



Macintosh Color Classic





Basics

Macintosh Color Classic





Overview

This manual contains complete repair procedures for the Macintosh Color Classic shown at left.

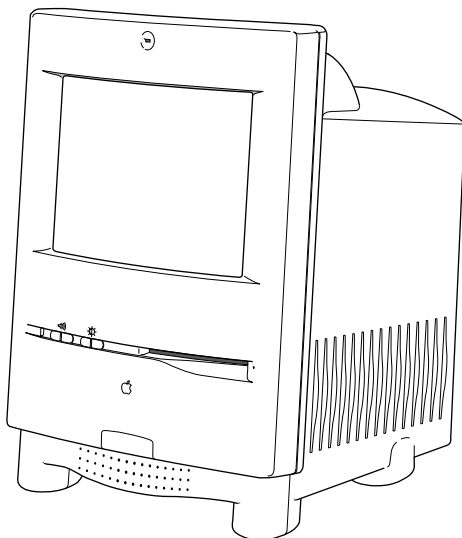


Figure: Macintosh Color Classic





Specifications

Color Classic





Configurations

Standard

4 MB RAM, 256K VRAM, 3.5-in. hard drive (many sizes), internal 1.4 MB floppy drive, user-removable logic board, 9-in. color display, built-in speaker and microphone, keyboard, mouse, ADB and power cables, system software installed on hard drive (requires System 7.1)

Options

Memory expansion kit
256K VRAM SIMM upgrade
Apple IIe emulation card
LC ethernet card
Math coprocessor
Anti-glare, anti-static CRT





Processor

CPU

Motorola 68030 microprocessor

16 MHz

Built-in Paged Memory Management Unit (PMMU)

256-byte instruction and data caches

Coprocessor

Socket for optional Motorola 68882 floating-point coprocessor

16 MHz

Addressing

16-bit data bus

32-bit address bus

16-bit internal registers





Memory

RAM	4 MB of dynamic RAM on board Expandable to 10 MB (100 ns or faster SIMMs) Dual SIMM expansion slot (two 30-pin connectors) Includes RAM disk software
ROM	1 MB of main ROM on board; 2 MB maximum of main ROM
PRAM	256 bytes of clock/calendar/parameter memory Long-life lithium battery





VRAM

256K of VRAM on board

Expandable to 512K of VRAM with 256K VRAM SIMM (100 ns or faster VRAM SIMM)

68-pin VRAM SIMM connector





Disk Storage

Floppy Drive

Internal 1.4 MB Apple SuperDrive

Hard Drive

3.5-inch, internal 40, 80, or 160 MB SCSI hard drive





I/O Interfaces

Serial	Two RS-232/RS-422 serial ports; mini DIN-8 connectors
SCSI	One SCSI parallel port; DB-25 connector Connects up to six external SCSI devices
Apple Desktop Bus	Two ADB ports; mini DIN-4 connector Maximum of three ADB devices recommended Maximum current draw: 500 mA (Mouse draws 10 mA, keyboard draws 25 mA)





Sound	Sound-input, external microphone port, 8-bit monaural sound, sampled at 22 or 11 KHz Monophonic sound-output jack for external audio amplifier or headphones
Processor Direct Slot	Macintosh LC-compatible, 96-pin PDS expansion connector





I/O Devices

Keyboard

Standard 80-key Apple keyboard with numeric keypad; ADB connector

Soft power-on switch

2.5 mm travel, 18 mm vertical and horizontal pitch

Two-level tilt adjustment

Mouse

Apple Desktop Bus Mouse II

Microphone

Built-in electret, omnidirectional microphone

Speaker

Adjustable sound control on front of bezel





Sound and Video

Sound Generator

Monophonic 8-bit digital-analog conversion using 22-KHz sampling rate for sound input (capable of driving stereo headphones or other stereo equipment through the sound jack)

VRAM

Standard: 256K of VRAM on board; displays up to 256 colors;
Supports 1, 2, 4, or 8 bits per pixel

Enhanced: 512K of VRAM; displays up to 32,000 colors; Supports 1, 2, 4, 8, or 16 bits per pixel





Video Display

Built-in, 10-in. diagonal (254 mm), 9-in. viewable (228 mm) screen

Trinitron CRT

512 pixels by 384 lines; 76 dpi

Adjustable contrast control on front bezel





Electrical

Line Voltage	90-240 VAC; Universal power supply
Frequency	47-63 Hz, single phase
Maximum Power	100 W





Physical

Dimensions

Height: 14.5 in. (37.0 cm)

Width: 9.9 in. (25.2 cm)

Depth: 12.6 in. (32.15 cm)

Weight

22.5–23.2 lb. (10.2–10.5 kg)





Environmental

**Operating
Temperature**

50-104° F (10-40° C)

**Storage
Temperature**

-40 to 116° F (-40 to 47° C)

Relative Humidity

20-95% noncondensing

Altitude

0-15,000 ft. (0-4722 m)





Troubleshooting

Color Classic





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

Video

Screen is black, too dark, or too bright; audio and drive operate

- 1 Adjust contrast button on front bezel.
- 2 Reset PRAM.
- 3 Check yoke cable connection.
- 4 Perform video adjustments. Refer to “Video” in Adjustments chapter.
- 5 Replace analog board.
- 6 Replace CRT.

Screen is bright and audio is present, but no video information is visible

- 1 Perform video adjustments. Refer to “Video” in Adjustments chapter.
- 2 Replace analog board.
- 3 Replace CRT.





Video (Continued)

Single vertical or horizontal line is displayed

Note: A thin, gray, horizontal line may be visible across the bottom third of a lit screen. This line is inherent in the design of Trinitron monitors. Do not replace modules.

Otherwise,

- 1 Replace analog board.
- 2 Replace CRT.

Predominant color tint or color cannot be adjusted

- 1 Perform video adjustments. Refer to “Video” in Adjustments chapter.
- 2 Replace analog board.
- 3 Replace CRT if red, green, or blue cannot be turned off using appropriate controls.





Video (Continued)

Picture breaks into diagonal lines, or picture rolls vertically or horizontally

Replace analog board.

Out of convergence (color bleeds from text or lines)

- 1 Perform convergence adjustment. Refer to “Convergence” in Adjustments chapter.
- 2 Replace analog board.
- 3 Replace CRT.

Black screen spots (burnt phosphors)

Replace CRT.





Video (Continued)

Screen jitters or flashes

- 1 Verify that adjacent computer equipment is properly grounded. Move electrical devices away from monitor. Temporarily shut off all fluorescent lights in area.
- 2 Check that all ground cables are secure.
- 3 Disconnect internal hard drive and floppy drive.
- 4 Replace analog board.

Out of focus

- 1 Perform focus adjustment. Refer to “Focus” in Adjustments chapter.
- 2 Replace analog board.
- 3 Replace CRT only if one part of display remains out of focus despite adjustment of focus controls to their limits.





Video (Continued)

Flashing or wavy screen or monitor emits high-pitched noise

Replace analog board.

Raster size too short/tall or narrow/wide

- 1 Adjust horizontal or vertical size control. Refer to Adjustments chapter.
- 2 Replace analog board.

Linearity bad (size of text/graphics differs at top, bottom, or sides of screen)

Replace analog board.





Video (Continued)

Raster tilted or shifted

- 1 Verify that distortion is not due to environmental conditions (move monitor to different location). Refer to “Monitor Distortion” in Basics chapter of any large-screen monitor manual.
- 2 Perform appropriate geometric adjustments.
- 3 Perform yoke adjustment. Refer to “Yoke” in Adjustments chapter.
- 4 Replace analog board.





Video (Continued)

Raster distorted
(barrel-shaped,
corners not square,
stretched or
compressed at top of
display, or sides not
perpendicular)

- 1 Verify that distortion is not due to environmental conditions (move monitor to different location). Refer to “Monitor Distortion” in Basics chapter of any large-screen monitor manual.
- 2 Perform appropriate geometric adjustments.
- 3 Replace analog board.
- 4 Replace CRT (only in rare instances).

Raster not centered

- 1 Verify that distortion is not due to environmental conditions (move monitor to different location). Refer to “Monitor Distortion” in Basics chapter of any large-screen monitor manual.
- 2 Adjust horizontal or vertical center control. Refer to Adjustments chapter.
- 3 Replace analog board.





Floppy Drives

Audio and video are present, but internal floppy drive does not operate

- 1 Replace bad disk with known-good disk.
- 2 Replace floppy drive.
- 3 Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.
- 4 Replace floppy drive cable. See "Flat-Cable Assembly" in Take Apart.

Disk ejects; display shows icon with blinking "X"

- 1 Replace bad system disk with known-good system disk.
- 2 Replace floppy drive.
- 3 Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.





Floppy Drives (Continued)

Unable to insert disk
all the way

- 1 To eject previously inserted disk, insert opened paper clip into hole beside floppy drive.
- 2 Switch off system and hold mouse button down while switching system on (to complete eject cycle).
- 3 Replace floppy drive.

Does not eject disk

- 1 Insert opened paper clip into hole beside floppy drive.
- 2 Switch off system and hold mouse button down while switching system on (to complete eject cycle).
- 3 Replace floppy drive.





Floppy Drives (Continued)

Internal floppy drive runs continuously

- 1 Replace bad disk with known-good disk.
- 2 Replace floppy drive.
- 3 Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.
- 4 Replace floppy drive cable. See "Flat-Cable Assembly" in Take Apart.





Hard Drives

Internal or external hard drive does not operate

- 1 Verify that SCSI loopback card is not attached.
- 2 Verify that internal hard drive has all three terminating resistor packs on circuit board.
- 3 Verify that external drive is properly terminated.
- 4 Replace hard drive data cable. See “Flat-Cable Assembly” in Take Apart.
- 5 Replace hard drive.
- 6 Replace logic board. Retain customer’s SIMMs, math coprocessor, and PDS card.





Hard Drives (Continued)

Works with internal or external SCSI device but does not work with both

- 1 Verify that SCSI device ID switch setting on external device is higher than 0. Also verify that ID switch setting on external SCSI device does not duplicate ID switch settings on any other attached external SCSI devices.
- 2 Replace terminator on external SCSI device.
- 3 Replace SCSI select cable.





Peripheral

Cursor does not move

- 1 Check mouse connection.
- 2 If mouse was connected to keyboard, connect it to rear ADB port instead. If mouse works, replace keyboard.
- 3 Reset PRAM.
- 4 If mouse does not work in any ADB port, replace mouse.
- 5 Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.

Cursor moves, but clicking mouse button has no effect

- 1 Replace mouse.
- 2 Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.





Peripheral (Continued)

Cannot double-click to open application, disk, or server

- 1 Remove extra system files on hard drive.
- 2 Clear parameter RAM. Hold down <Command> <Option> <P> <R> keys during system startup but before “Welcome to Macintosh” appears.
- 3 If mouse was connected to keyboard, connect it to rear ADB port instead. If mouse works, replace keyboard.
- 4 If mouse does not work in any ADB port, replace mouse.
- 5 Replace logic board. Retain customer’s SIMMs, math coprocessor, and PDS card.

No response to any key on keyboard

- 1 Check keyboard connection to ADB port.
- 2 Replace keyboard cable.
- 3 Replace keyboard.
- 4 Replace logic board. Retain customer’s SIMMs, math coprocessor, and PDS card.





Peripheral (Continued)

Known-good
ImageWriter or
ImageWriter II does
not print

- 1 Make sure that Chooser and Control Panel are set correctly.
- 2 Replace printer driver and system software with known-good.
- 3 Reset PRAM.
- 4 Replace printer interface cable.
- 5 Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.

Known-good
LaserWriter does not
print

- 1 Make sure that Chooser and Control Panel are set correctly.
- 2 Replace printer driver and system software with known-good.
- 3 Reset PRAM.
- 4 Refer to Networks and Communications manual.





Miscellaneous

Clicking, chirping,
or thumping sound

- 1 Verify that logic board power cable is connected at J12 on logic board.
- 2 Replace analog board.
- 3 Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.

Smoke/odor

Replace analog board.

No video, no audio, and
no drive operation

- 1 Connect power cord.
- 2 Switch power on.
- 3 Replace power cord.
- 4 Replace analog board.
- 5 Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.





Miscellaneous (Continued)

- | | |
|--|---|
| “Sad Macintosh” icon | <ol style="list-style-type: none"><li data-bbox="443 215 1151 248">1 Replace bad disk with known-good disk.<li data-bbox="443 261 1084 294">2 Replace RAM SIMMs on logic board.<li data-bbox="443 306 1364 393">3 Replace logic board. Retain customer’s SIMMs, math coprocessor, and PDS card. |
| Screen shows “Sad Macintosh” icon and black vertical lines; screeching sound | <ol style="list-style-type: none"><li data-bbox="443 453 1084 486">1 Replace RAM SIMMs on logic board.<li data-bbox="443 499 1364 580">2 Replace logic board. Retain customer’s SIMMs, math coprocessor, and PDS card. |





Take Apart

Color Classic

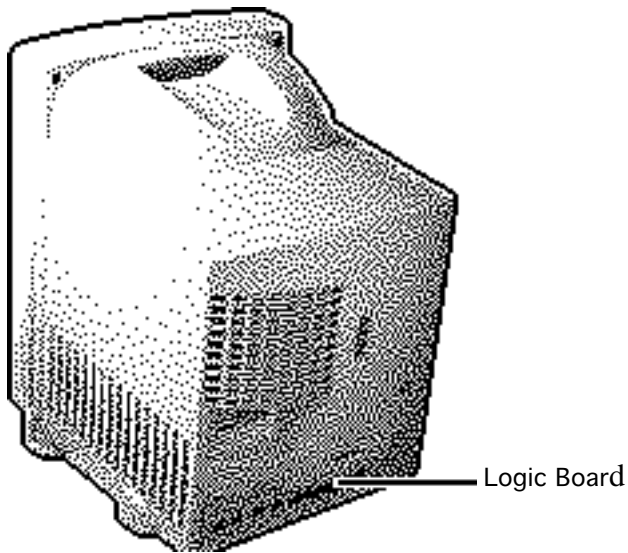


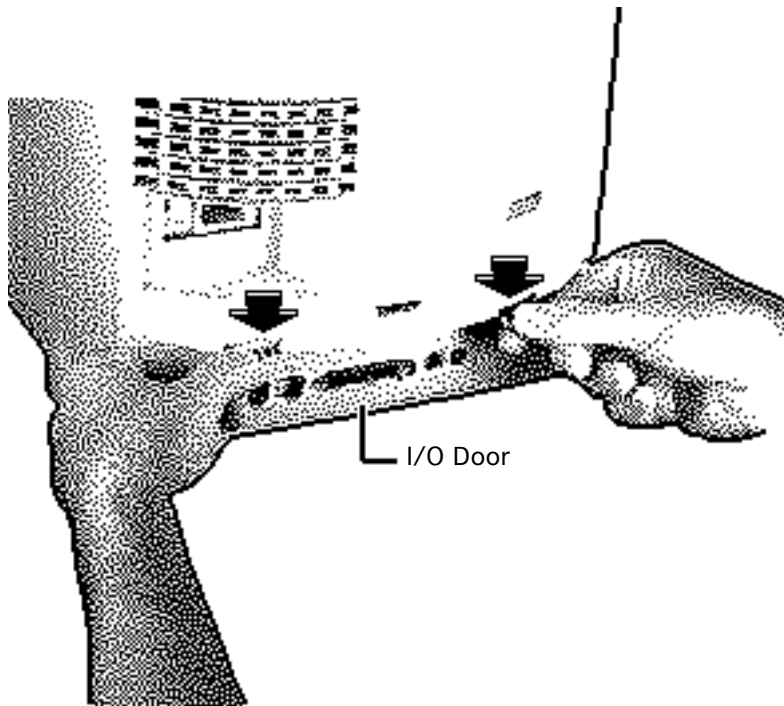


Logic Board

No preliminary steps are required before you begin this procedure.

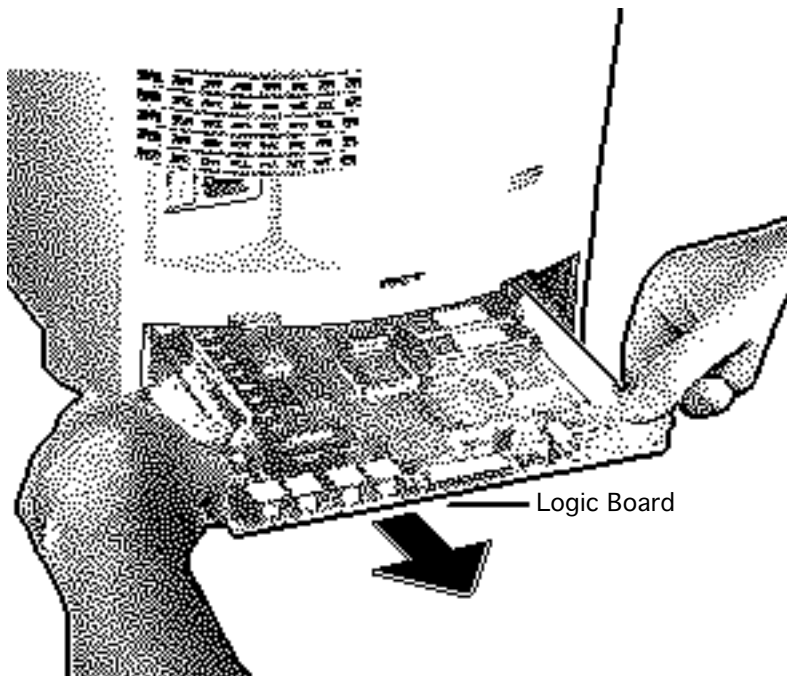
Caution: You can access and remove the Color Classic logic board merely by removing the I/O door at the rear of the machine. Although upgrading the logic board is now extremely easy, do not neglect to follow proper ESD precautions (refer to Bulletins/Safety).





