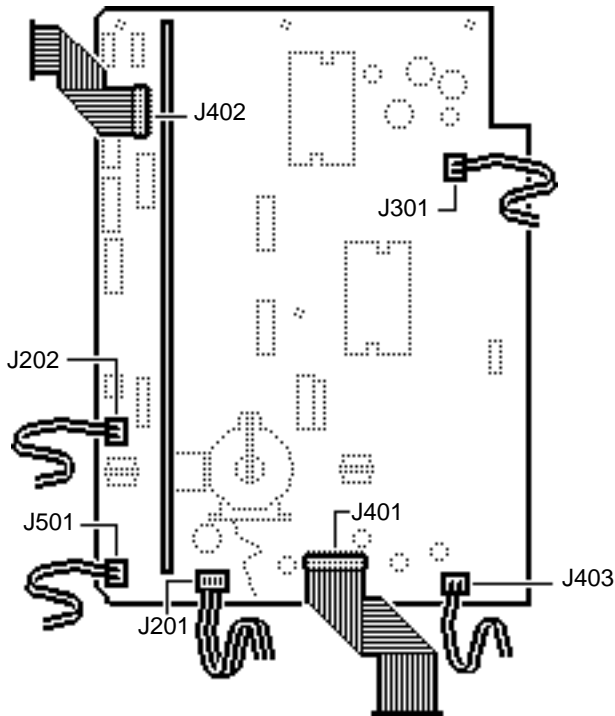
2 Disconnect the following cable connectors from the deflection board:

- 11-wire (white) from J402
- 3-wire (red/blue) from J202
- 2-wire (red/orange) from J501
- 5-wire (rd/blk/or/yel) from J201
- 13-wire (white) from J401
- 2-wire (gray) from J403
- 2-wire (yellow/black) from J301

Caution: Do not remove the connectors by pulling on the connector cables. If the connectors are difficult to disconnect, slip a jeweler's screwdriver between the two halves of the connector and carefully pry the halves apart.
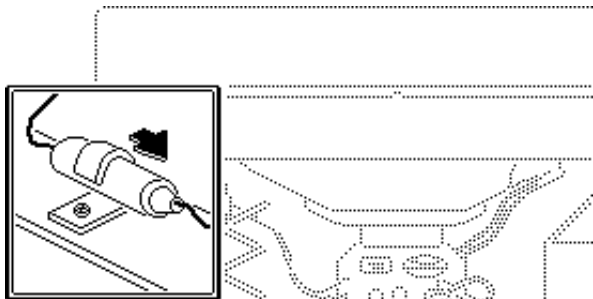
Cigar-shaped Resistor
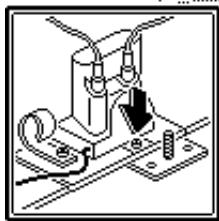
Box-shaped Resistor

3   Locate the bleeder resistor on the floor of the monitor.

4   If the resistor is cigar-shaped, slide the resistor sideways, pull up slightly on the plastic clip, and remove the resistor.

5   If the resistor is box-shaped, remove the screw that holds the resistor. Slide the resistor forward and release it from the metal bracket.
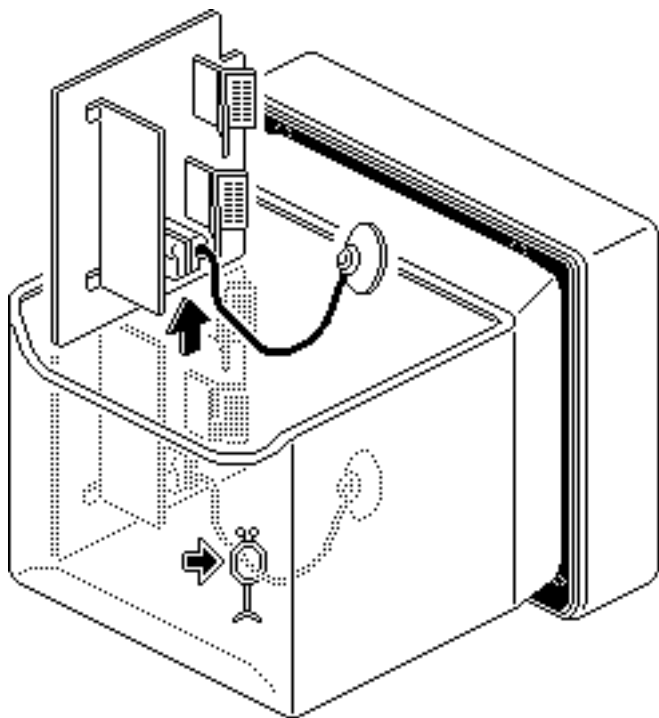
6   Remove the anode wire
     from the plastic cable
     clamp.

7   Lift the deflection board
     up and out of the chassis.

Power Supply

Before you begin, do the following:

• Remove the rear cover
• Remove the access 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.
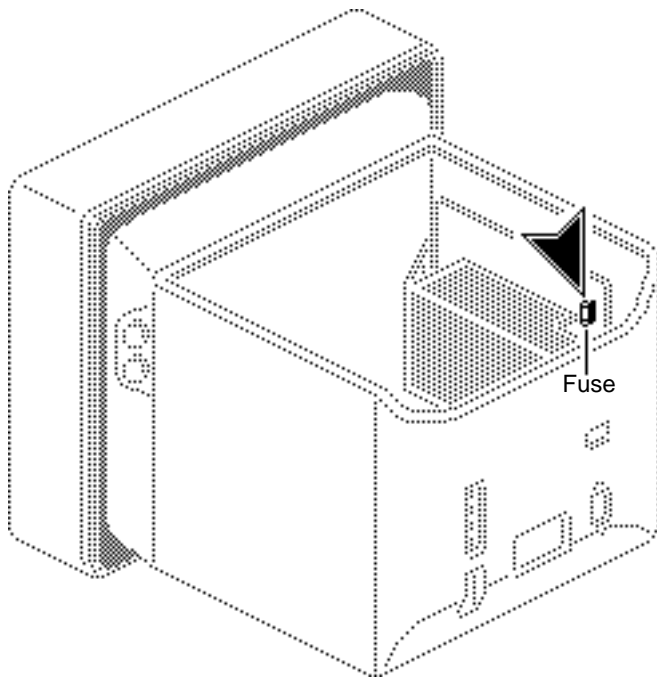
1 Remove the two screws that fasten the power supply to the chassis.

Power Supply
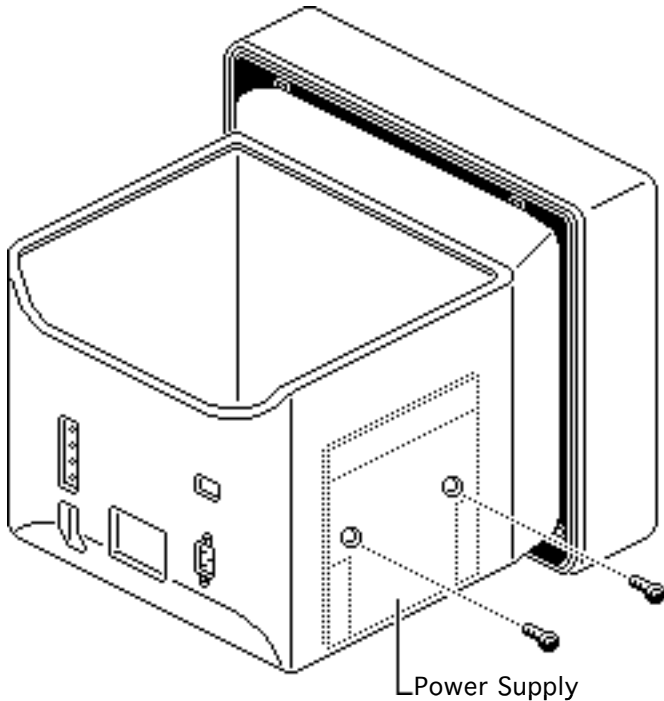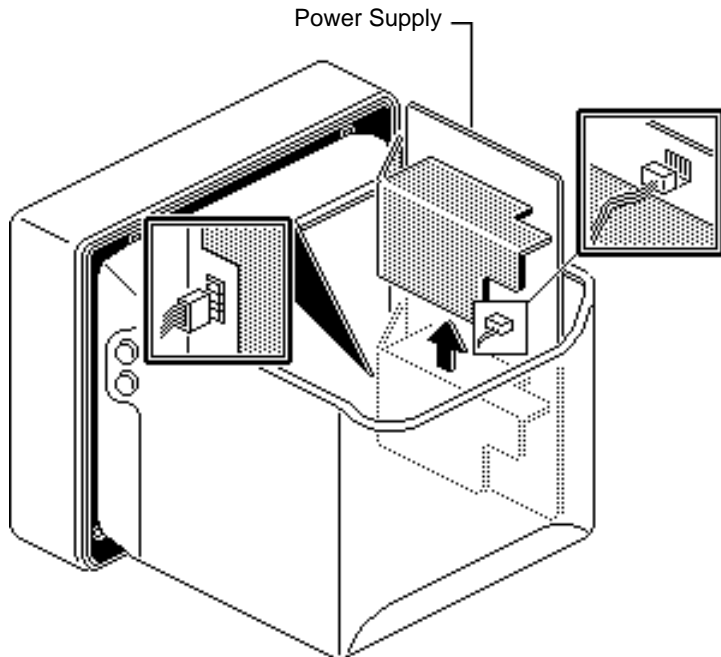
Power Supply

2 Disconnect the three-wire connector from the top of the power supply and the five-wire connector from the front of the power supply.