- 1 If necessary, remove the two security screws from the I/O door.
- 2 Push down the two latches until the I/O door snaps open. Remove the door from the rear housing.





- 3 Grasp the logic board firmly with both hands and pull it straight out of the chassis. Place the logic board on a grounded workbench pad.

Replacement Note: If you are replacing a defective logic board, remove the RAM and VRAM SIMMs (if installed), 68882 math coprocessor, and PDS card. Install these components on the replacement logic board.





Replacement Caution: After reconnecting the logic board, make sure there are no bent metal tabs on the chassis that could contact the bottom of the logic board and short out the board.

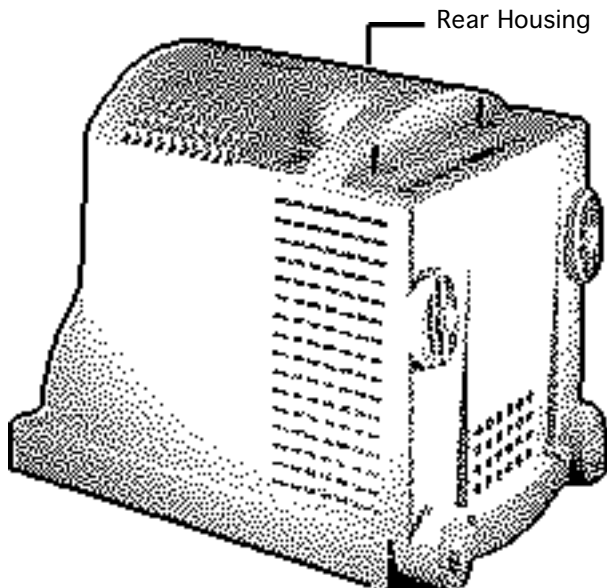


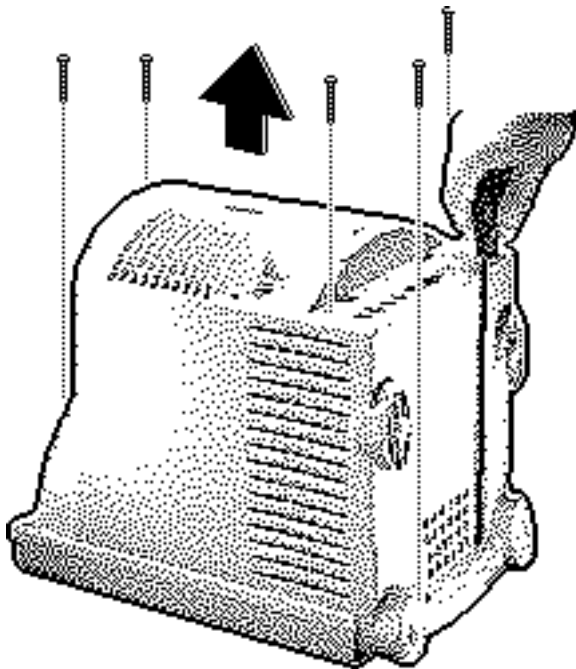


Rear Housing

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 personal injury or equipment damage, review CRT safety and discharge instructions in Bulletins/Safety.





- 1 Using a long-handled Torx screwdriver, remove the four case screws. If necessary, remove the two security screws from the I/O door.
- 2 Using a case spreader (pull-apart tool), separate the housing from the chassis. Carefully lift the rear housing and set it aside.





⚠ Warning: The edges of the metal chassis may be sharp. When moving the computer with the rear housing off, be sure to handle the chassis carefully.

Replacement Note: If you are replacing a damaged rear housing, first remove the fan (see the “Fan” topic in this chapter).



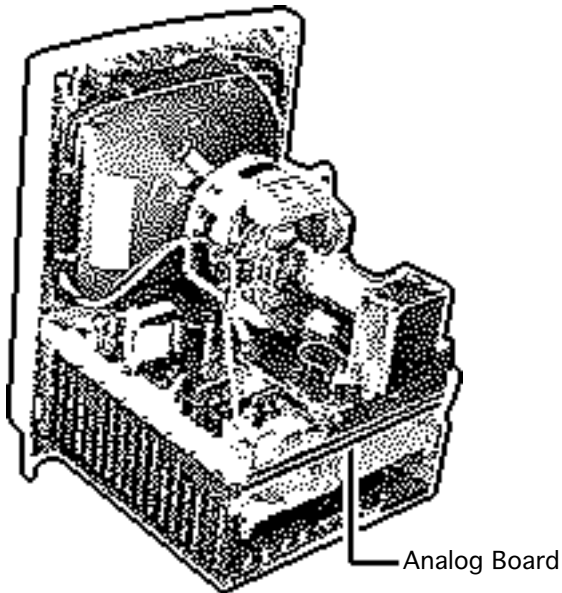


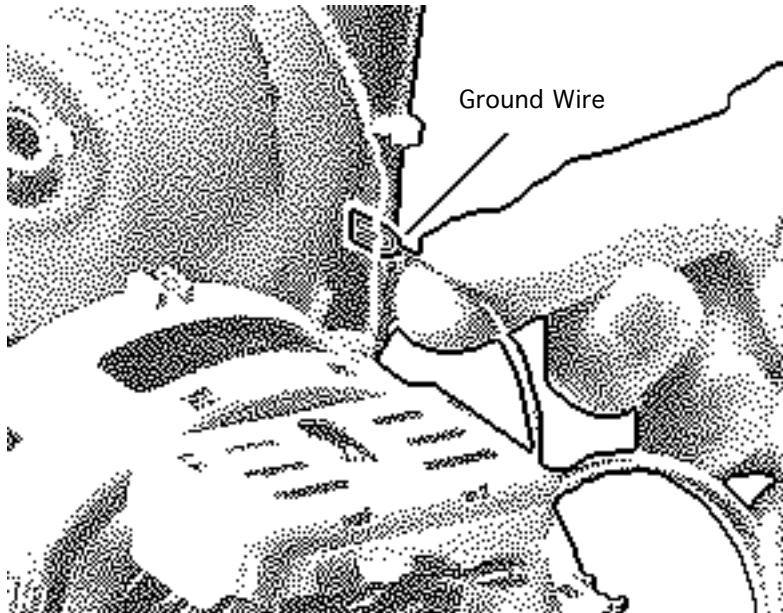
Analog Board

Before you begin,

- Remove the rear housing
- Discharge the CRT
- Remove the anode cap

⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious personal injury or equipment damage, review CRT safety and discharge instructions in Bulletins/Safety. Never use a grounding wriststrap until after discharging the CRT.

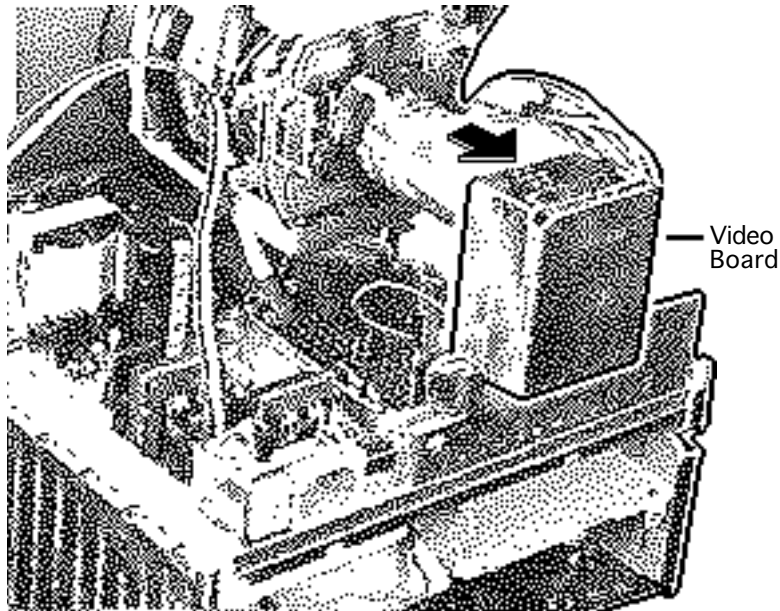




- 1 Unhook the video board ground wire from the CRT grounding strap.

Replacement Caution: When replacing the analog board, be sure to securely reconnect the ground wire to the CRT grounding strap. Switching on system power without reconnecting the ground strap could damage components.

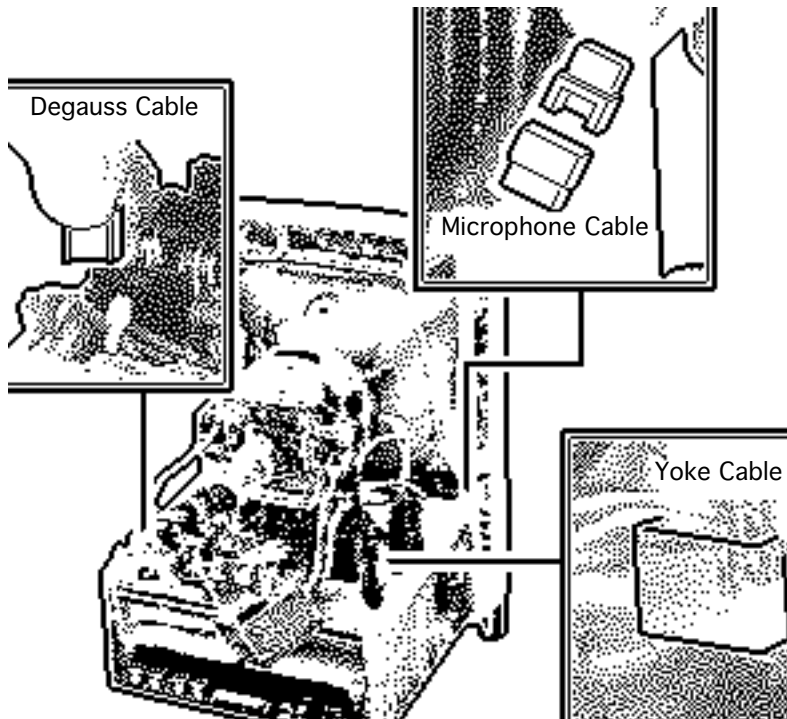




- Note:** If sealant holds the video board in place, cut the sealant with an art knife.

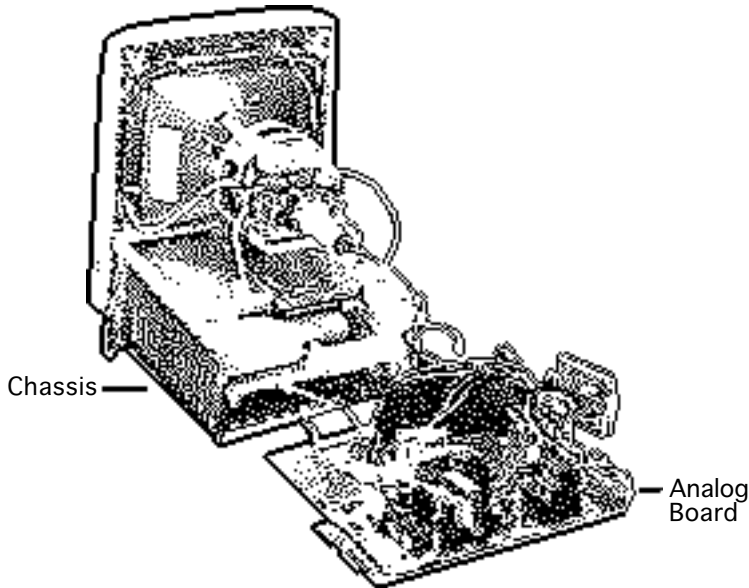
Carefully pull the video board straight off the neck of the CRT.





- 3 Using a flat-blade screwdriver, release the connector latch and disconnect the degauss cable from analog board connector BP2.
- 4 Disconnect the yoke cable from analog board connector BD1.
- 5 Disconnect the two halves of the microphone cable.



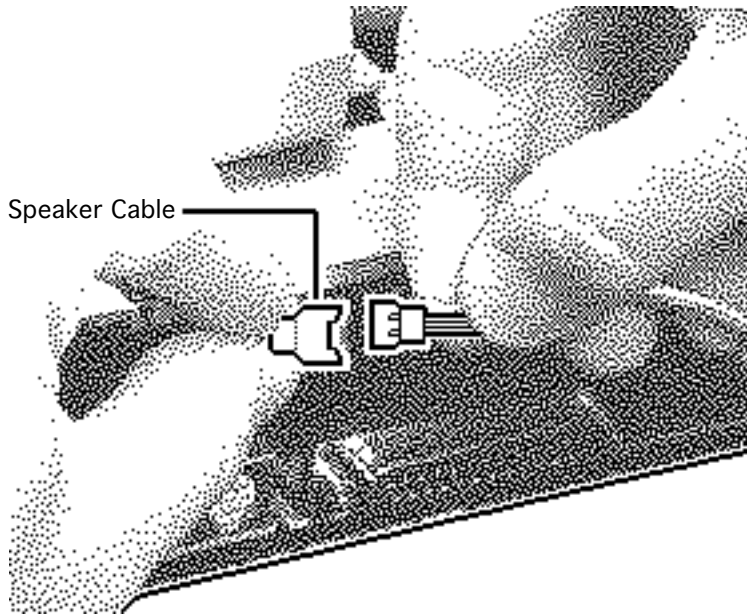


- Note:** When removing the analog board, be careful not to damage the speaker cable that is connected beneath the analog board.

Pull out the analog board approximately two inches and align the edge of the board with cutouts in the plastic guide.

- Lift out the analog board and place it on the workbench pad.





- 8 Disconnect the two halves of the speaker cable, located beneath the analog board.
- 9 Place the analog board on a grounded workbench pad.



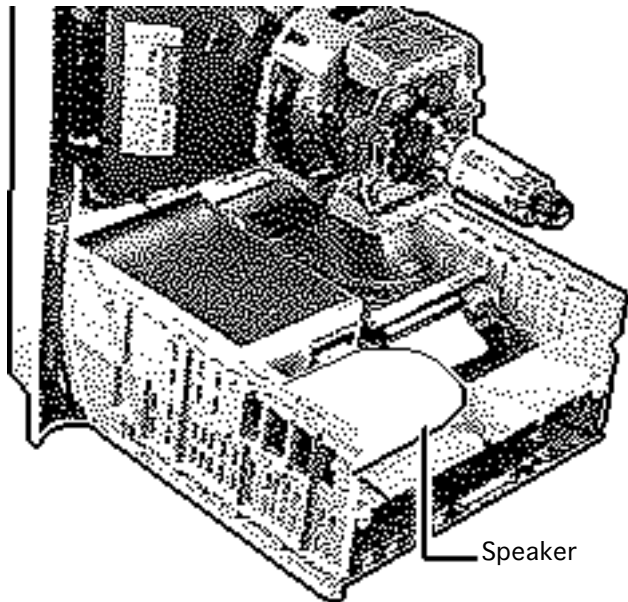


Speaker

Before you begin,

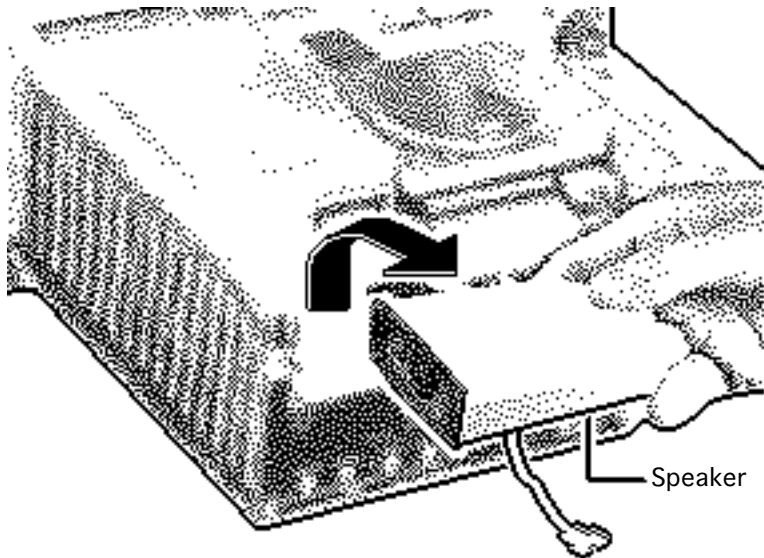
- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board

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Remove the speaker from the two hook loop fasteners on the chassis.



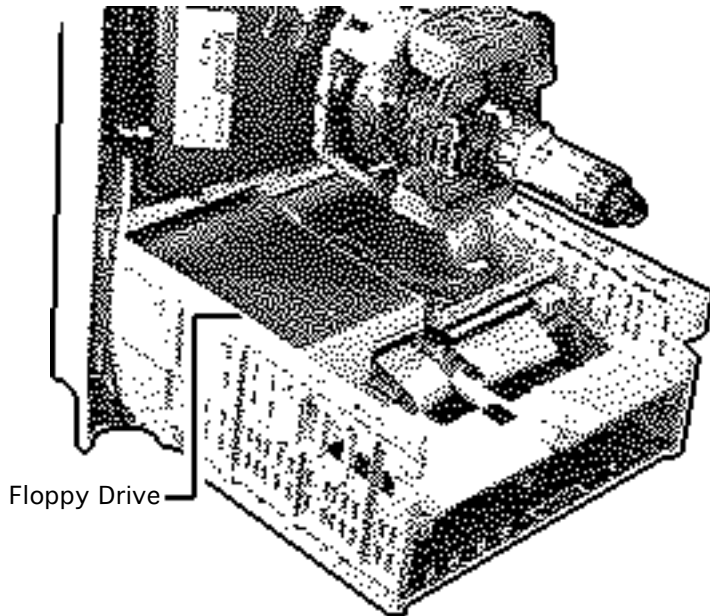


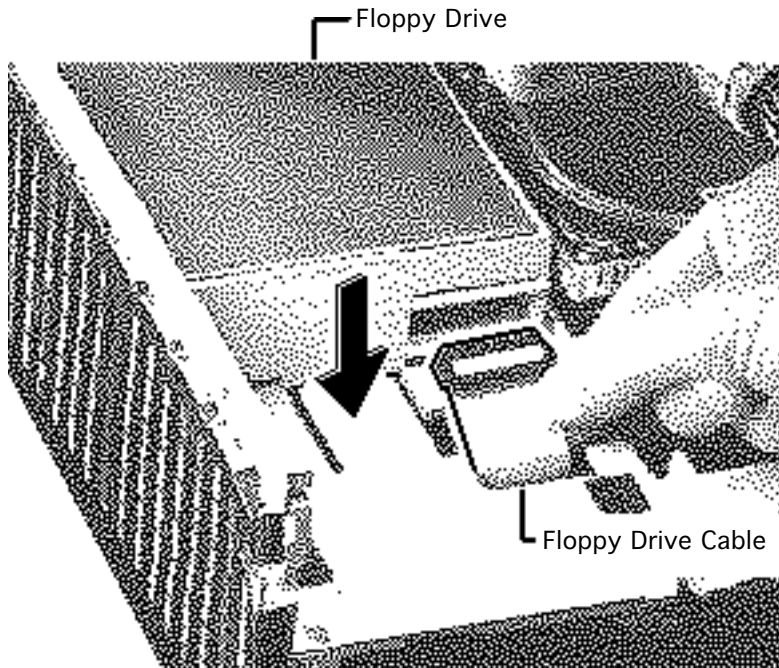
Floppy Drive

Before you begin,

- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board
- Remove the speaker

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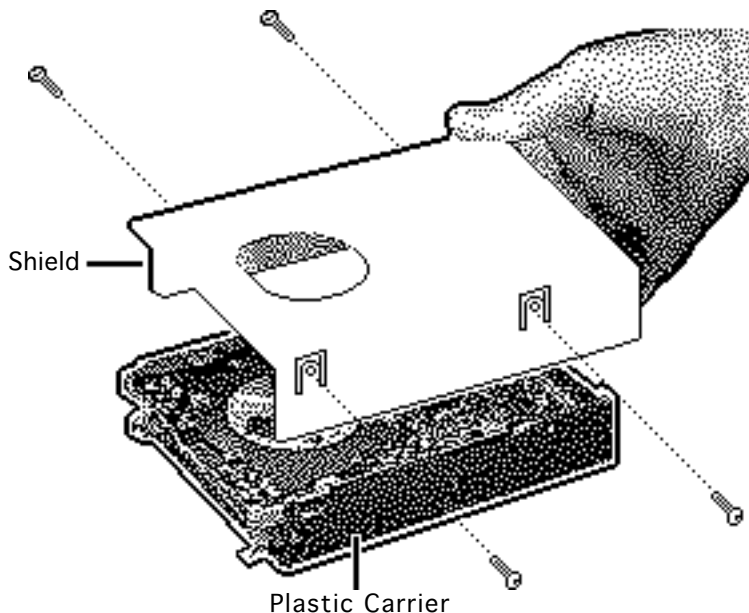




- 1 Disconnect the floppy drive cable and push it through the hole in the plastic chassis.
- 2 Depress the mounting tab and pull the floppy drive straight out of the chassis mounting channel.

Note: The mounting tab may catch beneath the front of the drive mount. If this happens, tug the drive straight back and it will pop over the tab.





Replacement Note: If you are replacing a defective floppy drive, remove the four carrier mounting screws and separate the drive from the plastic carrier. Remove the shield from the drive mechanism.

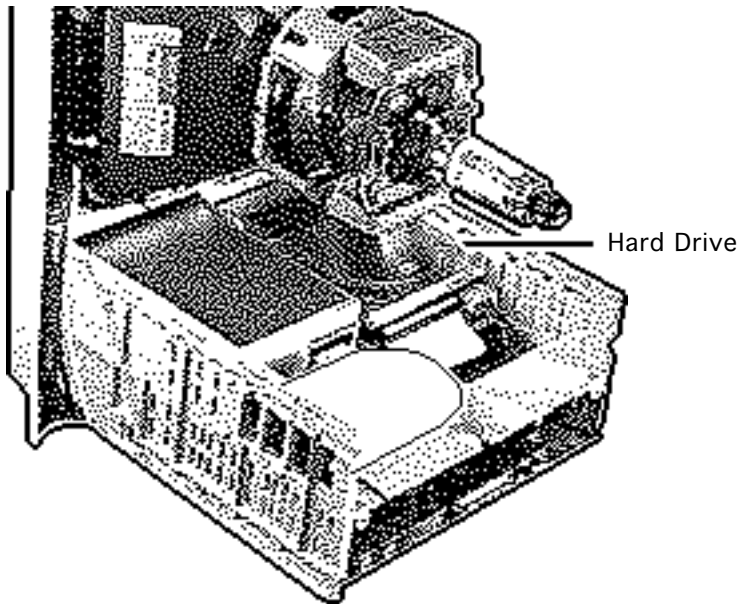




Hard Drive

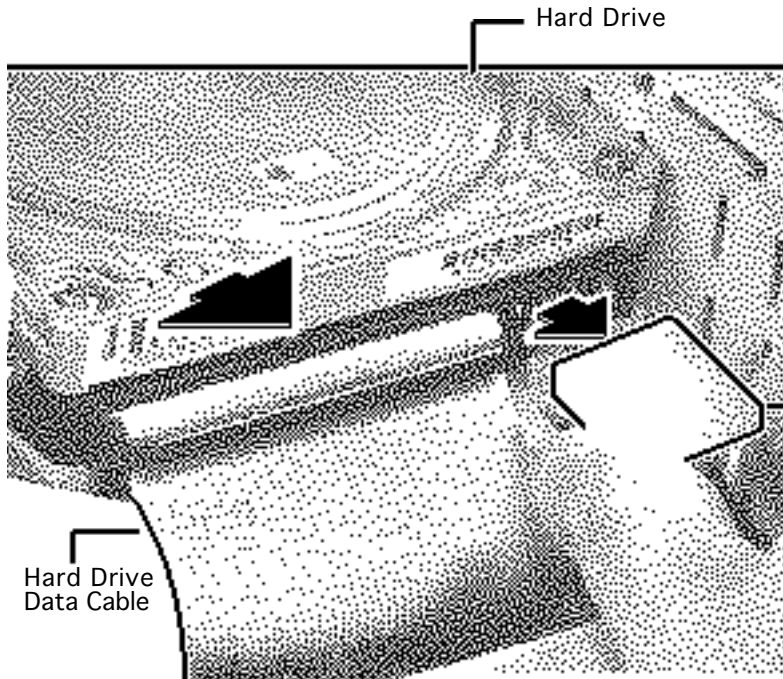
Before you begin,

- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board



⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent injury, review CRT safety and discharge instructions in Bulletins/ Safety. Never use a grounding wriststrap until after discharging the CRT.





- 1 Disconnect the hard drive data and hard drive power cables.
- 2 Push the cables through the hole in the plastic chassis.

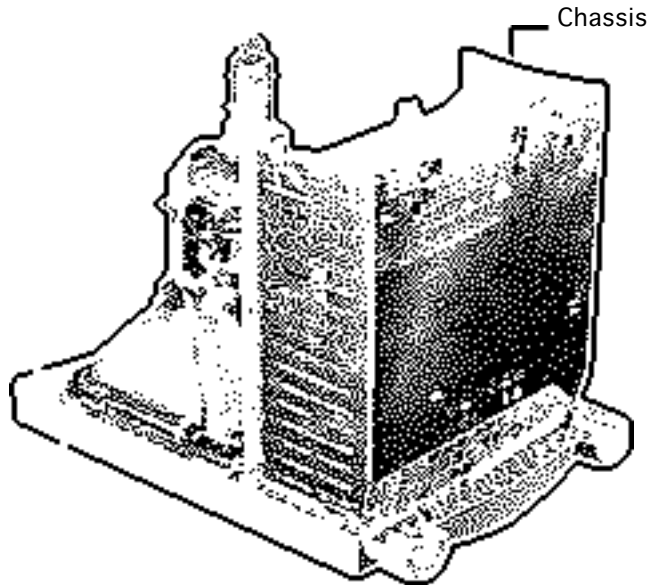




- 3 Raise the mounting tab and pull the hard drive straight out of the chassis mounting channel.

Replacement Note: For information on removing the hard drive from the carrier and returning drives, cables, and carriers to Apple, refer to the Hard Drives manual.





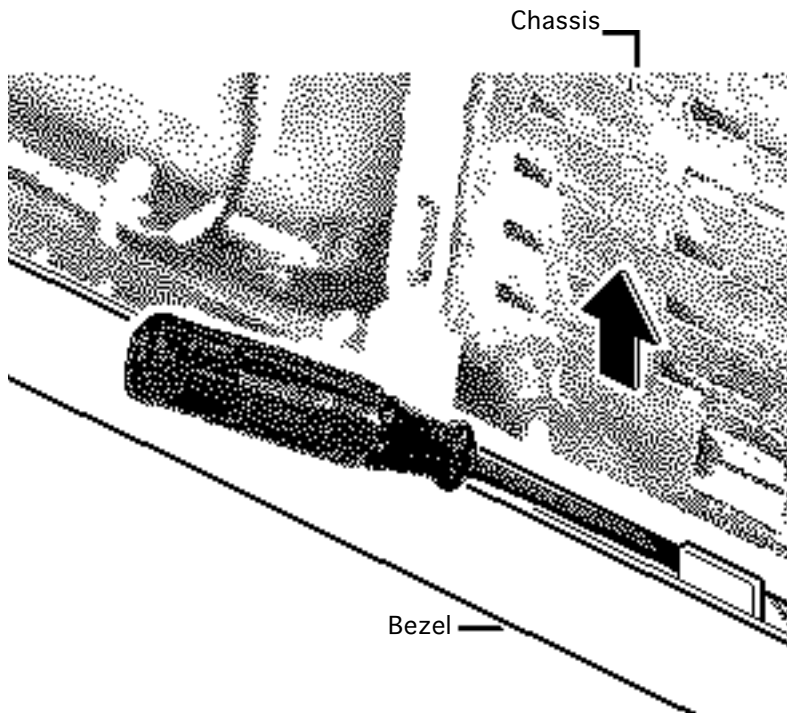
Chassis

Before you begin,

- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board

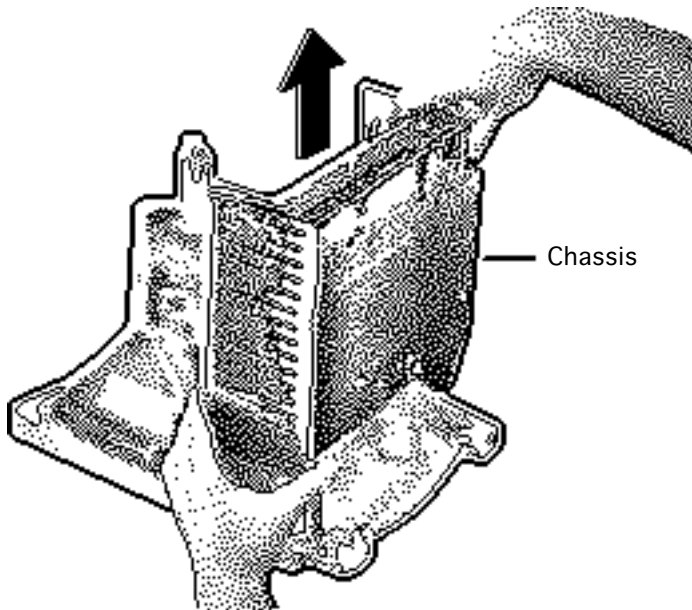
⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent injury, review CRT safety and discharge instructions in Bulletins/ Safety. Never use a grounding wriststrap until after discharging the CRT.





- 1 Open the two release tabs on one side of the chassis and raise that side of the chassis.
- 2 To keep the side of the chassis raised, insert a small flat-blade screwdriver between the bezel and the chassis.





- 3 Using a small flat-blade screwdriver, pry open the two release tabs on the other side of the chassis and raise the chassis.
- 4 Lift the chassis straight out of the bezel.

Replacement Note: If you are replacing a damaged chassis, first remove the speaker, floppy drive, hard drive, logic board, push-button board, and flat-cable assembly. Refer to the appropriate topics in this chapter.

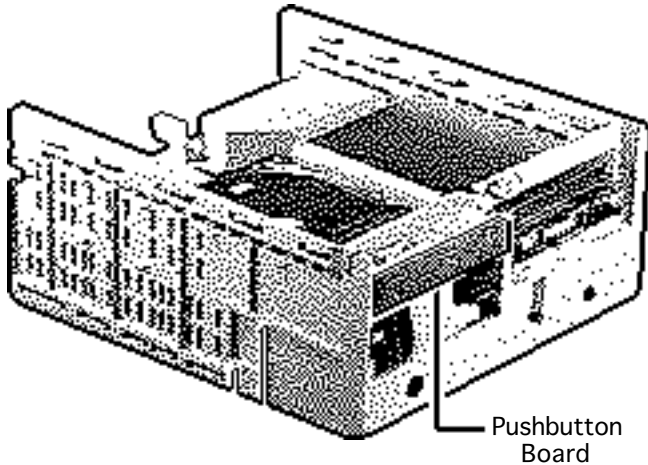




Pushbutton Board

Before you begin,

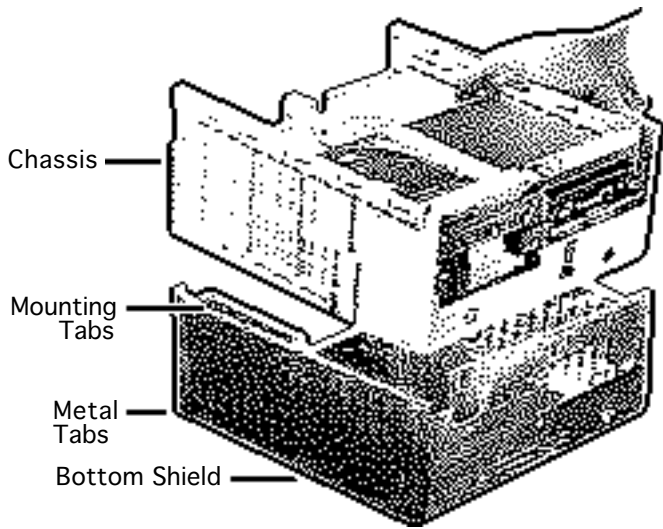
- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board
- Remove the chassis





⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent injury, review CRT safety and discharge instructions in Bulletins/ Safety. Never wear a grounding wriststrap until after discharging the CRT.

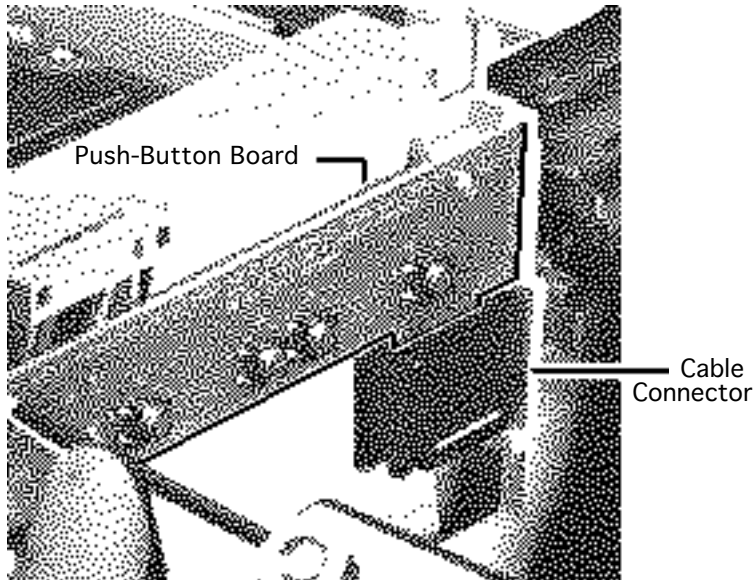




- 1 Raise and push out the mounting tabs along both sides of the bottom shield.
- 2 Remove the bottom shield from the chassis.
- 3 Set the shield aside.