3 Carefully lift the power supply from the chassis.
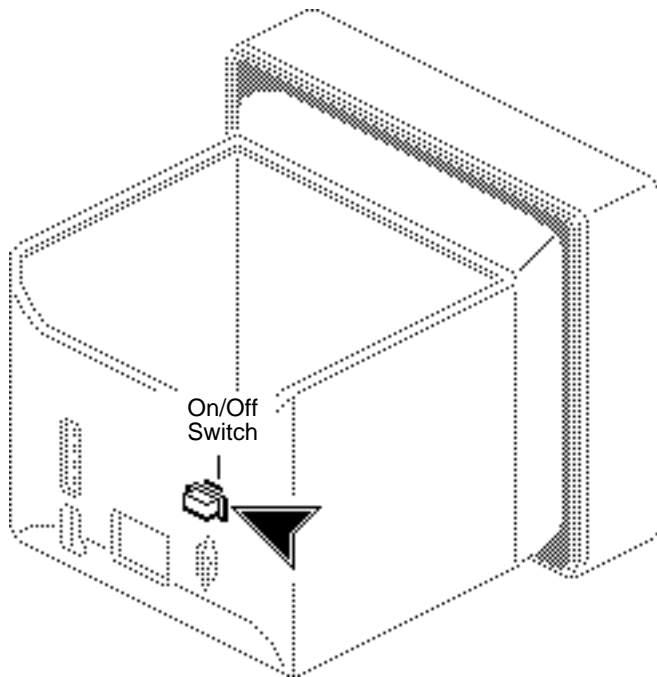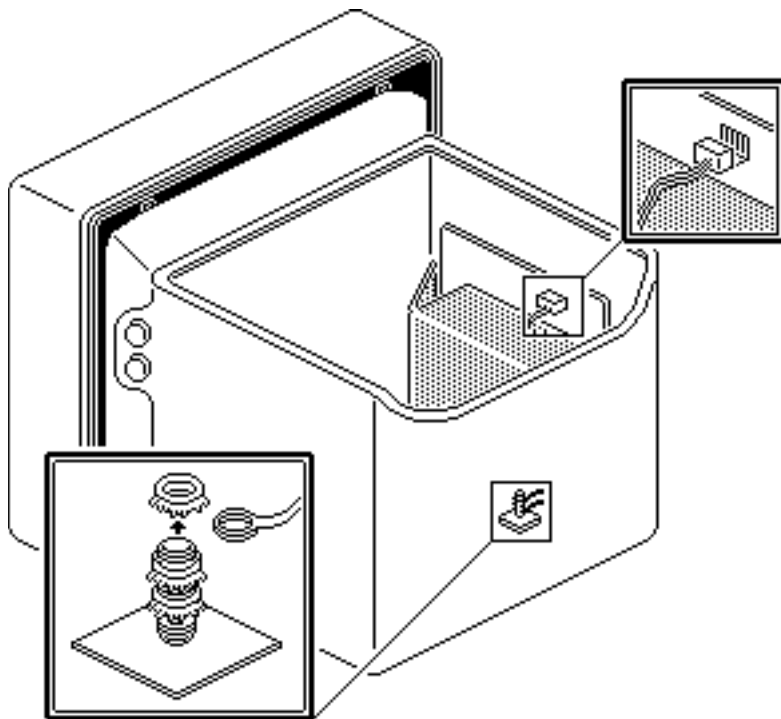
Fuse

Before you begin, do the following:

- Remove the rear cover
- Remove the access 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.
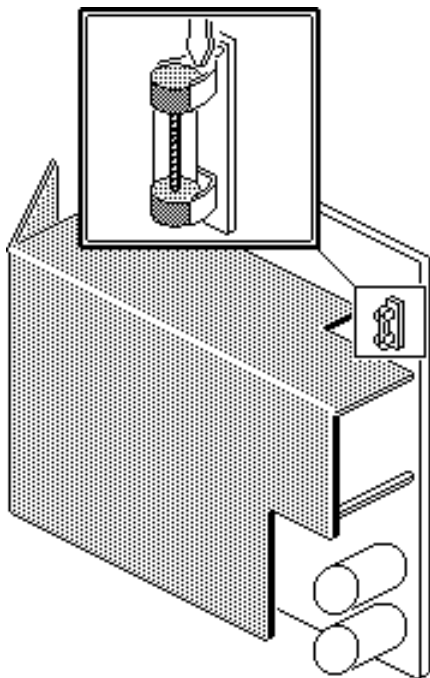
Fuse

Note: Some units with serial numbers between 43661GXW and 44718HQX have 1.6 A for the fuse on the power supply board. This amperage is incorrect. The correct value is 2.5 A.

Using your fingers or a flat-blade screwdriver, gently pry up one end of the fuse and remove the fuse from the holder.

On/Off Switch

Before you begin, do the following:

- Remove the rear cover
- Remove the access 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.

On/Off Switch

1 Remove the three hex nuts, the washers, and the three grounding wires from the metal post on the floor of the monitor.

2 Disconnect the 3-wire connector from the top of the power supply.
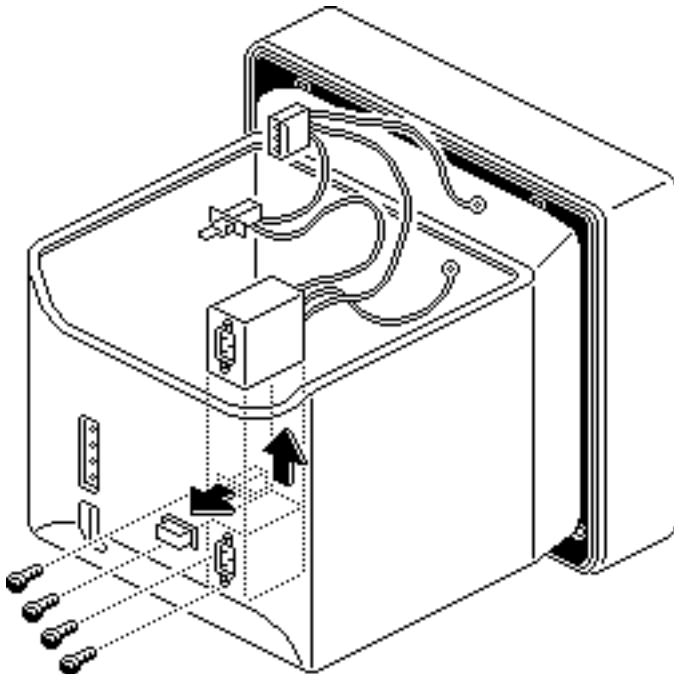
3 Pull the plastic knob off the on/off switch.

4 Remove the two screws that secure the on/off switch to the chassis.

5 Remove the two screws that secure the A/C power socket to the chassis.
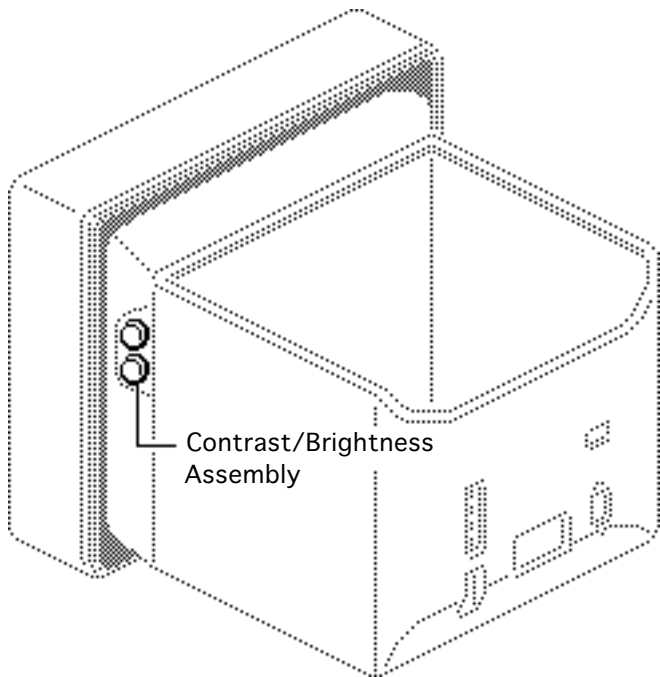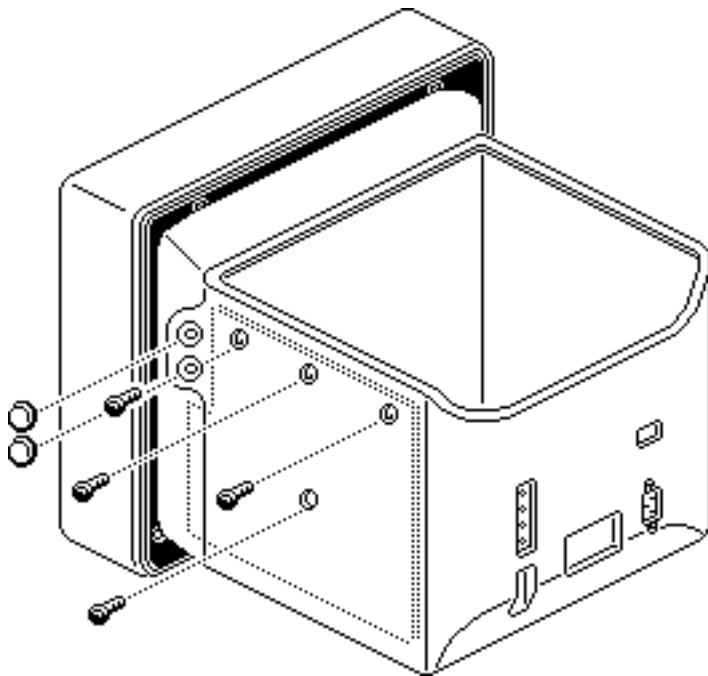
6 Lift out the on/off switch assembly.