Replacement Caution: When replacing the bottom shield on the chassis, make sure none of the metal tabs along the bottom (rear) edge of the shield is bent up (toward the logic board). Bent tabs could contact and short out the logic board.





- 4 Using a T-8 Torx driver, remove the two screws that secure the pushbutton board to the chassis.
- 5 Disconnect the pushbutton board from the cable connector.

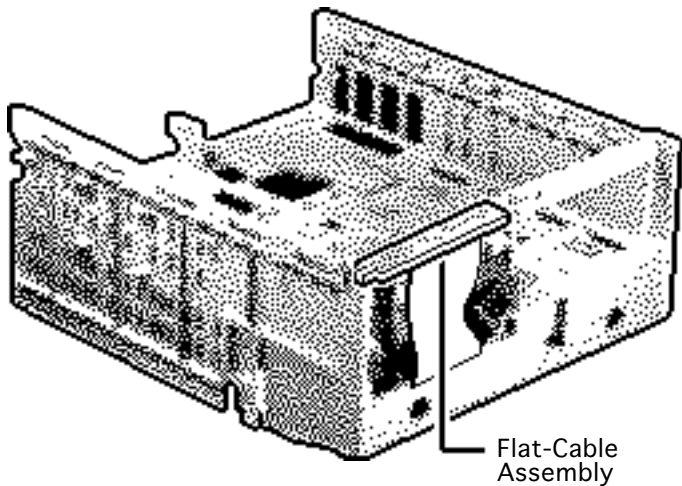
Replacement Note:

Reconnect the cable to the pushbutton board before reinstalling the board on the chassis.





Flat Cable Assembly



Before you begin,

- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board
- Remove the chassis
- Remove the logic board
- Remove the speaker
- Remove the floppy drive
- Remove the hard drive
- Remove the pushbutton board





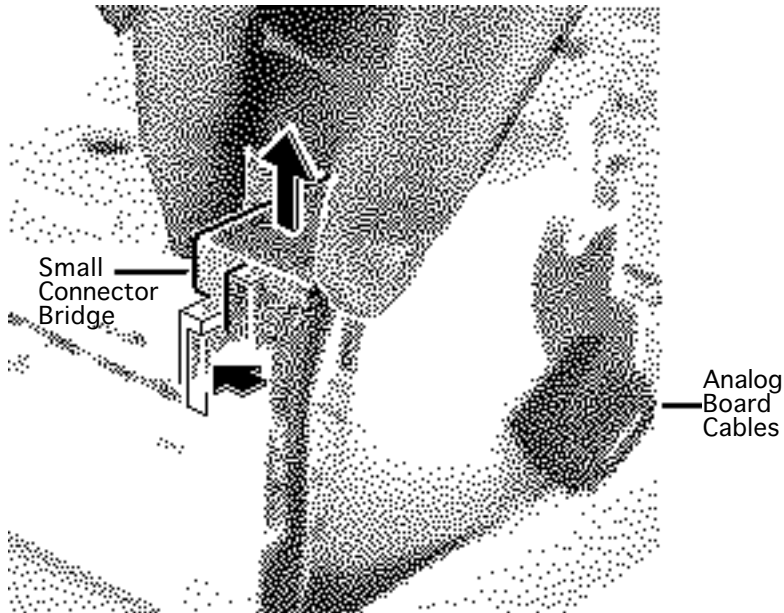
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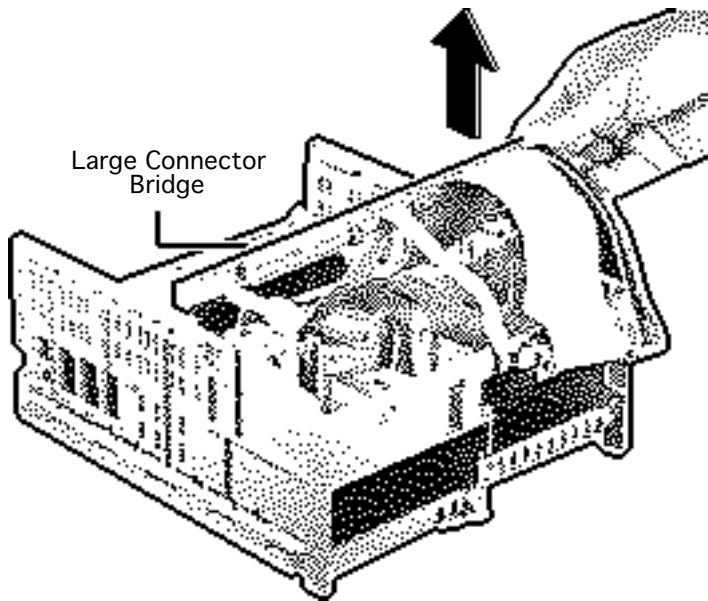
- 1 Release the plastic latch and remove the small connector bridge (to the analog board) from the chassis.
- 2 Turn over the chassis.





- 3 Push the analog board cables and small connector bridge through the access hole in the chassis.





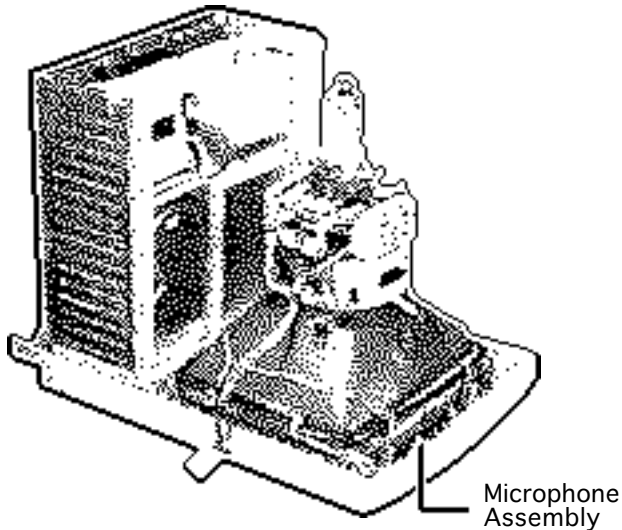
- 4 Release the three plastic latches and remove the large connector bridge (to the logic board) from the chassis.
- 5 Remove the drive cables from the plastic cable retainers, and remove the flat-cable assembly.

Replacement Note: The plastic cable retainers on the chassis fit the width of the drive cables.





Microphone Assembly

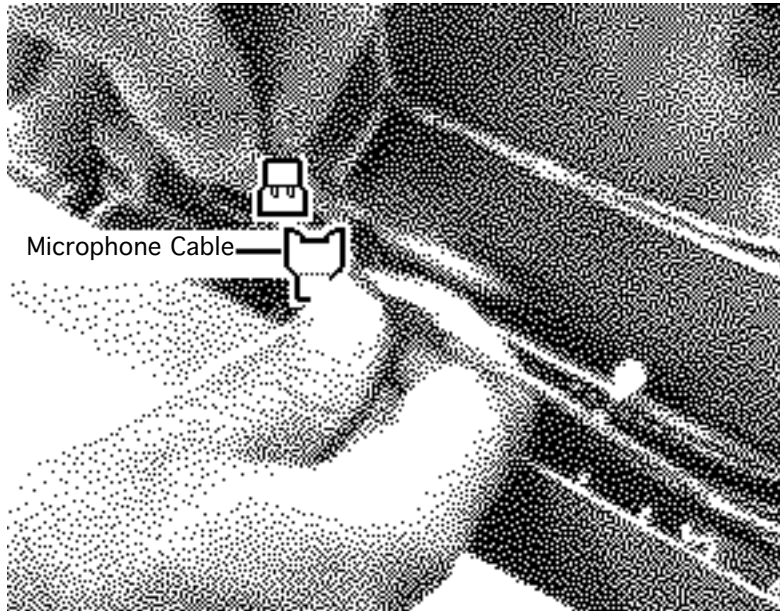


Before you begin,

- Remove the rear housing
- Discharge the CRT
- Remove the anode cap

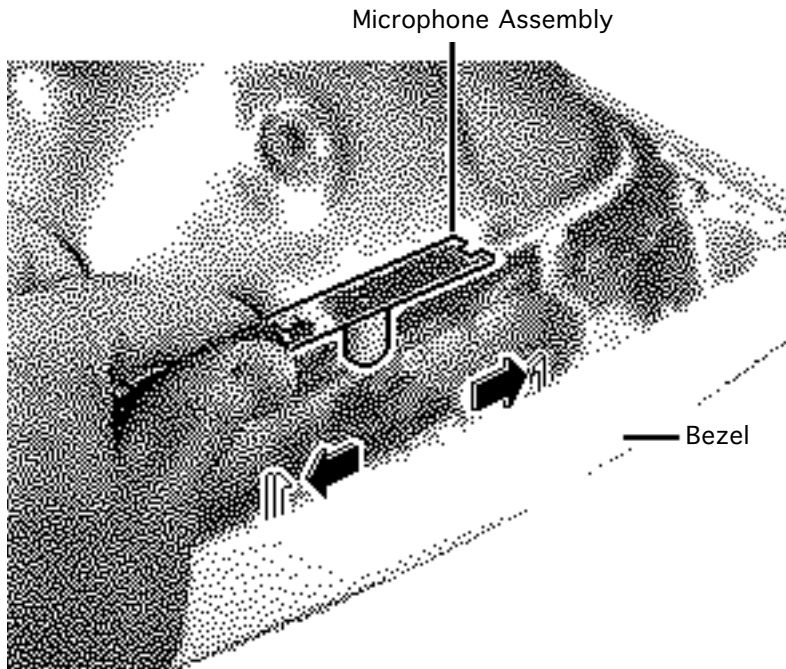
⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent injury, review CRT safety and discharge instructions in Bulletins/ Safety. Never use a grounding wriststrap until after discharging the CRT.





- 1 Disconnect the microphone cable between the microphone and the analog board.
- 2 If necessary, cut the tie-wrap that secures the microphone cable to the degauss coil.





- 3 Open the two plastic latches and remove the microphone assembly from the bezel.

Replacement Note: You may need to use a flat-blade screwdriver to press the microphone gasket back into the chassis.

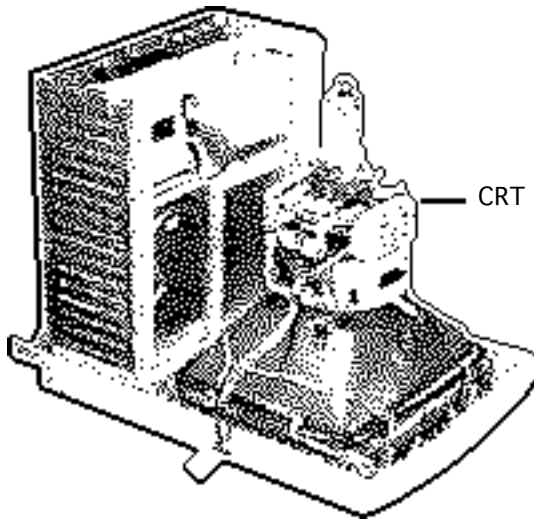




CRT

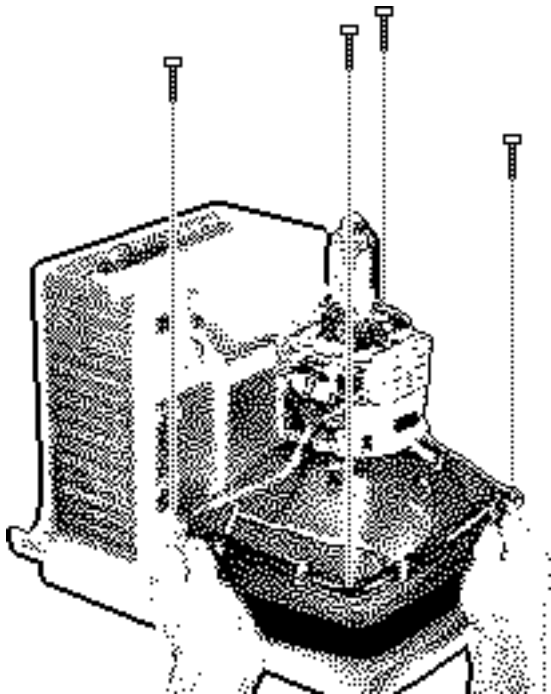
Before you begin,

- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board
- Disconnect the microphone cable



⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent injury, review CRT safety and discharge instructions in Bulletins/ Safety. Never use a





grounding wriststrap until after discharging the CRT.

- 1 Remove the four self-threading screws that secure the CRT to the bezel.
- 2 **⚠ Warning:** Never touch the anode or grasp the neck of the CRT to remove it from the bezel. The neck of the CRT breaks easily and the anode may retain high voltages.

Lift the CRT straight out of the bezel and place the CRT facedown on the





protective workbench
pad.

⚠ Warning: If you need to dispose of the CRT, refer to CRT disposal instructions in Bulletins/Safety.

Replacement Note: If you are replacing a defective CRT, first remove the degauss coil (see the next topic).

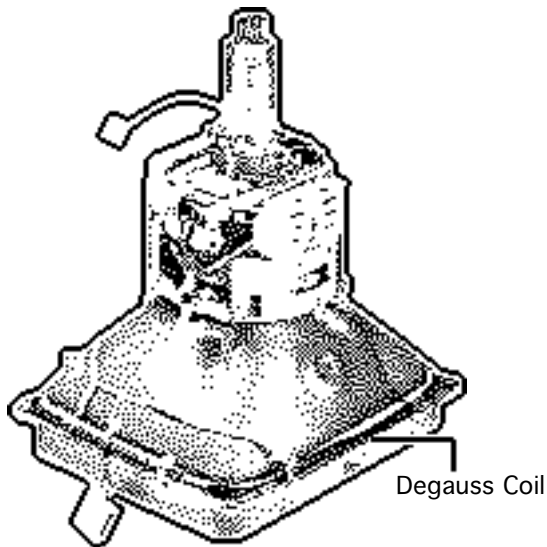




Degauss Coil

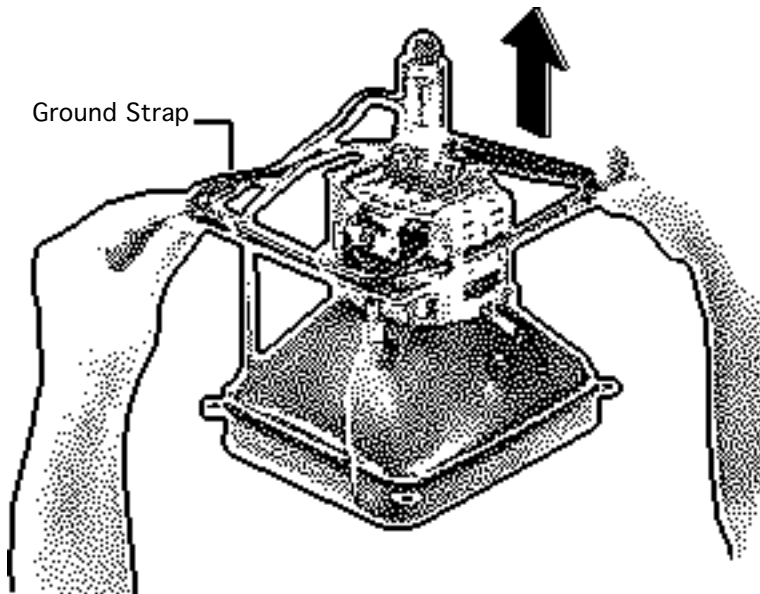
Before you begin,

- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board
- Disconnect the microphone cable
- Remove the CRT



⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent injury, review CRT safety and discharge instructions in Bulletins/Safety. Never use a





grounding wriststrap until after discharging the CRT.

- 1 Remove the degauss coil cable from the tie-wrap at the side of the CRT yoke.
- 2 Lift the degauss coil with attached brackets over the neck of the CRT.

Replacement Note: When replacing the degauss coil, be sure to reattach the ground strap to the degauss bracket.