Contrast/Brightness
Assembly

Contrast/ Brightness Assembly

Before you begin, do the following:

- Remove the rear cover
- Remove the access 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.
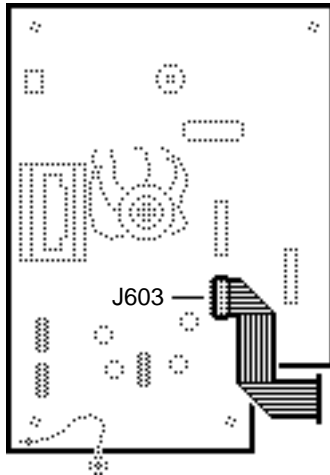
1 Pull off the contrast and
   brightness control
   knobs.

2 Remove the four screws
   that secure the deflection
   board to the chassis. Pull
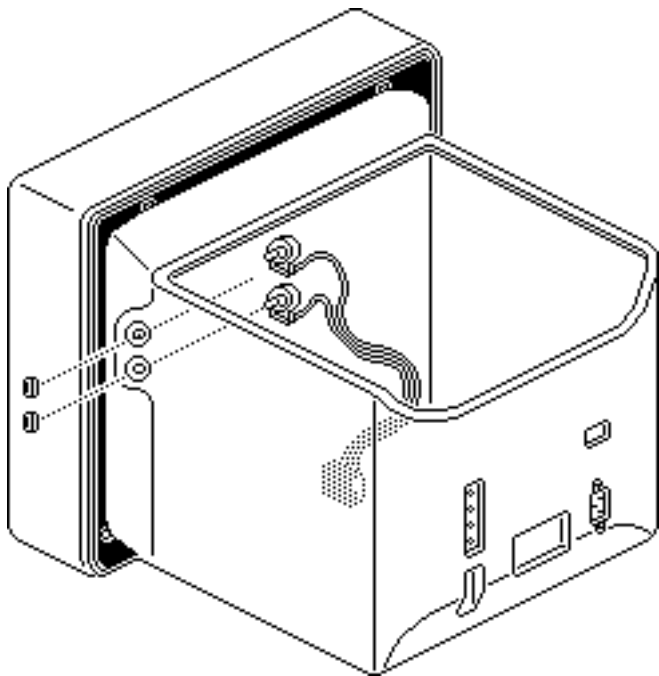   the logic board slightly
   away from the side of the
   chassis.

3   Disconnect the six-wire
    cable from connector
    J603 on the video board.

J603 —

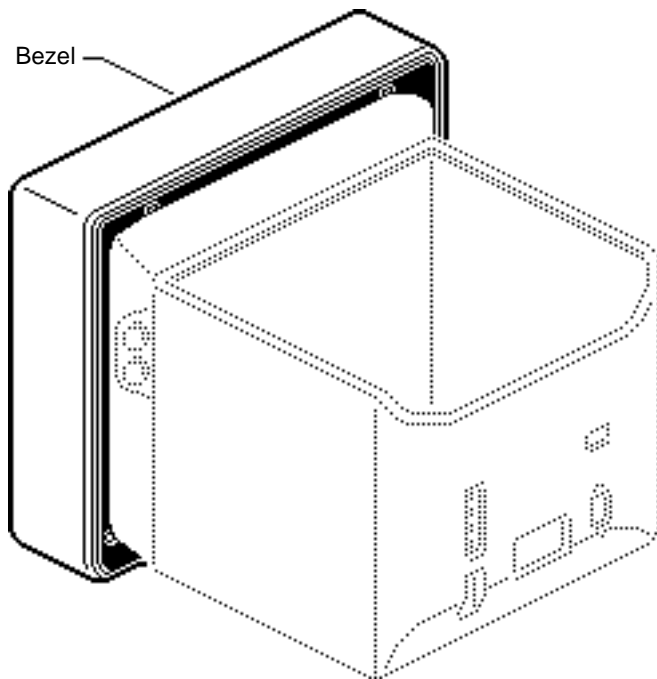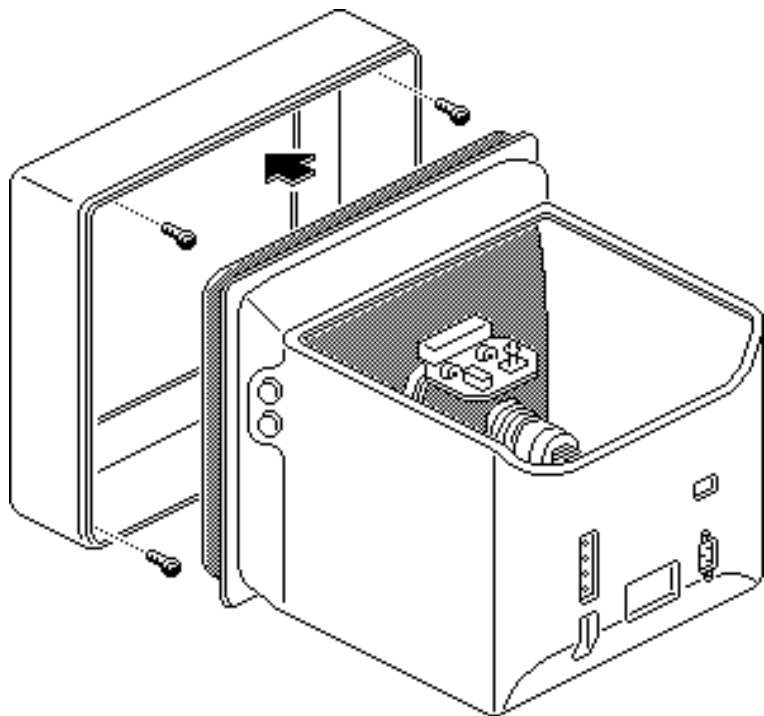4 Remove the two hex nuts and pull the contrast-brightness assembly off the chassis.

Bezel

Bezel

Before you begin, do the following:

- Remove the rear cover
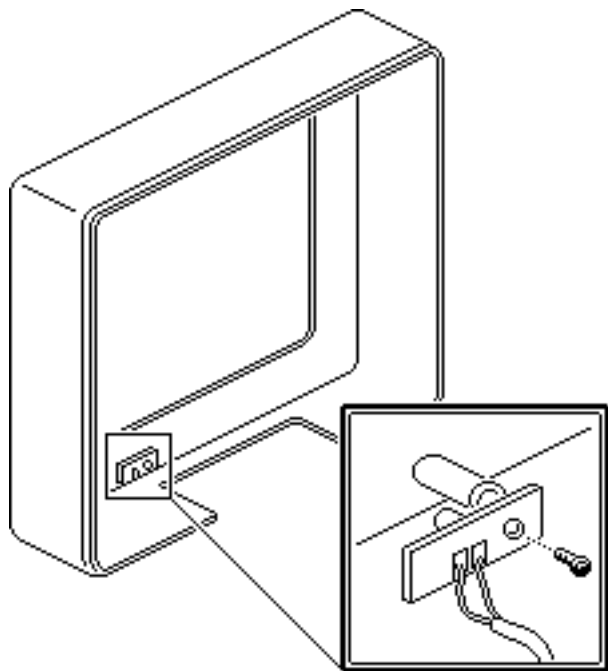- Remove the access cover
- Discharge the CRT

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

1 Remove the four hex nuts that secure the bezel to the chassis.
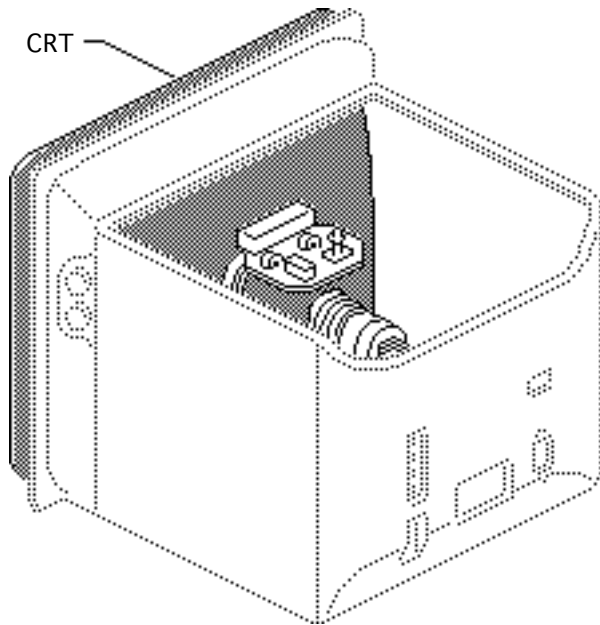
2 Pull the bezel off the chassis.