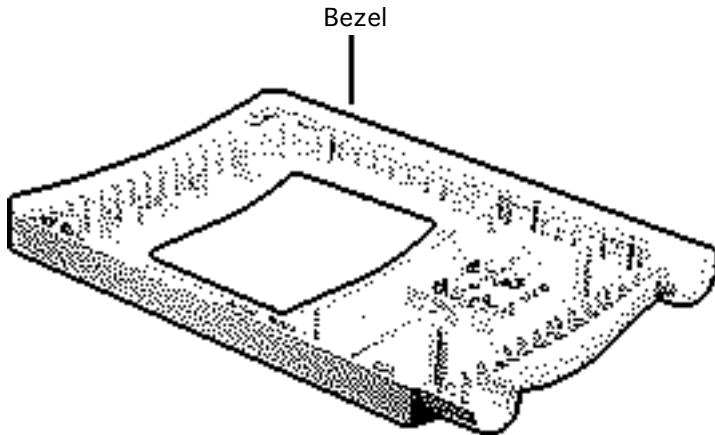




Bezel

To remove the bezel,

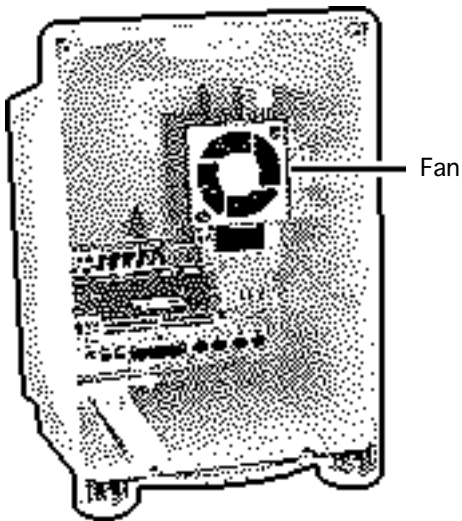
- Remove the rear housing
- Discharge the CRT
- Remove the anode cap
- Remove the analog board
- Remove the chassis
- Remove the microphone assembly
- Remove the CRT





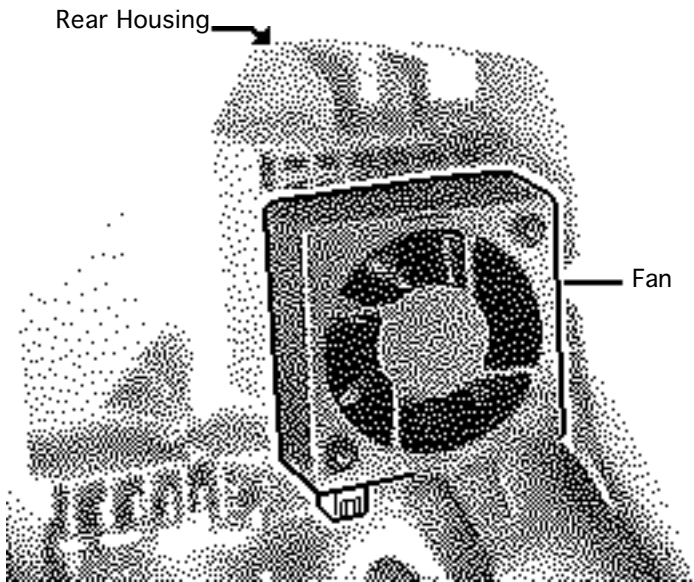
Fan

Before you begin, remove the rear housing.





Open the two latches and pull the fan straight out of the rear housing.





Upgrades

Color Classic



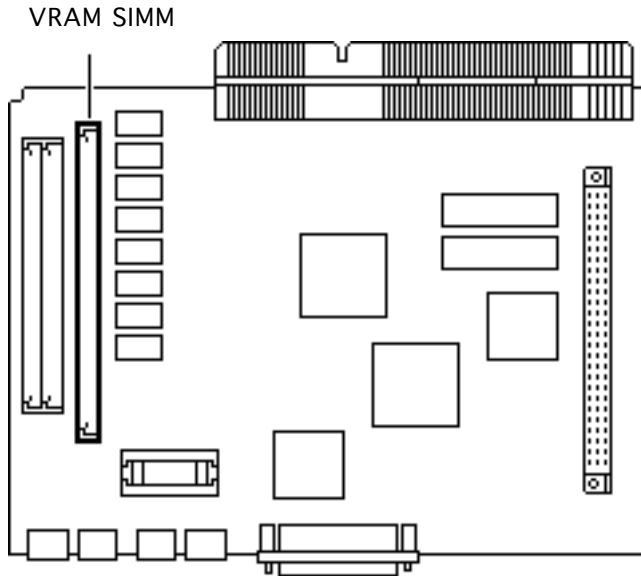


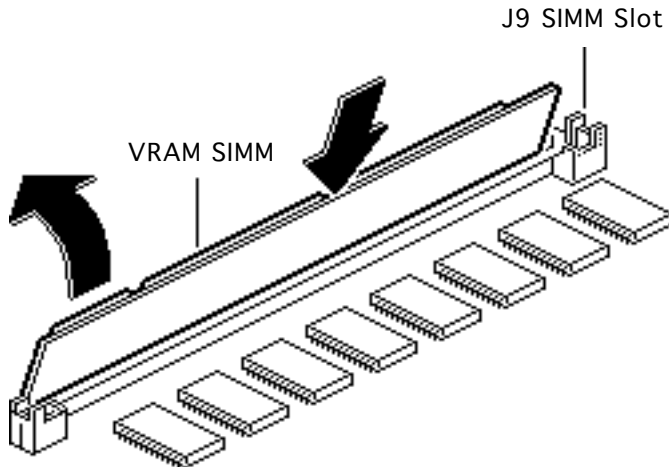
VRAM Upgrade

Before you begin, remove the logic board.

Caution: To prevent ESD damage to components, wear a grounding wriststrap and use a grounded workbench pad. Review the ESD precautions in Bulletins/ Safety.

Note: The Color Classic has 256K of video RAM (VRAM) soldered on the logic board. You can increase the amount of VRAM to 512K by





installing a 256K VRAM SIMM in the SIMM slot (connector J9). Use only 100 ns or faster VRAM SIMMs.

- 1 Grasp the VRAM SIMM by its edges with the contacts pointing down. Insert the SIMM at an angle into SIMM slot J9.
- 2 Push back on the SIMM until it snaps into place.

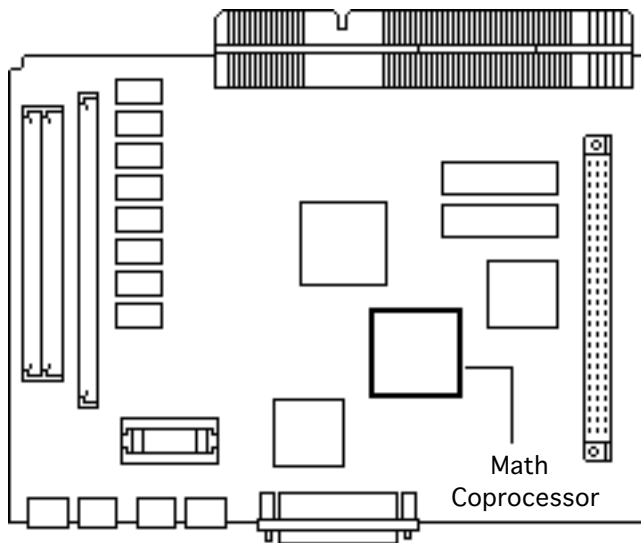


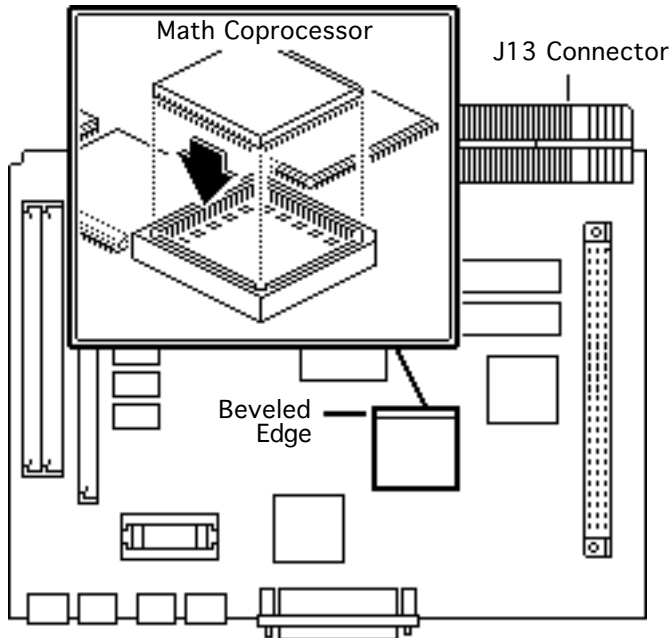


Math Coprocessor

Before you begin, remove the logic board.

Caution: To prevent ESD damage to components, wear a grounding wriststrap and use a grounded workbench pad. Review the ESD precautions in Bulletins/ Safety.





Adding a Motorola 68882 math coprocessor to the logic board in the Color Classic increases overall system performance.

- 1 Position the math coprocessor over socket U9 with the beveled edge of the chip toward the large contact connector (J13) at the front of the board.
- 2 Align the pins in the socket and gently press down the chip.



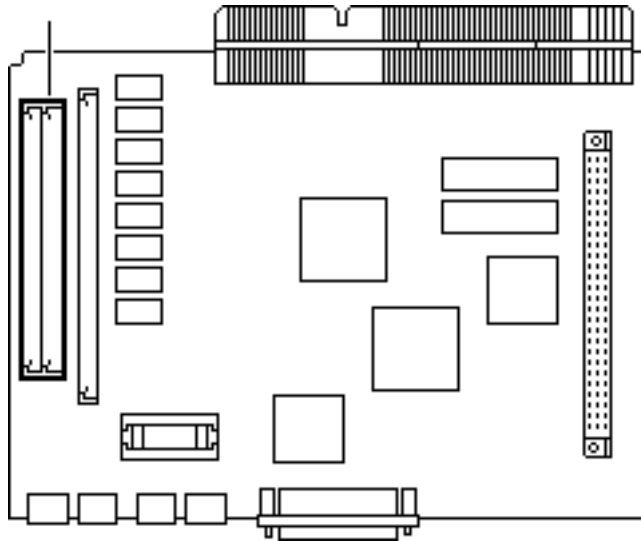


Memory Upgrade

Before you begin, remove the logic board.

Caution: To prevent ESD damage to components, wear a grounding wriststrap and use a grounded workbench pad. Review the ESD precautions in Bulletins/ Safety.

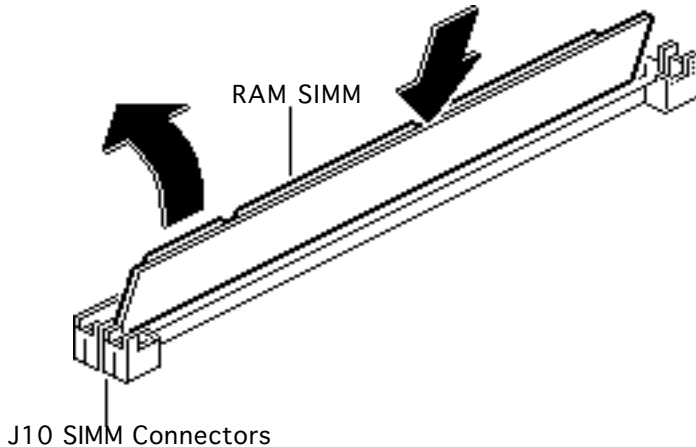
RAM SIMMs





Note: The Color Classic has 4 MB of RAM soldered on the logic board which can be expanded to 10 MB of RAM. The Color Classic includes one SIMM expansion slot with two 30-pin connectors. The system requires 100 ns or faster RAM SIMMs. For additional information, refer to Hardware/Memory.





Note: Both connectors in the J10 SIMM slot must be filled or both must be empty; you cannot install a SIMM into just one of the two slots.

- 1 Grasp the RAM SIMMs by the edges with the contacts pointing down. Insert the SIMMs at an angle into the J10 connectors.
- 2 Push back on the SIMMs until they snap into place.

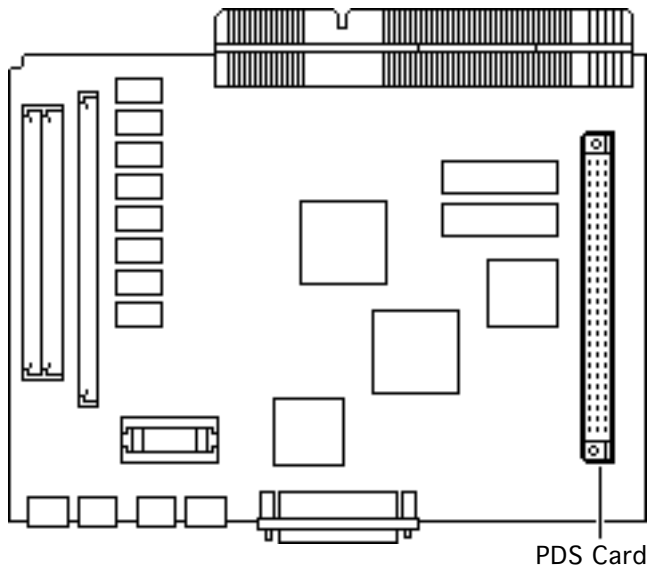




PDS Upgrades

Before you begin, remove the logic board.

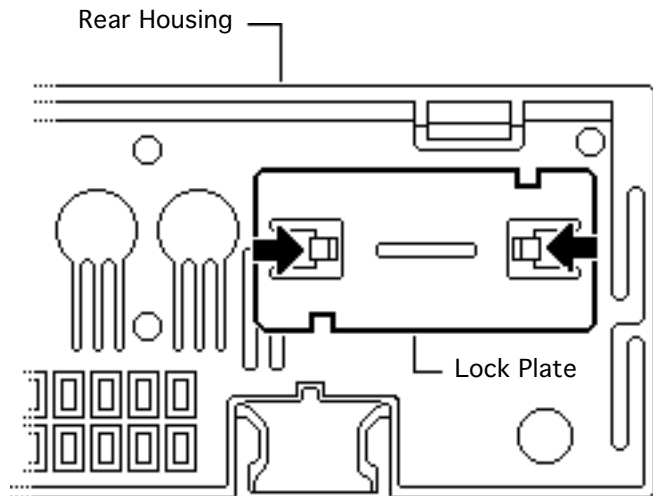
Note: The 96-pin processor direct slot in the Color Classic is compatible with the PDS slot in the Macintosh LC. Currently Apple offers two PDS expansion cards for the Macintosh LC and Color Classic: the Apple IIe emulation card and the LC Ethernet card.





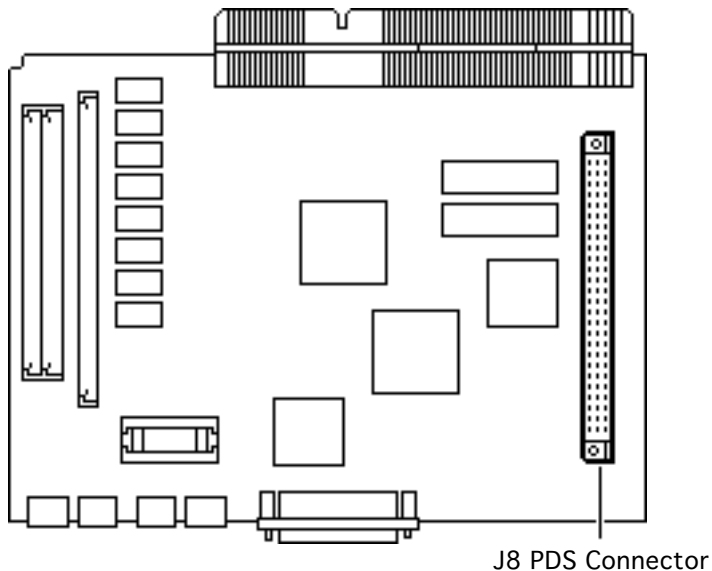
Caution: Review the ESD precautions in Bulletins/ Safety.

- 1 Squeeze together the latches and pull the lock plate off the inside of the access cover.
- 2 Remove the access cover from the rear housing.





- 3 Connect the expansion card to the 96-pin PDS connector (J8) on the logic board.





Additional Procedures

Color Classic

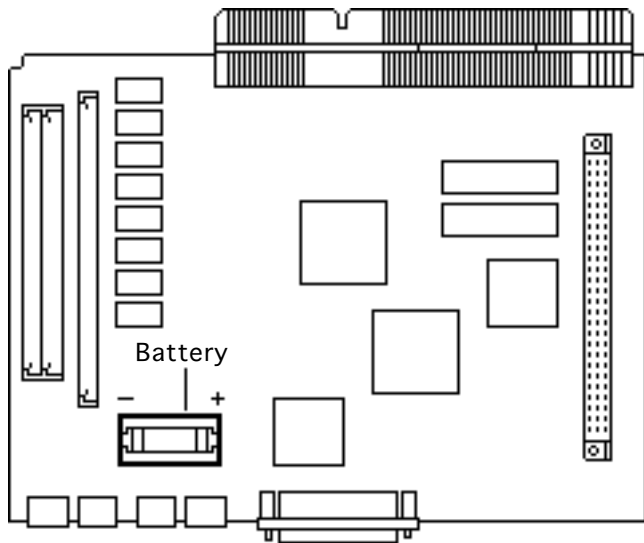


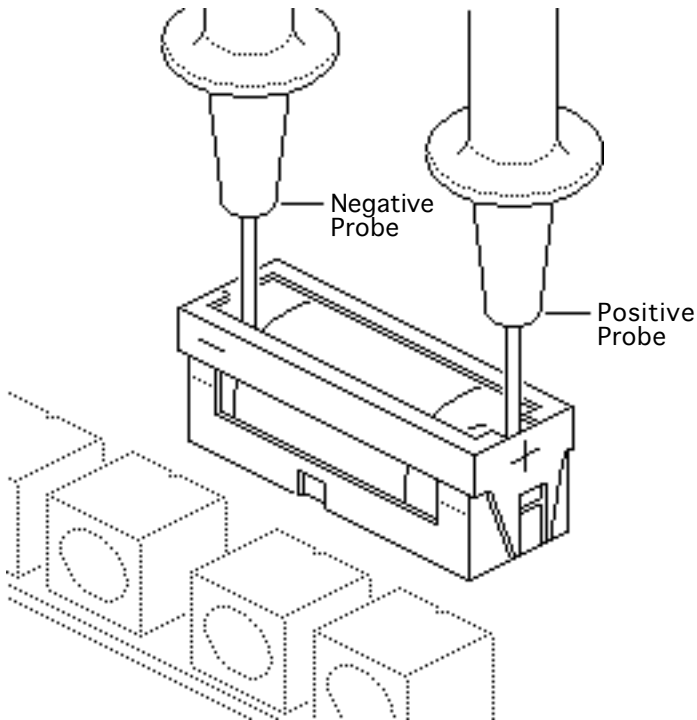


Battery Verification

Before you begin, remove the logic board.