3 Remove the hex nut that secures the LED and the black paper baffle to the bezel.

CRT

CRT

Before you begin, do the following:

- Remove the rear cover
- Remove the access cover
- Discharge the CRT
- Remove the anode cap
- Remove the bezel
- Remove the swivel stand

⚠️**Warning:** This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.
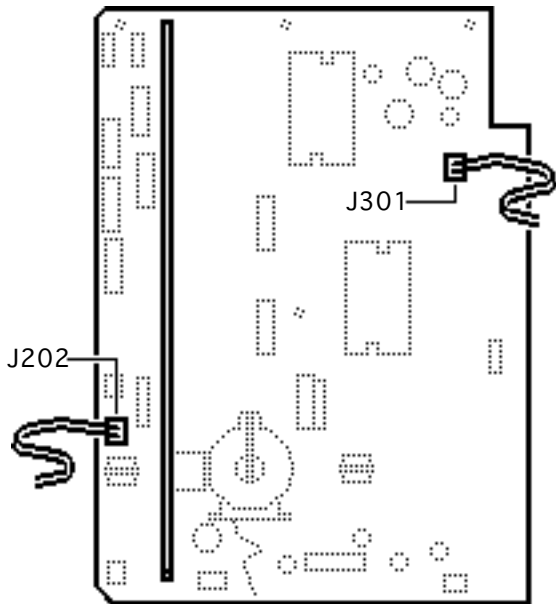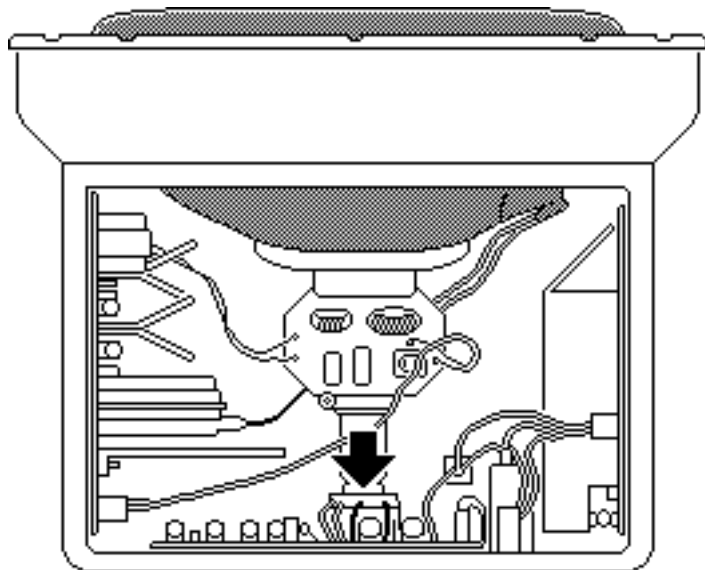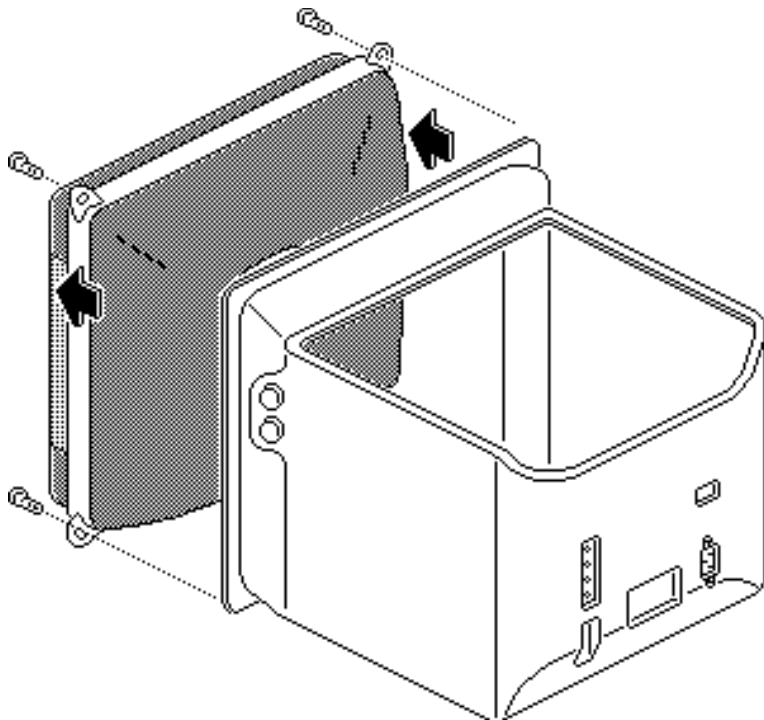
1 Disconnect the following
   cable connectors from
   the deflection board:
   • 3-wire (CRT neck)
     from J202
   • 2-wire (CRT neck)
     from J301

2 Pull the CRT socket off
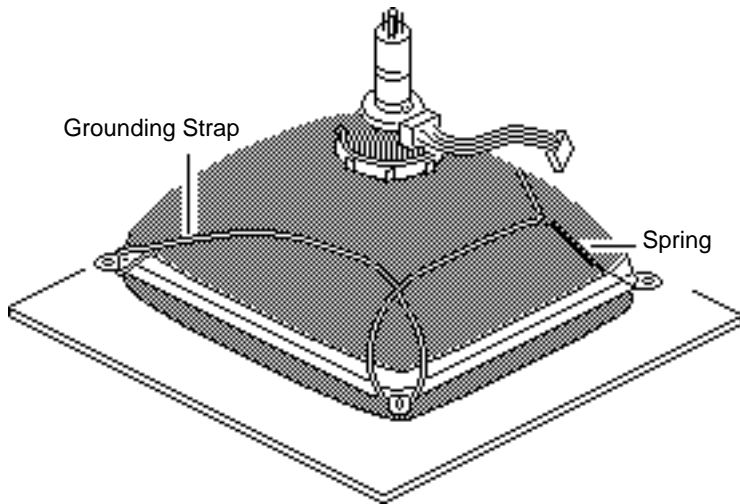the neck of the CRT.

3   While supporting the
    CRT with one hand,
    remove the four screws
    and washers that secure
    the CRT to the chassis
    frame. Save the washers
    to use on the
    replacement CRT.

    ▲**Warning:** Do not
    handle the CRT by the
    neck!

4   Carefully grasp the sides
    of the CRT and lift the
    CRT out of the chassis.

Grounding Strap

Spring

5   Place the CRT face-down on a soft, protective surface.

6   Remove the grounding strap and the spring. Save them to use on the replacement CRT.

▲**Warning:** If the CRT is cracked or broken, refer to the CRT disposal instructions in Bulletins/Safety.
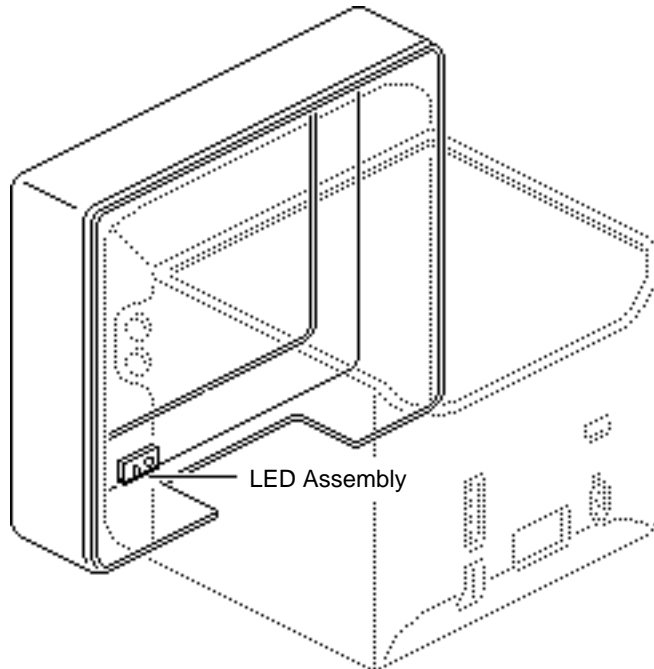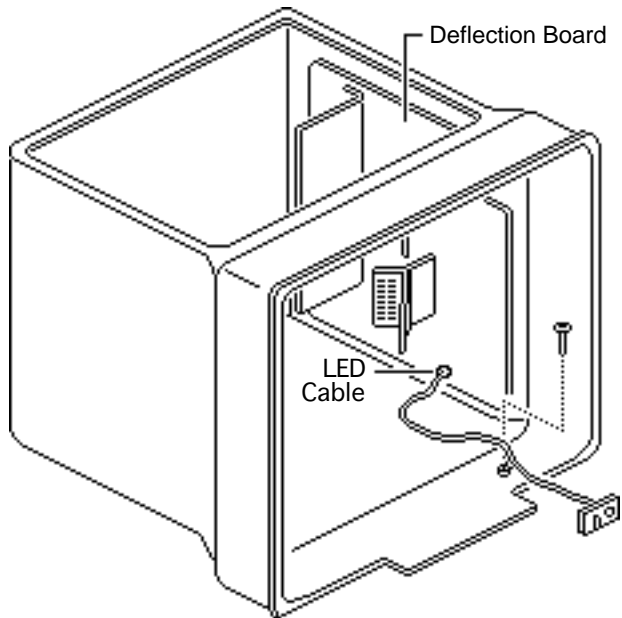
LED Assembly

LED Assembly

Before you begin, do the following:

- Remove the rear cover
- Remove the access cover
- Discharge the CRT
- Remove the anode cap
- Remove the bezel
- Remove the swivel stand
- Remove the CRT

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

Deflection Board

LED
Cable

1 Disconnect the LED
   cable from the
   deflection board.

2 Remove the hex nut that
   secures the green
   grounding wire to the
   inside of the chassis. Lift
   out the LED assembly.