⚠ Warning: If handled or discarded improperly, the lithium battery in the computer could explode. Review battery handling and disposal instructions in Bulletins/Safety.





Caution: Review the ESD precautions in Bulletins/ Safety.

- 1 Set the voltmeter to the 10 volts DC scale.
- 2 Hold the positive probe of the voltmeter to the positive end of the battery and the negative probe to the negative end of the battery.
- 3 If the battery voltage is below 3.0 volts, replace the battery. Refer to “Battery Replacement” in this chapter.



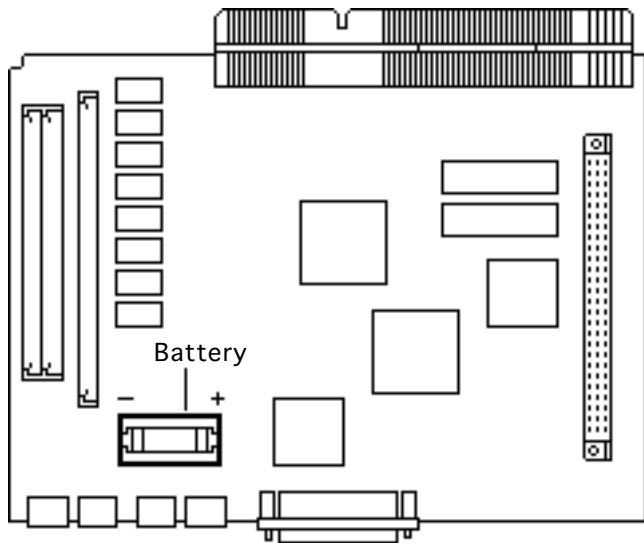


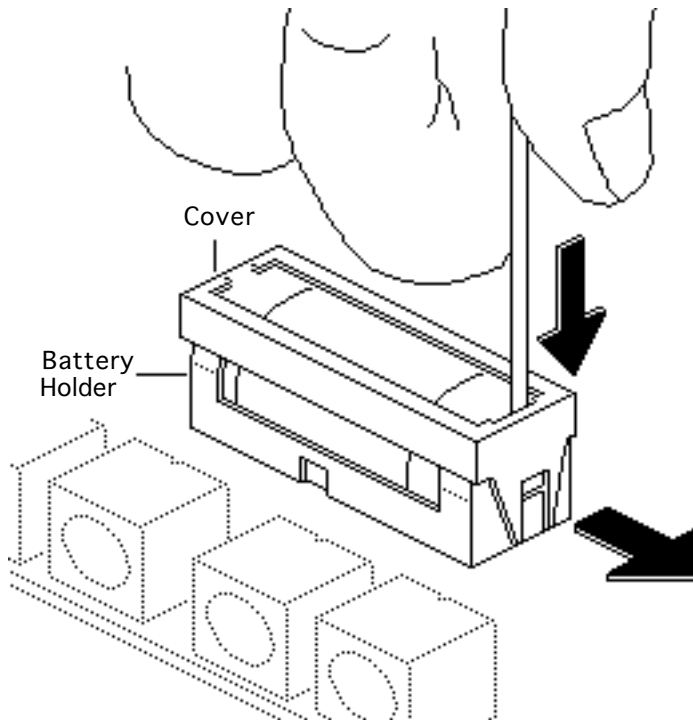
Battery Replacement

Before you begin, remove the logic board.

⚠ Warning: If handled or discarded improperly, the lithium battery in the computer could explode. Review battery handling and disposal instructions in Bulletins/Safety.

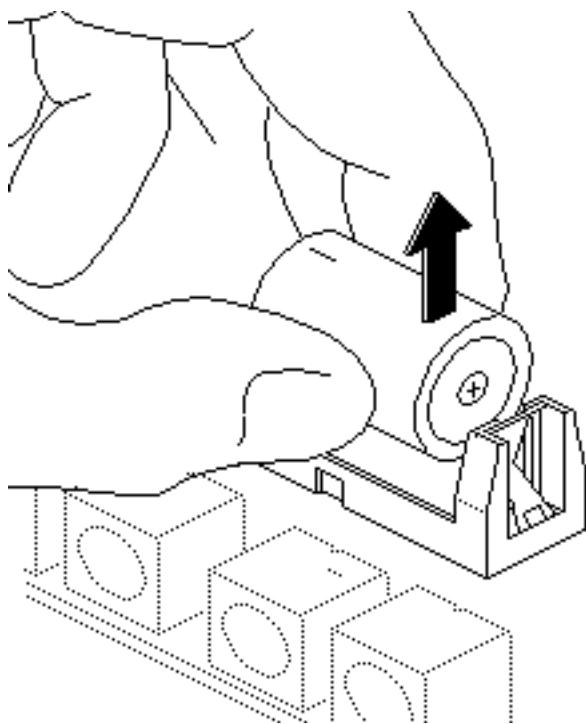
Caution: Review the ESD precautions in Bulletins/Safety.





- 1 Insert a small flat-blade screwdriver into the top of the battery holder cover and gently push down and out with the screwdriver to release the tab.
- 2 Repeat on the other end and remove the cover from the battery holder.
- 3 Grasp the battery and remove it from the holder.





- 4 Return the battery to Apple for proper disposal. For information on battery packaging and labeling, refer to instructions in Bulletins/Safety.

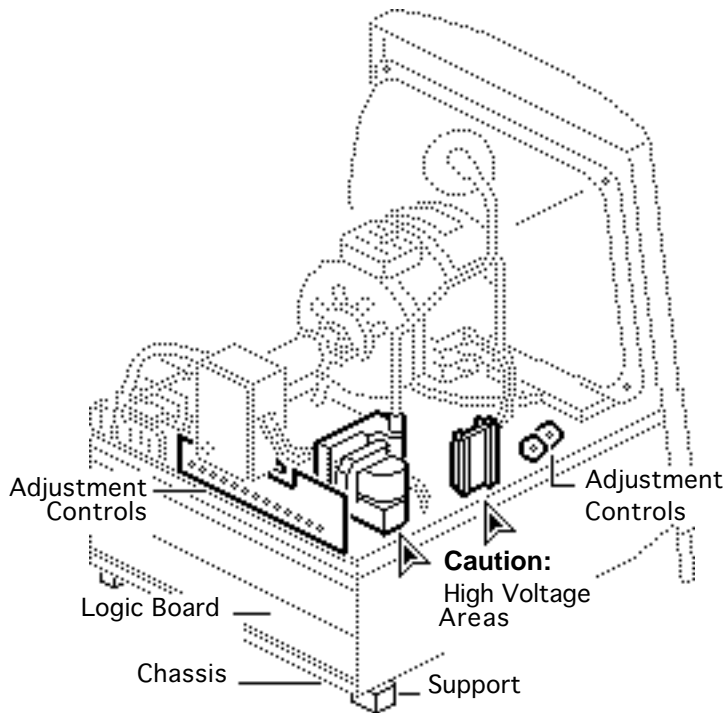




Adjustments

Color Classic





Geometry

Before you begin, remove the rear housing.

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

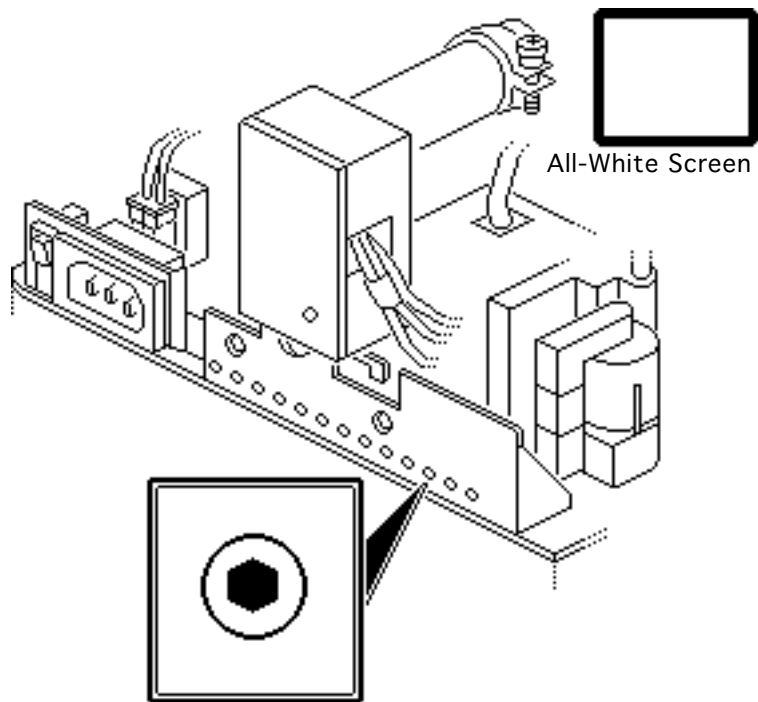




Caution: With the rear housing removed, the metal chassis could short to the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from buckling and touching the logic board, you may want to support the rear corners of the chassis.

Note: The controls on this monitor require a short hex-head plastic tool to make adjustments. If the tool



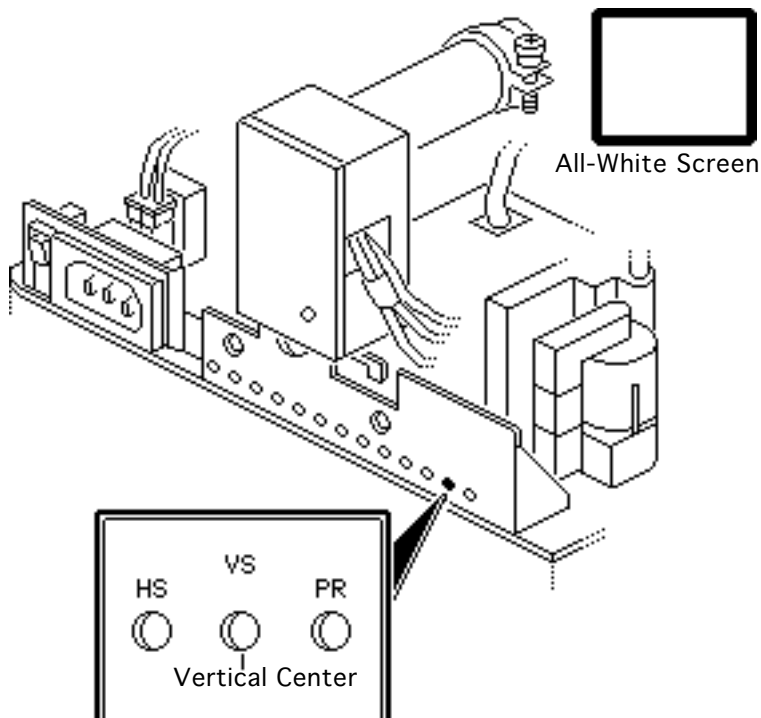


is long or too thin, it will be too flexible, which will make fine adjustments difficult. Use a short, rigid, hex-head plastic tool to minimize flexing.

⚠ Warning: Do not use metal alignment tools—they are a shock hazard.

- 1 Switch on system power.
- 2 Using Display Service Utility, display the All-White Screen test pattern.

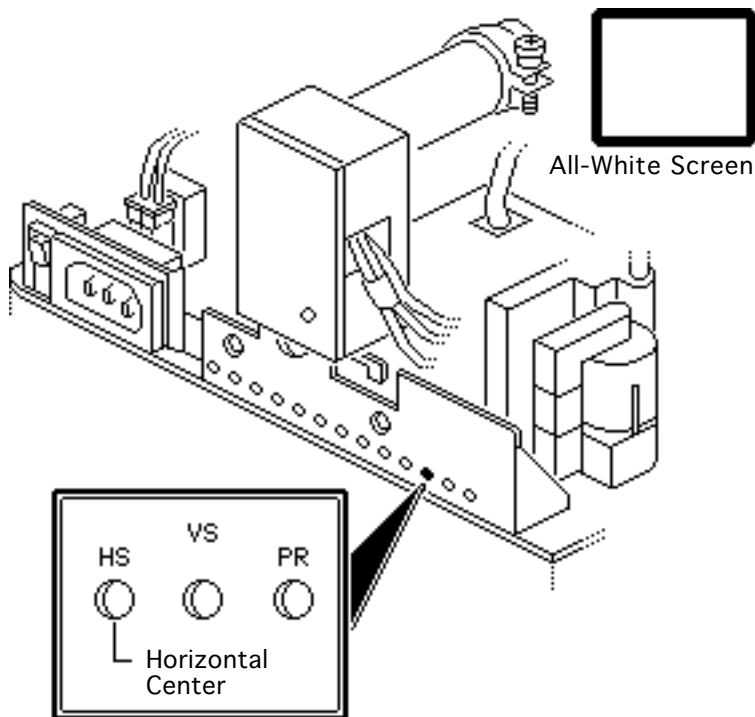




Vertical Center

Using a hex-head plastic adjustment tool, adjust the vertical center control until the raster is centered (top to bottom) in the display area.

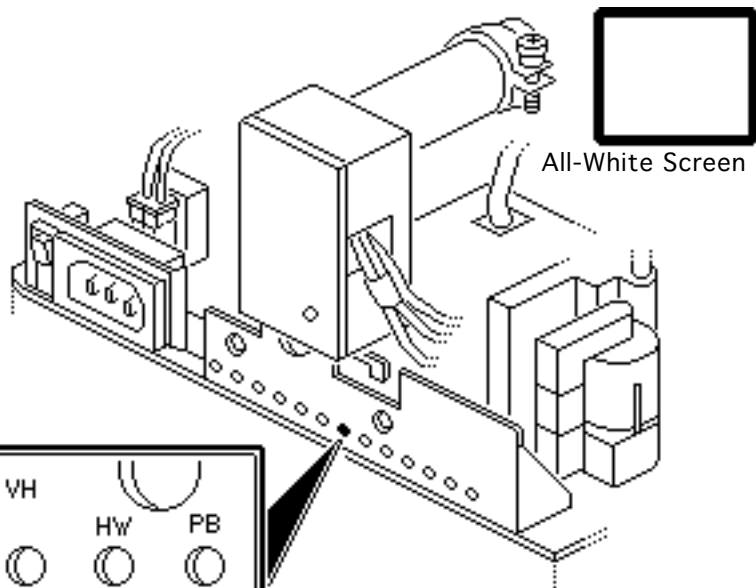




Horizontal Center

Using a hex-head plastic adjustment tool, adjust the horizontal center control until the raster is centered (side to side) in the display area.



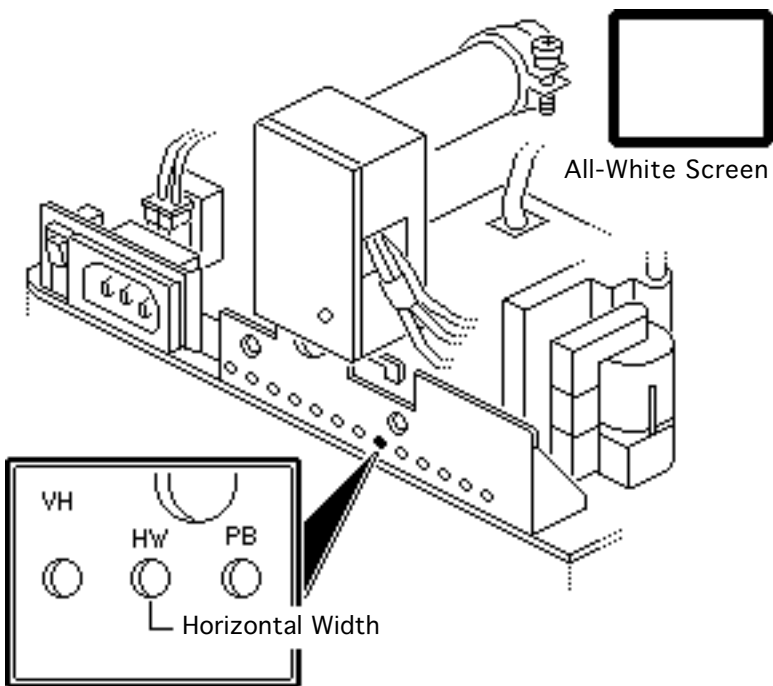


Vertical Size

Using a hex-head plastic adjustment tool, adjust the vertical height control until the raster height is 4.9 inches ($\pm 1/16$ inch) or 124.5 mm (± 1.5 mm).