Adjustments
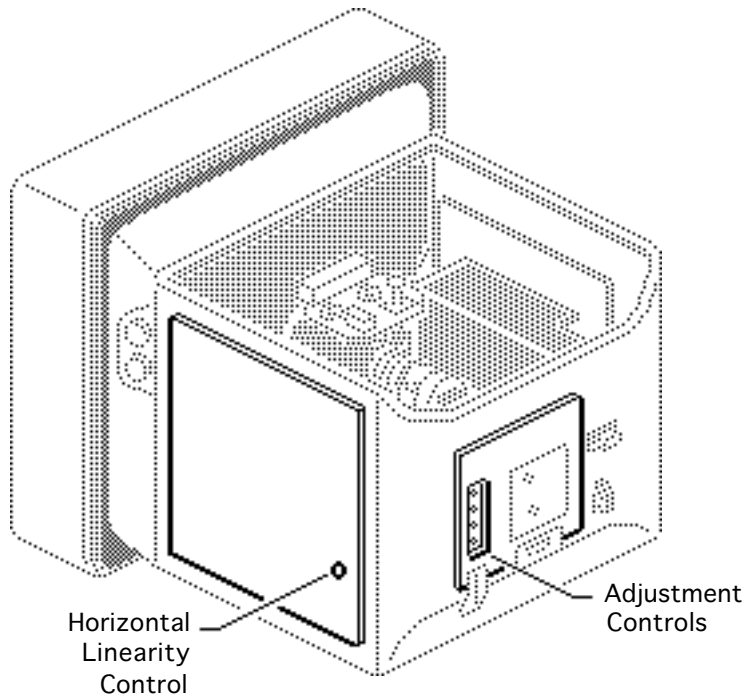
Apple Two-Page Monochrome
Monitor

Geometry

Before you begin, remove the following:

- Rear cover
- Access cover

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

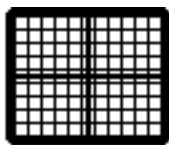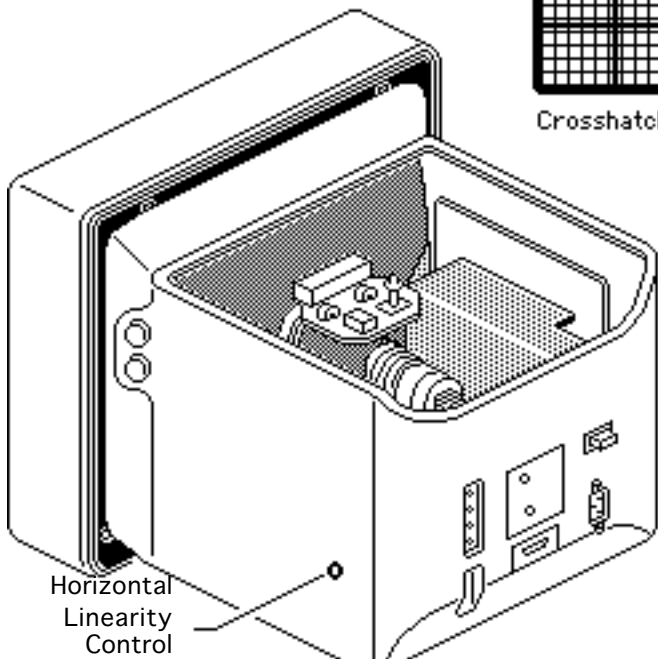Horizontal Linearity Control

Adjustment Controls

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

Note: Geometry adjustments should always be performed whenever you replace the CRT, deflection board, or video board.

Crosshatch II

Horizontal Linearity

1 Use Display Service Utility to display the Crosshatch II (white background) test pattern.

Caution: The linearity adjustment tool is the only tool that can be used to adjust the Horizontal Linearity control! Use of any other tool may damage the adjustment control coil core or cause a short in the monitor's circuitry.

Horizontal Linearity Control

Crosshatch II
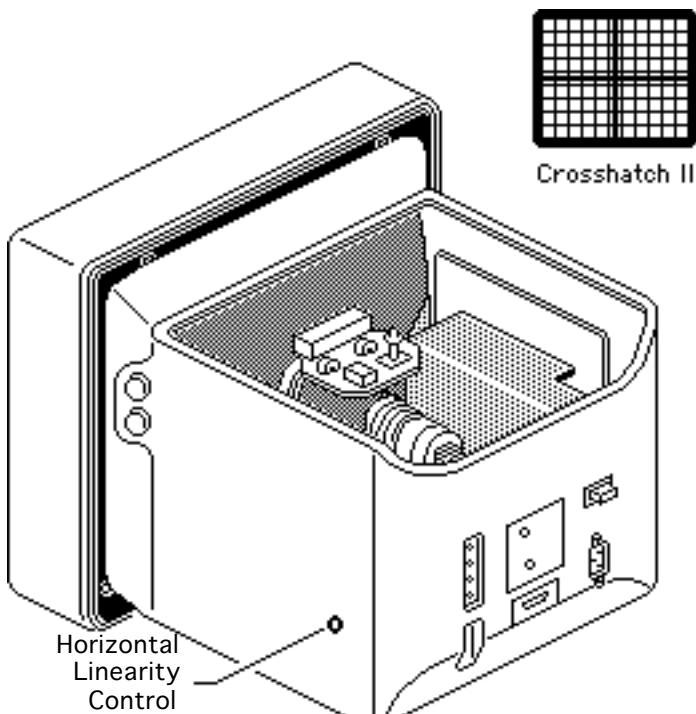
2   Using the linearity
    adjustment tool, adjust
    the horizontal linearity
    control until the raster
    is as wide as possible.

3   Using the linearity
    adjustment tool, slowly
    adjust the horizontal
    linearity control until
    the left and right halves
    of the raster are the
    same distance from the
    center of the screen.
    • To measure the left
      half of the raster,
      place a flexible ruler
      against the screen
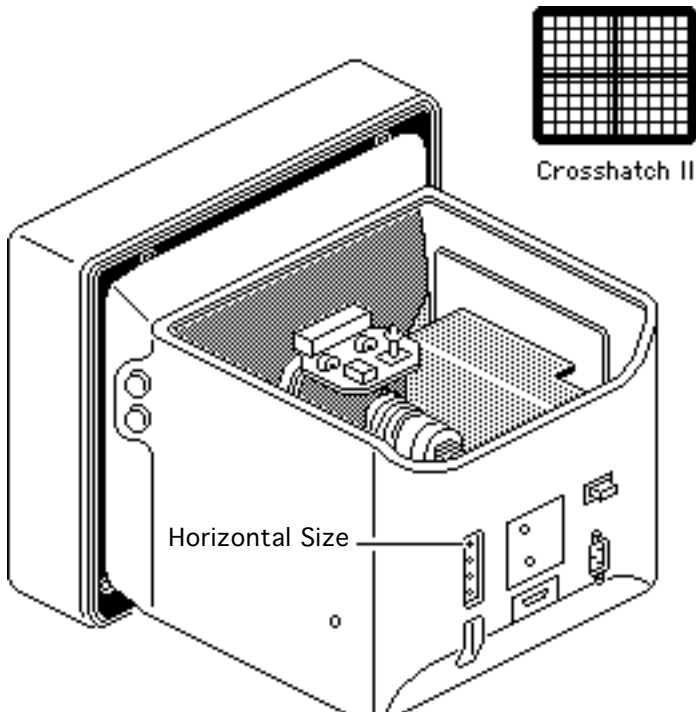
Horizontal
Linearity
Control

directly over the black horizontal line. Align the zero mark of the ruler with the left edge of the raster. Note the measurement at the point where the two black lines intersect.

• To measure the right half of the raster, align the zero mark of the ruler where the two black lines intersect. Note the measurement at the right edge of the raster.

Crosshatch II

4   Using the plastic alignment tool, slowly adjust the horizontal size control until the raster is 15 inches (± 1/8") or 381 mm (± 3 mm) wide.

5   Verify that the left and right halves of the raster are still the same distance from the center of the screen. If necessary, adjust the horizontal linearity control.

Horizontal Size
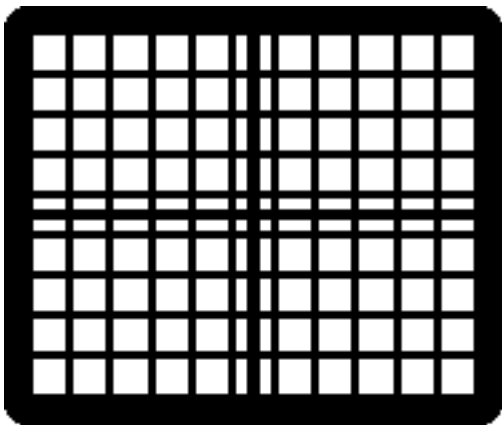
6   Verify that the boxes on both the left and right sides of the screen are the same size as the boxes in the center of the screen. If they are not the same size, perform the next step.

   ⚠ **Warning:** The monitor operates at extremely high voltages. To prevent electrical shock, use a plastic alignment tool to set the 3-position switch. Avoid touching the heatsink or any other
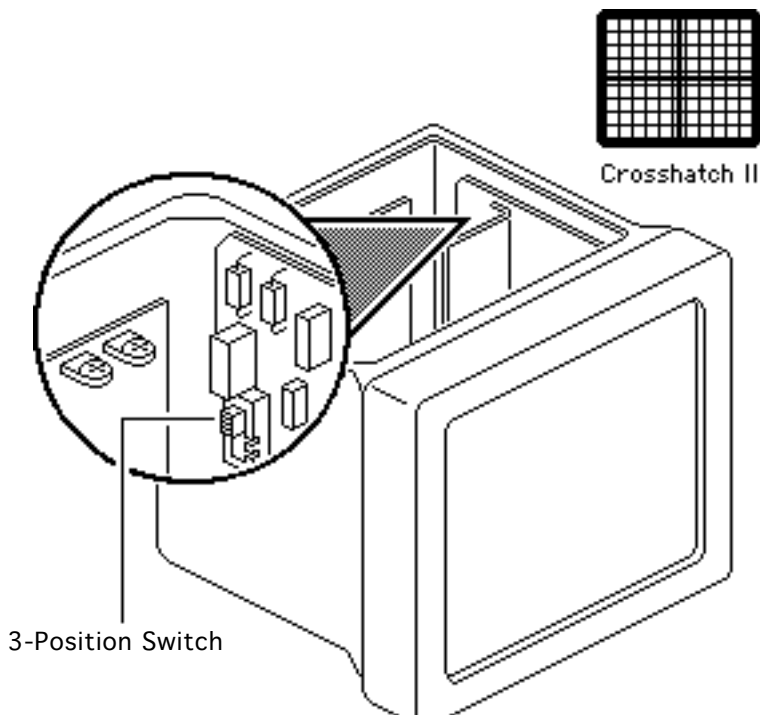
part of the monitor.

⚠ Warning: If you do not use a plastic alignment tool, turn off the power before reaching inside the chassis and adjusting the switch. Then turn on the power and view the monitor screen.
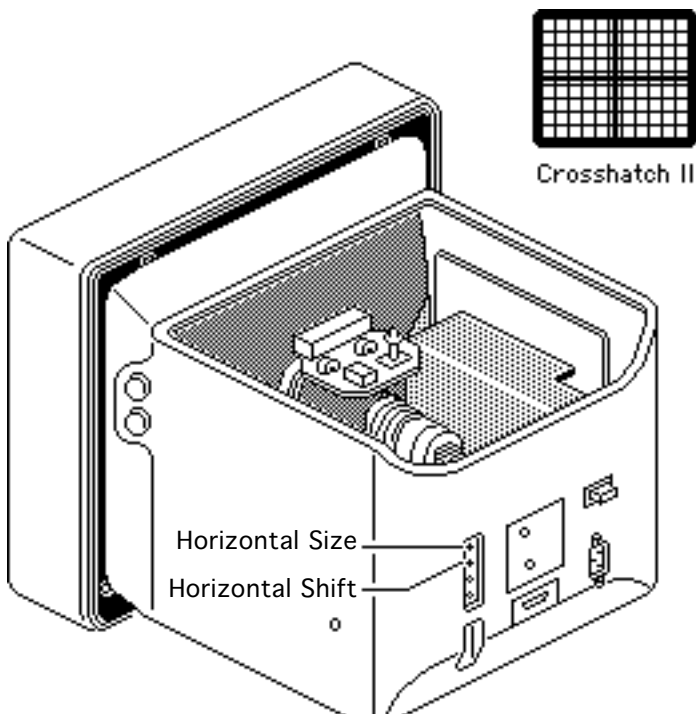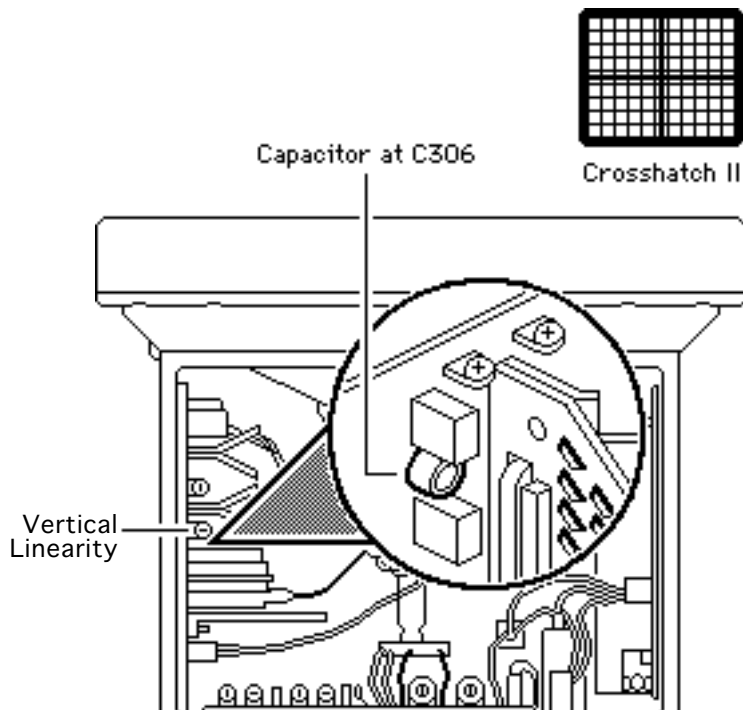
Crosshatch II

7 Using the plastic alignment tool, set the 3-position switch to the lowest of the three settings and recheck the relative size of the boxes. Repeat for all three positions of the switch and select the best position.

3-Position Switch

Crosshatch II

Horizontal Size
Horizontal Shift

8   Using the plastic alignment tool, slowly adjust the horizontal size control until the raster is 15 inches (± 1/8") or 381 mm (± 3 mm) wide.

9   Verify that the raster is centered on the screen. If necessary, adjust the horizontal shift control.
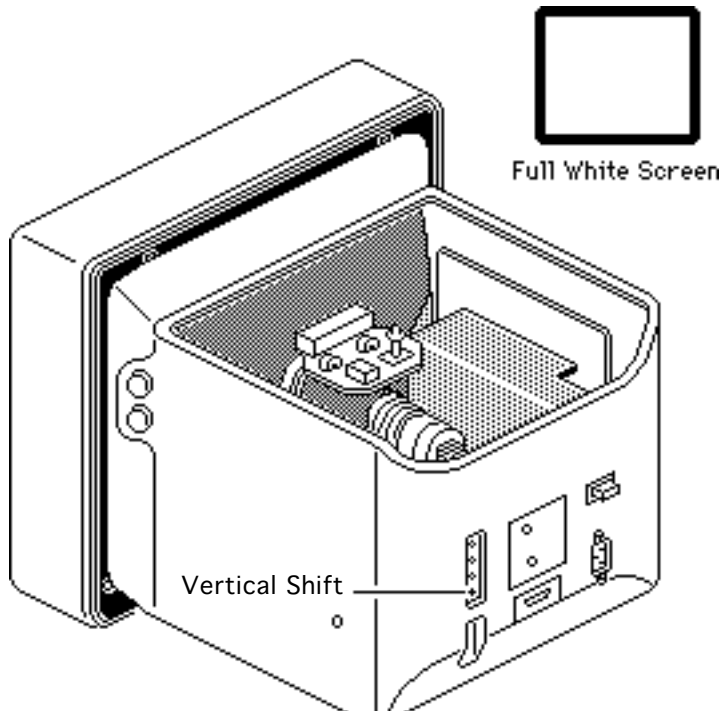
Crosshatch II

Capacitor at C306

Vertical
Linearity

Vertical Linearity

1 Use Display Service Utility to display the Crosshatch I or Crosshatch II test pattern.

2 Using the plastic alignment tool, adjust the orange capacitor at C306 until the top two rows of boxes are the same height.
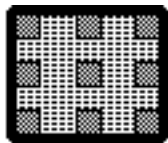
Full White Screen

3 Using the plastic alignment tool, adjust the vertical linearity control until the top and bottom rows of boxes are the same height.

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

5 Using the plastic alignment tool, adjust the vertical shift control until the white raster is vertically centered.
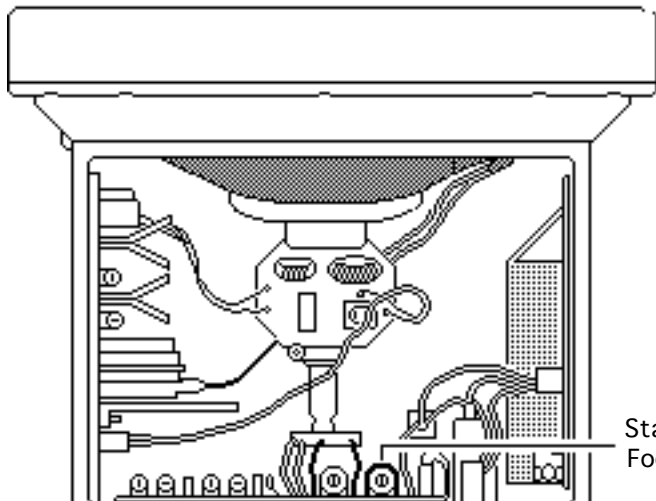
Vertical Shift
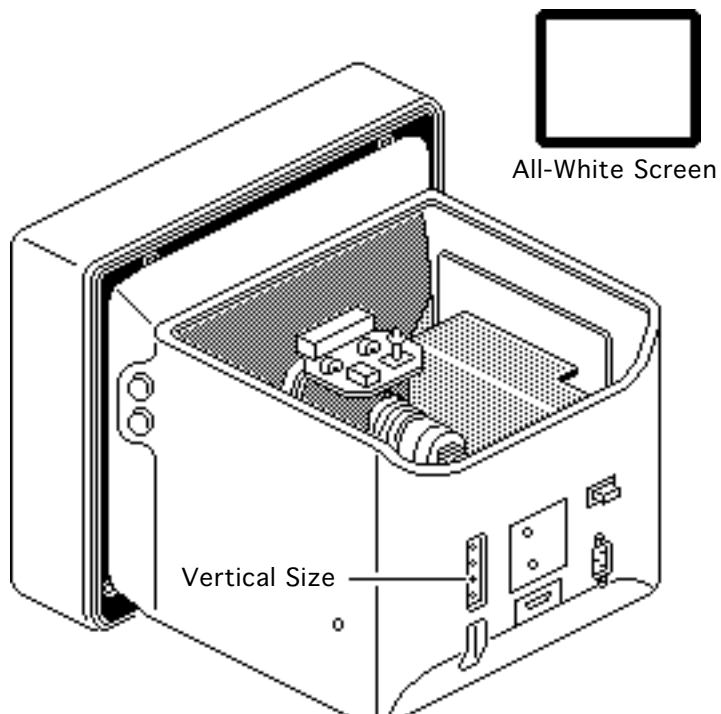
All-White Screen

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

7 Using a plastic alignment tool, adjust the vertical size control until the white raster is 11 5/16 inches (± 1/8") or 287.3 mm (± 3 mm) high.