Verify this height. If it is off, repeat the vertical size adjustment and, if necessary, the vertical center adjustment.

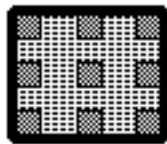
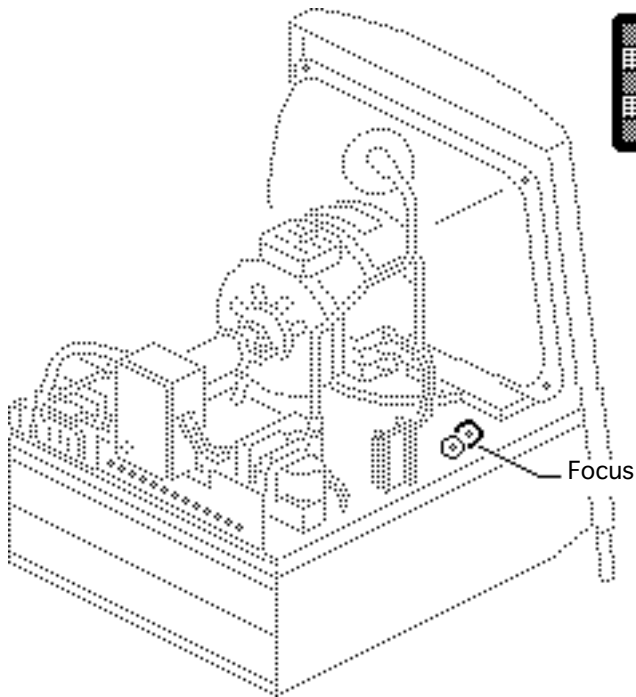




Horizontal Size

Using a hex-head plastic adjustment tool, adjust the horizontal width control until the raster is 6.7 inches ($\pm 1/16$ inch) or 168.5 mm (± 1.5 mm).



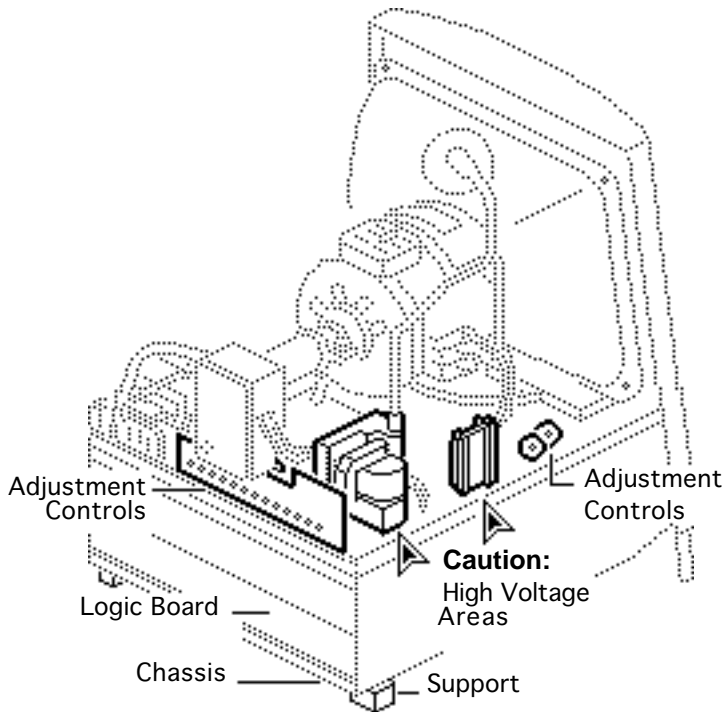


Focus

Focus

- 1 Using Display Service Utility, display the Focus test pattern.
- 2 Using a hex-head plastic adjustment tool, adjust the focus control until the Focus test pattern is as clear as possible.





Video

Before you begin, remove the rear housing.

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

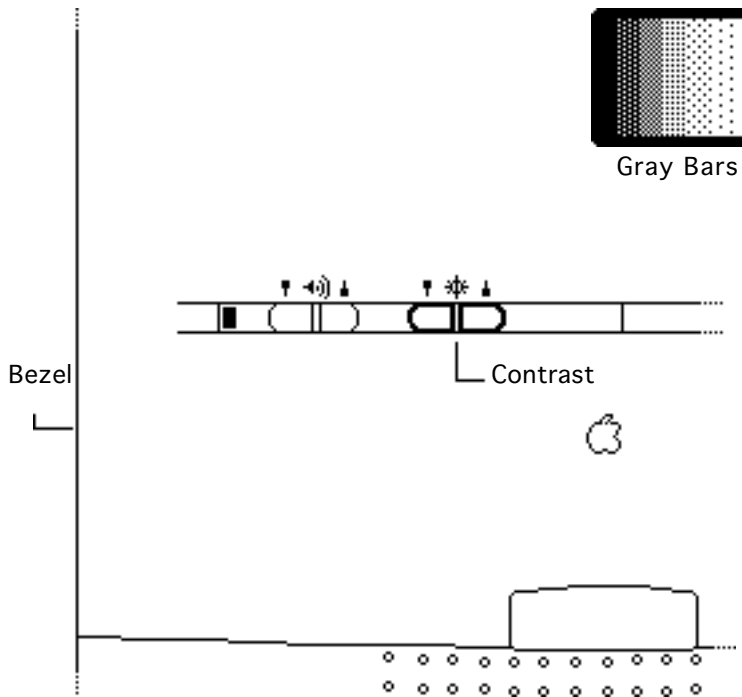




Caution: With the rear housing removed, the metal chassis could short to the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from buckling and touching the logic board, you may want to support the rear corners of the chassis.

Replacement Note: Perform the cutoff video adjustment whenever you replace the analog board.



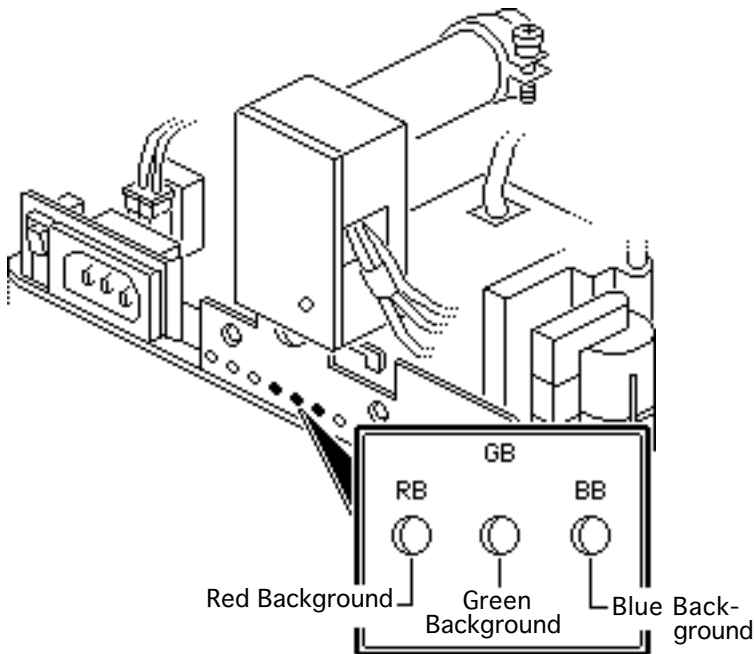


Cutoff

Note: Perform the cutoff video adjustment prior to adjusting white balance. Switch on the system at least 10 minutes prior to performing these adjustments.

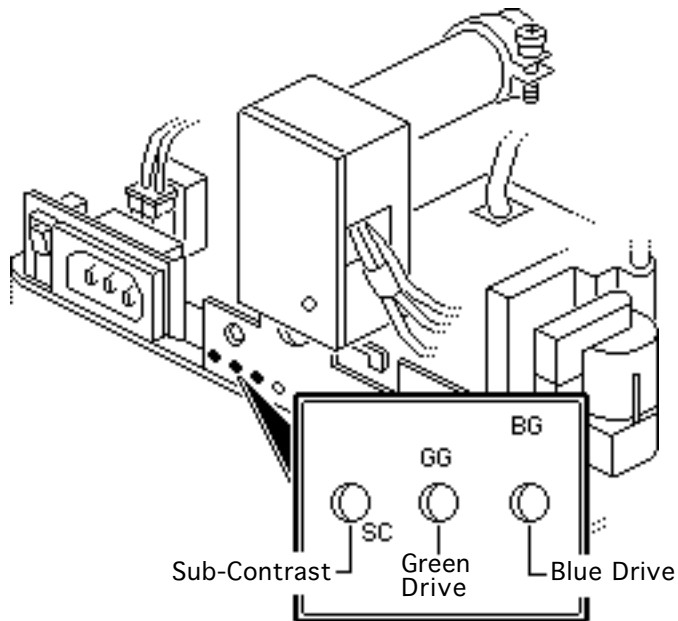
- 1 Using Display Service Utility, display the Gray Bars test pattern.
- 2 Press the contrast up button and set screen contrast to maximum.





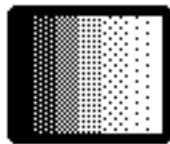
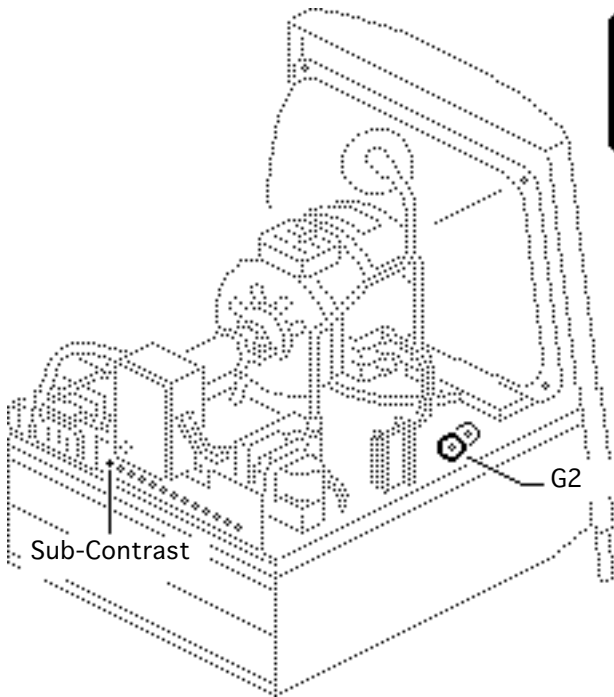
- 3 Select the Brightness Control Panel from the Apple menu. Drag the brightness control to midrange.
- 4 Using a hex-head plastic adjustment tool, set the red, green and blue background controls to the full counterclockwise positions.





- 5 Set the green and blue drive controls to their 3/4 position by turning the controls to their full clockwise position and then turn back 1/4 turn counterclockwise.
- 6 Set the sub-contrast control to its full clockwise position.

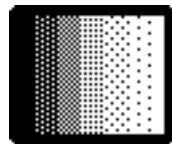




Gray Bars

- 7 Using a hex-head plastic adjustment tool, adjust G2 until the first bar in the test pattern is completely black and the second bar is barely discernible.
- 8 Set the sub-contrast control to the center position.





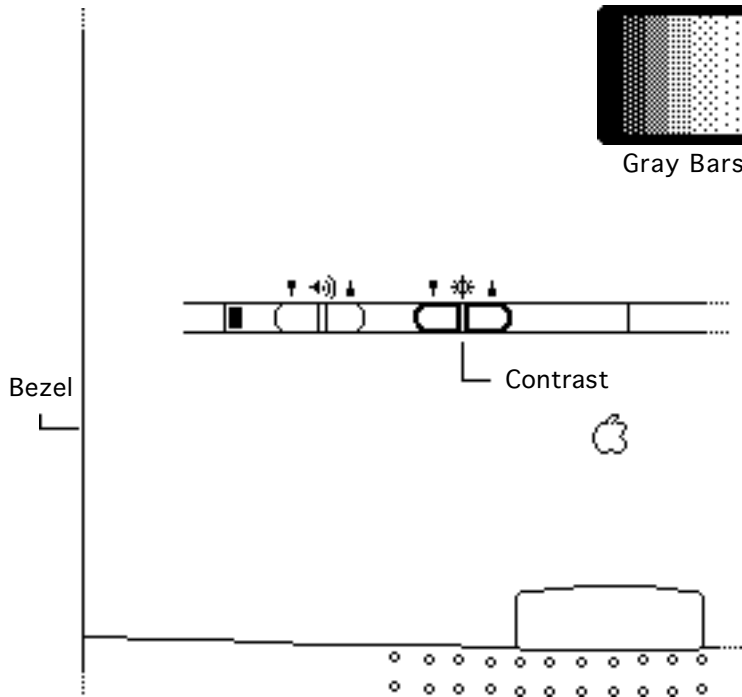
Gray Bars

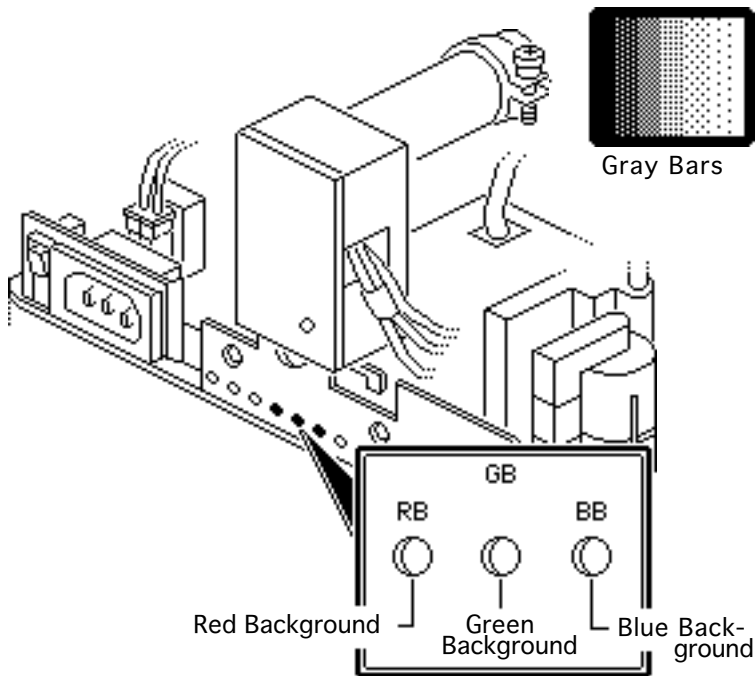
White Balance

Note: Before adjusting white balance, perform the cutoff video adjustment.

Make sure:

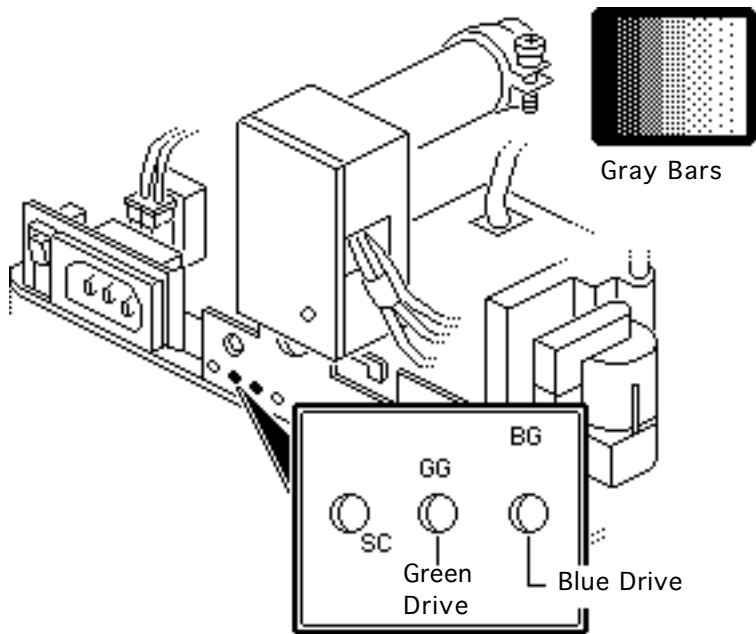
- The Gray Bars test pattern is displayed.
- Contrast is set to maximum.
- Brightness is set to midrange.





- 1 Note the predominant color.
- 2 Using a hex-head plastic adjustment tool, alternately adjust the red, green, and blue background controls until there is no predominant color in the four darkest bars.