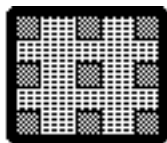Vertical Size

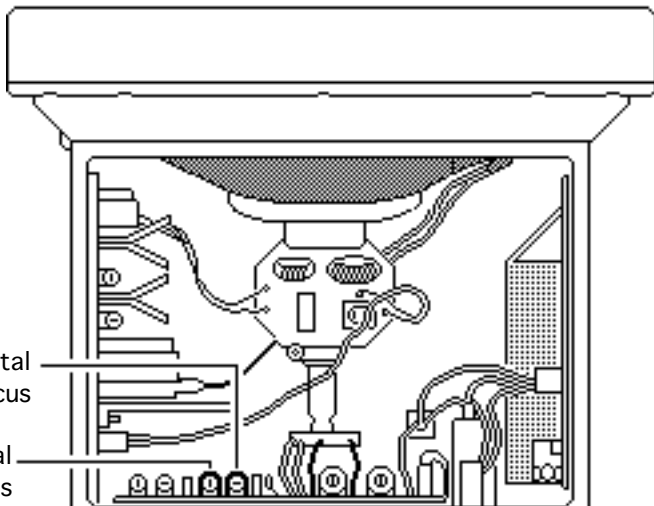**Focus**

1 Use Display Service Utility to display the Focus test pattern.

2 Using a plastic screwdriver, adjust the static focus control for the best focus in the box at the center of the screen.

Focus

Static Focus

Focus


Horizontal Focus

Vertical Focus

3 Using a plastic screwdriver, adjust the horizontal focus control for the best focus in the box at the left and right sides of the screen.

4 Using a plastic screwdriver, adjust the vertical focus control for the best focus in the box at the top and bottom center of the screen.

5 Repeat the adjustments until you have attained the best focus possible.

Brightness Range

Brightness

Contrast

Cutoff

Subcontrast
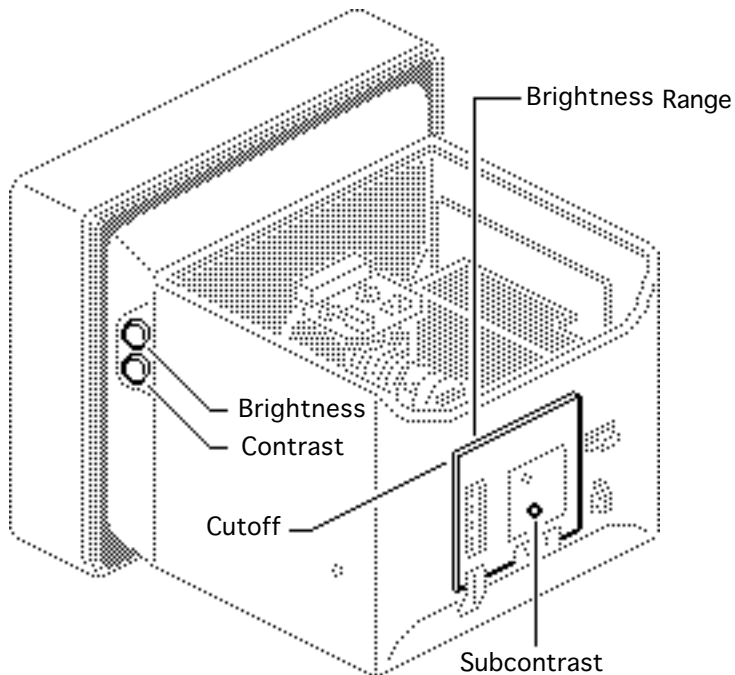
Video

Before you begin, remove the following:

- Rear cover
- Access cover

△**Warning:** This product contains high voltage and a high-vacuum picture tube. To prevent serious injury, review CRT safety in Bulletins/Safety.
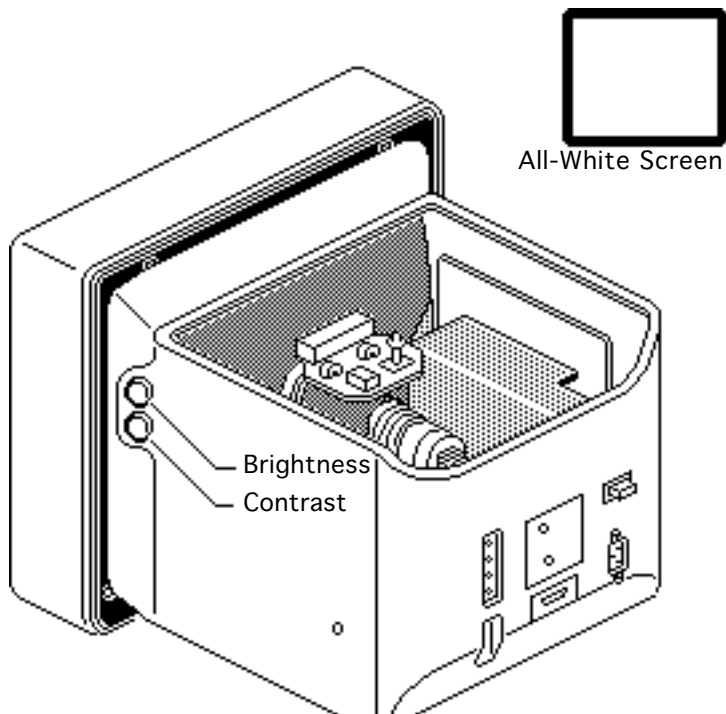
Warning: Because you must make adjustments from the rear of the computer, position a mirror to view the computer screen. Do not reach around the computer to adjust the controls.

Note: Video adjustments should always be performed whenever you replace the CRT, deflection board, or video board.
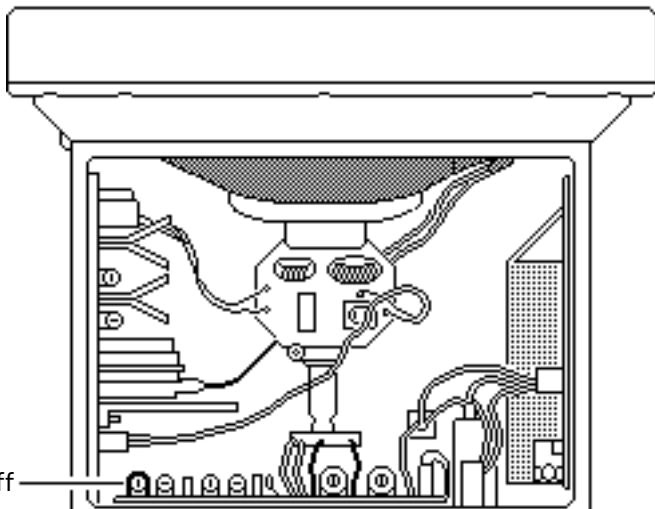
All-White Screen

1 Switch off the power and remove the video cable from the back of the monitor.

2 Set the external (user) contrast knob to maximum (turn fully clockwise) and the brightness knob to the center (detent) position.

Brightness

Contrast

All-White Screen
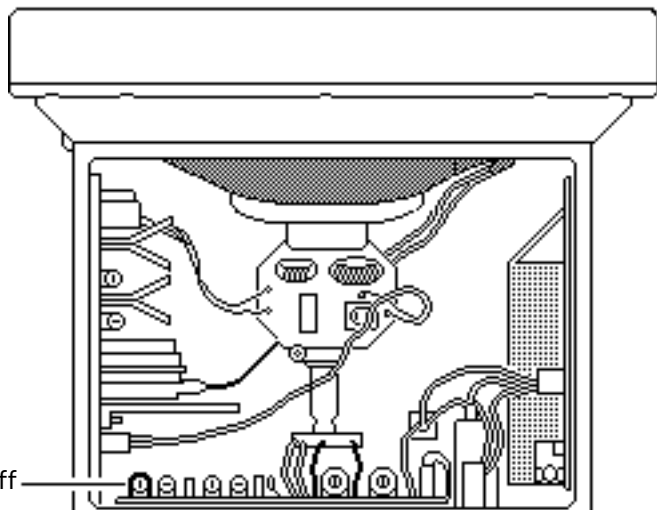
3   Using the plastic
     screwdriver, adjust the
     cutoff control to
     minimum (turn fully
     counterclockwise).

4   Switch on the power and
     wait 20 minutes for the
     monitor to warm up.

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

Cutoff

All-White Screen

Note: The Cutoff adjustment should be performed in a dimly lit room after the monitor has been on for at least 20 minutes.

6 Using the plastic screwdriver, turn the cutoff control clockwise until a white raster just appears, then turn counterclockwise until the raster just fades to black.

7 Switch off the power and reconnect the video cable.

Cutoff

8   Switch on the power.

    Note: If the power is
    turned off for more than
    a few seconds, you must
    wait for another 20
    minutes for the monitor
    to warm up.
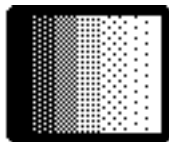
Gray Bars
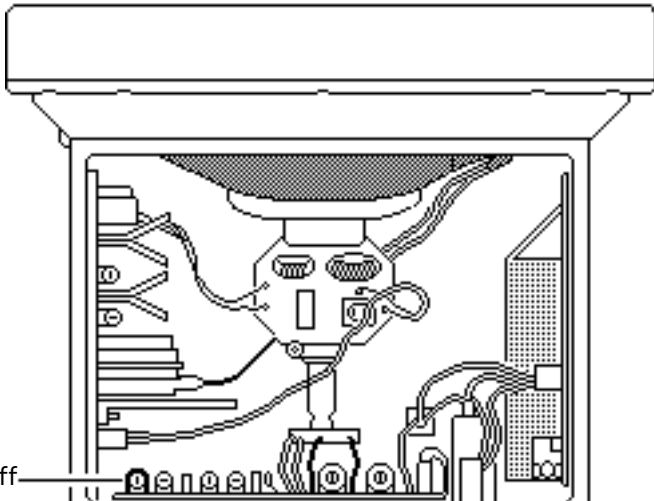
9 Use Display Service
   Utility to display the
   Gray Bars test pattern.

10 Using a plastic alignment
   tool, adjust the cutoff
   control until the
   leftmost bar (darkest)
   is black and the next bar
   is barely distinguishable
   from the black bar.

Cutoff
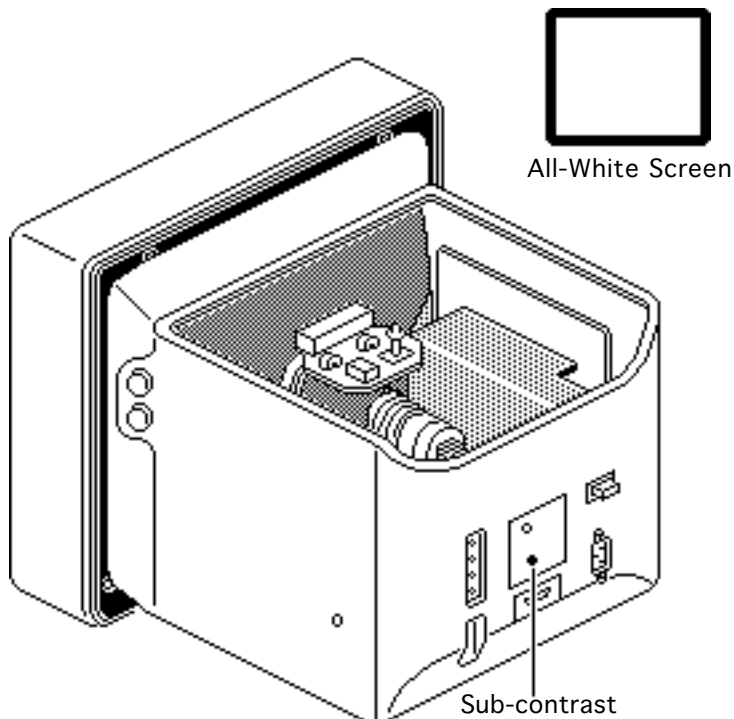
All-White Screen

Important: Readings from light meter L–248 and 246 differ. Please note which meter you are using before making adjustments. (See "Light Meter Setup.")

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

Sub-contrast

12 Using the light meter and a two-inch plastic screwdriver, adjust the sub-contrast control until you get 31 foot lamberts (± 3 foot lamberts), which on the light meter is

- Model L-248: middle of the 10 scale
- Model 246: 23 on the red scale

All-White Screen

Brightness Knob

Brightness Range

Important: Over time, light meter tolerances can vary. If you doubt your meter's accuracy, verify the readings with a known-good light meter or photometer.

13 Set the external (user) brightness knob to maximum (turn fully clockwise).

14 Using the plastic
   screwdriver, adjust the
   brightness range
   control until you get 31
   foot lamberts (± 3 foot
   lamberts), which on the
   light meter is
   • Model L-248: middle
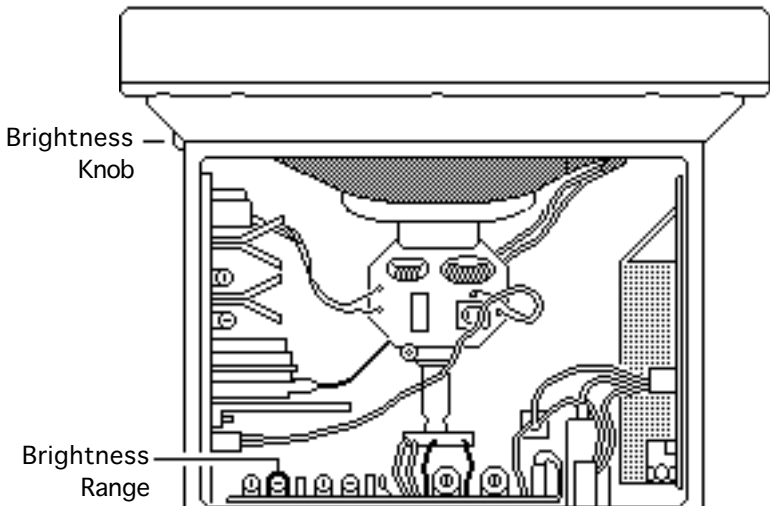   of the 10 scale
   • Model 246: 23 on the
     red scale

15 Reset the brightness
   knob to the center
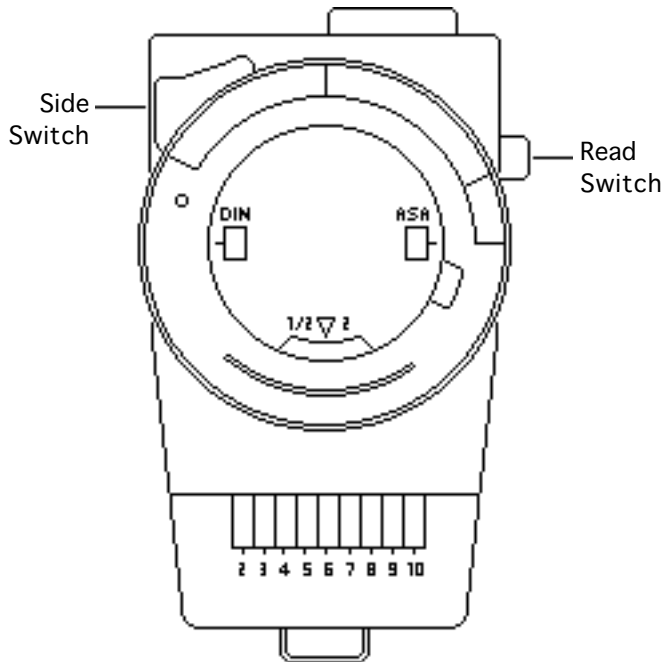   (detent) position.

Side Switch

Read Switch

Light Meter Setup

Model L-248

Note: This topic covers setup for two light meters: Models L-248 and 246.

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 lower position so that the scale reads 2-10.

3   Uncover the lens of the

meter.

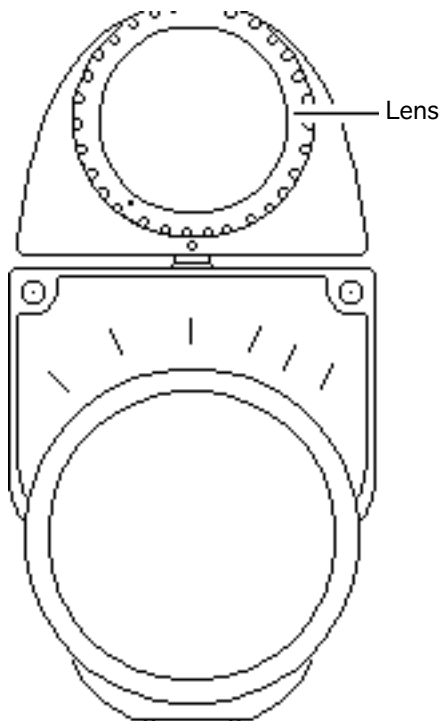4   Place the lens against the
    middle of the screen and
    press the Read switch.

Lens

Model 246

Note: Remove the metal slide, if installed, from the top of the light meter. Install the white lens with the red dot.

1 Rotate the lens of the meter to face the monitor.

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

Exploded View

Apple Two-Page Monochrome Monitor

Access Cover

949-0223
Bezel

905-0007
Contrast/
Brightness
Assembly

661-0453
Power
Supply

941-0016
Fuse

949-0224
Rear Cover

590-0393
Power Supply
Cable 6-Pin

590-0395
12-Pin Cable

590-0391
LED and Cable
Assembly

590-0397
3-Pin Cable

956-0012
Screw Knob Set

937-0040
On/Off Switch
Filter Assembly

661-0452
Video Board

076-0320
CRT
Assembly

661-0451
Deflection
Board

815-0558
Tilt/Swivel
Monitor Stand

590-0398
14-Pin Cable

590-0371
Power
Cable

590-0615
Video
Cable