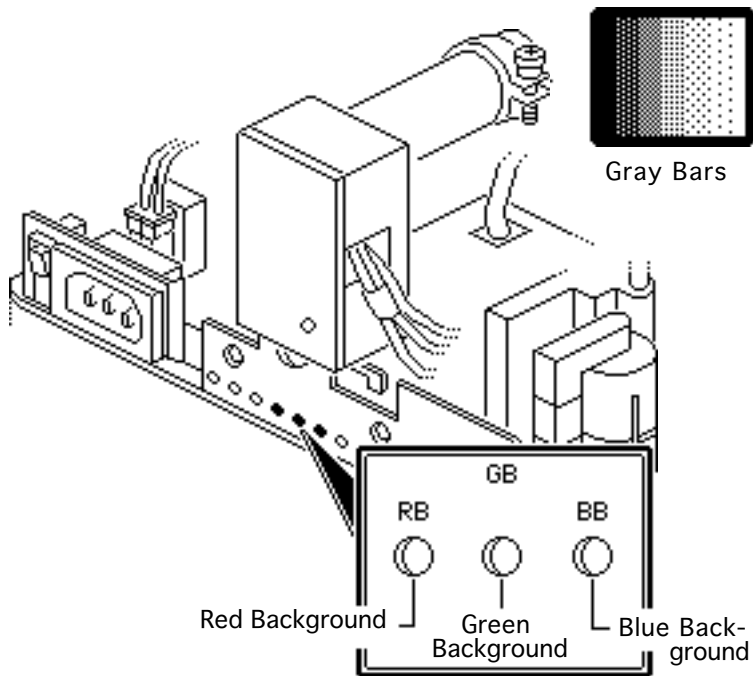




Note: The darkest bar must remain completely black throughout the rest of the procedure. If you notice a predominant color in the darkest bar, readjust the appropriate background control.

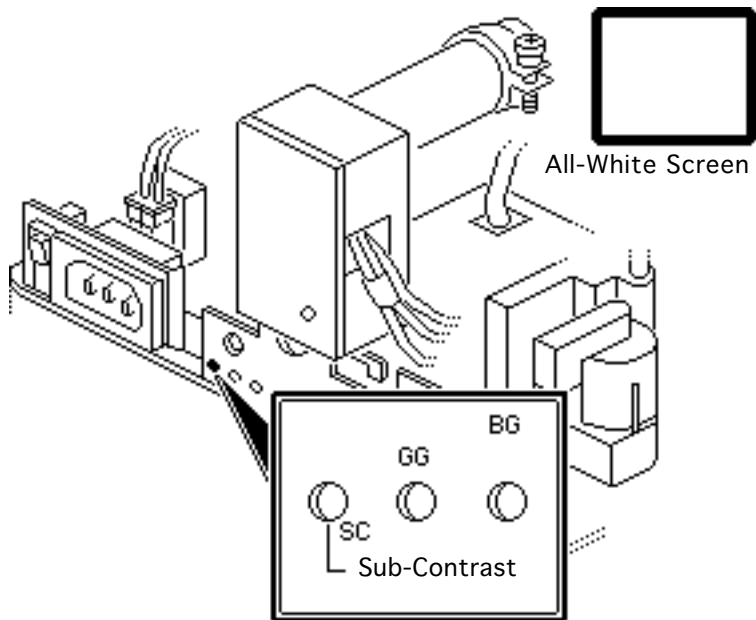
- 3 If necessary, adjust the blue and green drive controls until there is no predominant color in the four brightest bars.





- 4 Check the four darkest bars. If necessary, adjust the red, green and blue background controls until there is no predominant color.





- 5 Using Display Service Utility, display the All-White Screen test pattern.
- 6 Adjust the sub-contrast control until the luminance measures 37 foot lamberts (± 3 foot lamberts), which on the light meter is
 - Model R77: 27 on the bottom scale
 - Model L-248: high end of 10 on the 10-18 scale
 - Model 246: 27 on the red scale





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

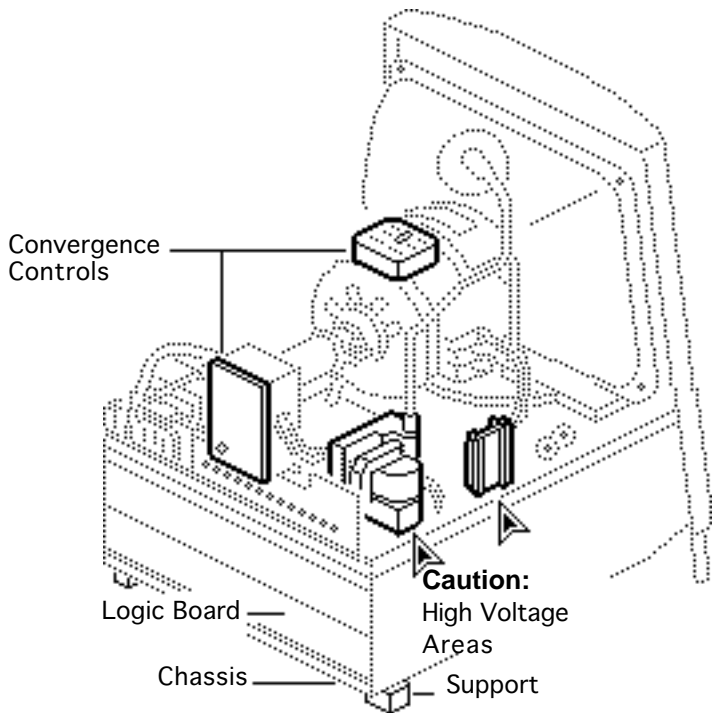




Convergence

Before you begin, remove the rear housing.

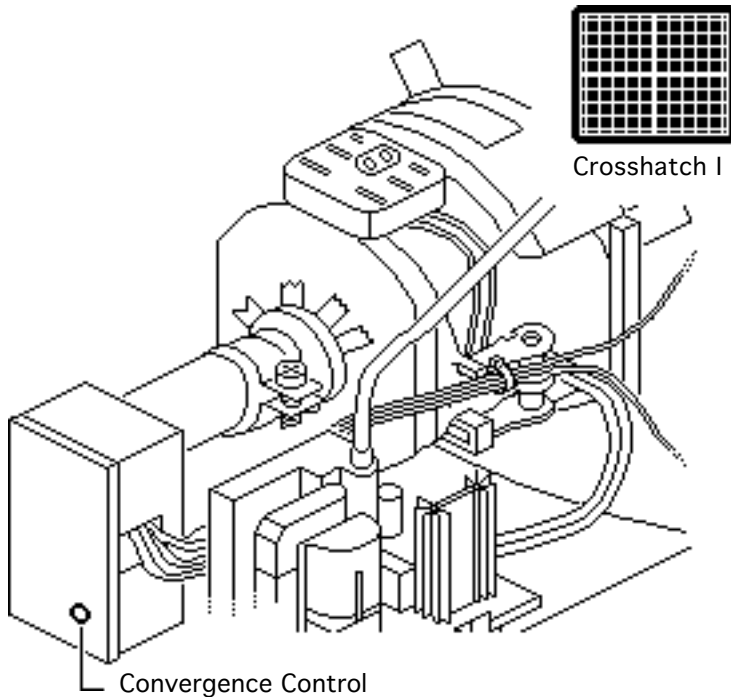
⚠ Warning: This product contains high voltage and a high-vacuum picture tube. To prevent serious personal injury or equipment damage, review the CRT safety instructions in Bulletins/Safety.





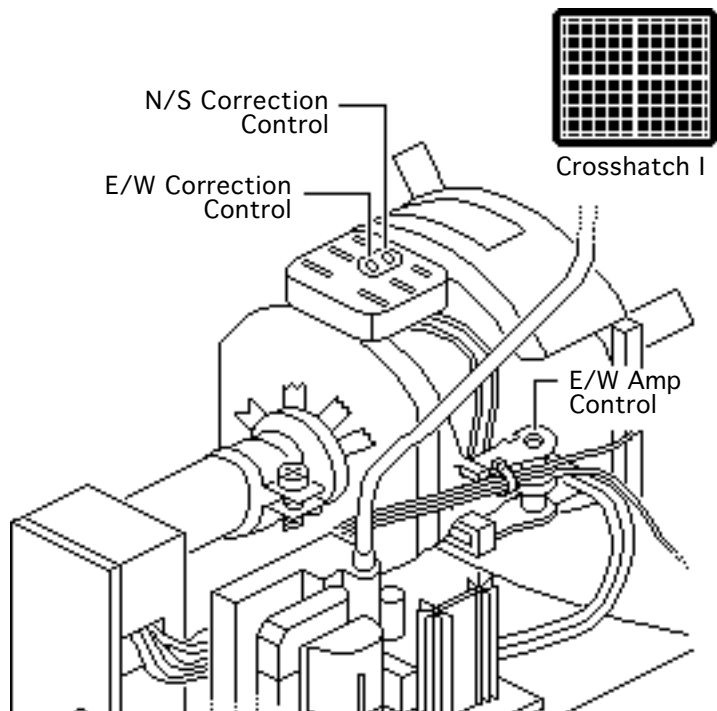
Caution: With the rear housing removed, the metal chassis could short to the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from buckling and touching the logic board, you may want to support the rear corners of the chassis.





- 1 Switch on system power. Using Display Service Utility, display the Crosshatch I test pattern.
- 2 Using a hex-head plastic adjustment tool, adjust the convergence control on the CRT video board for best overall convergence.





- 3 Using a hex-head plastic adjustment tool, adjust the N/S correction control for best convergence of horizontal lines at the top and bottom of the screen.
- 4 Adjust the E/W correction control for best convergence of vertical lines at the left and right sides of the screen.





- 5 Adjust the E/W amp control for best convergence of horizontal lines at the left and right sides of the screen.

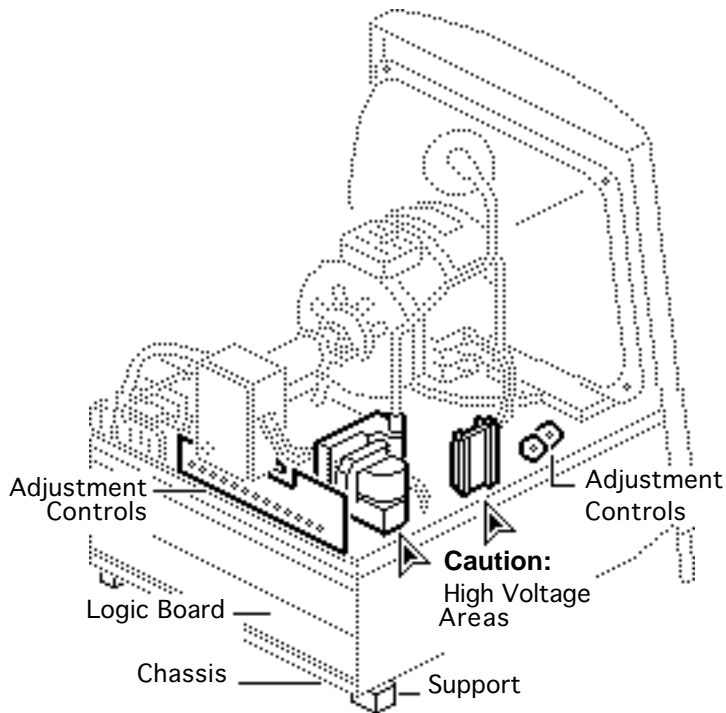




Geometric Distortion

Before you begin, remove the rear housing.

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





Caution: With the rear housing removed, the metal chassis could short to the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from buckling and touching the logic board, you may want to support the rear corners of the chassis.

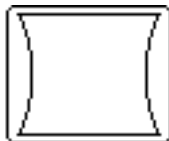




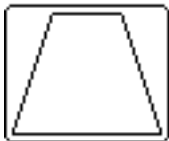
Horizontal Bow
(PB)



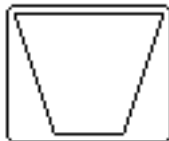
or



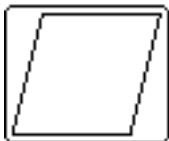
Pin Phase
(KS)



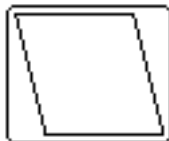
or



Vertical Angle
(PR)



or

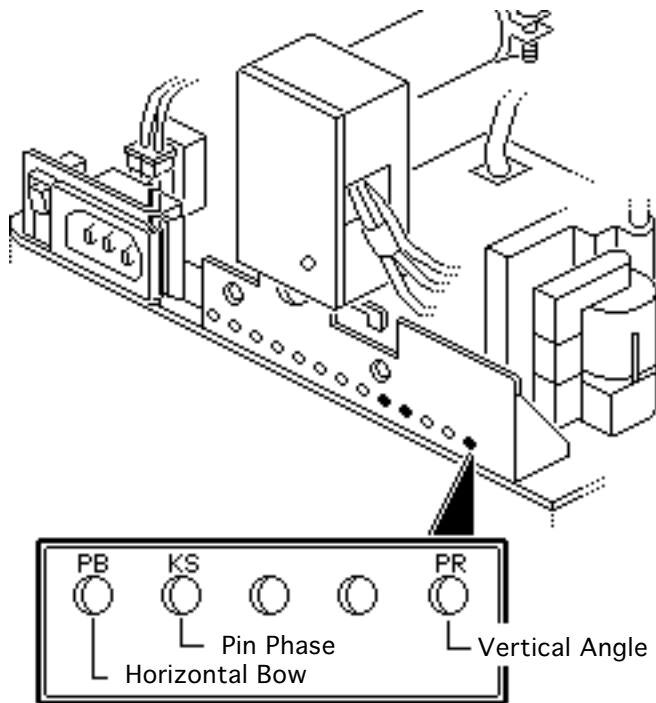


Note: Perform the following geometric adjustments to correct distortions other than geometric center, size, and focus problems (see “Geometry”).

Warning: The entire yoke assembly has very high voltage. To prevent electrical shock, do not touch the yoke assembly, the anode wire, or the yoke wires.

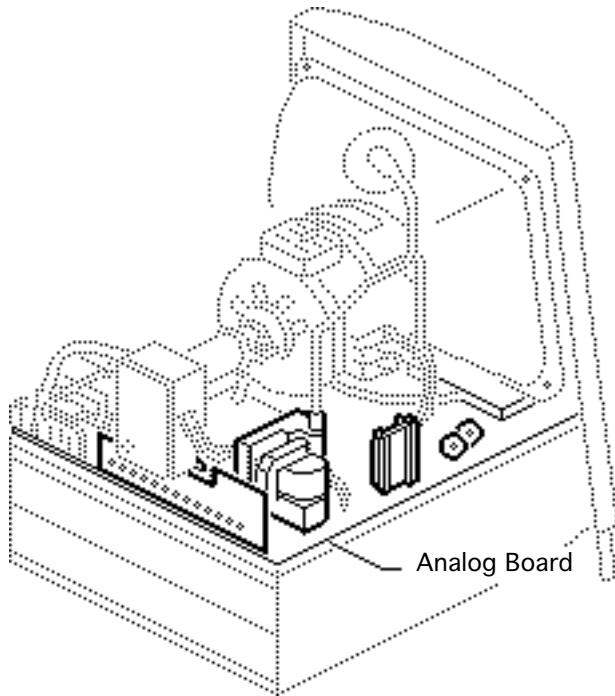
- 1 To determine which control to adjust, compare the display with the distortions shown.





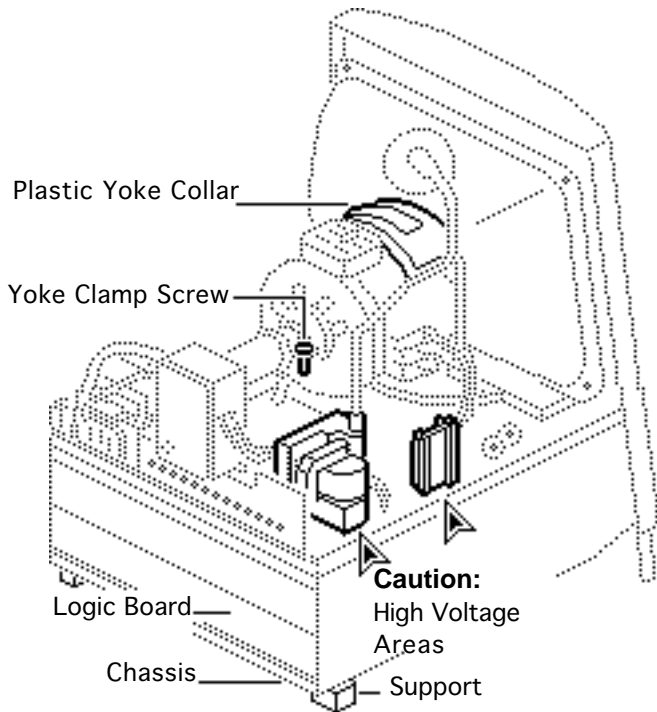
- 2 Using a hex-head plastic adjustment tool, adjust the control that is appropriate for the distortion.
- 3 If the display is so distorted that you can't tell which adjustments to make, perform the adjustments in the following sequence:
 - Pin Phase (KS)
 - Vertical Angle (PR)
 - Horizontal Bow (PB)





- 4 If the display is still distorted, repeat the vertical angle and pin phase adjustments.
- 5 If you can't correct the distortion, replace the analog board. See "Analog Board" in the Take Apart chapter.



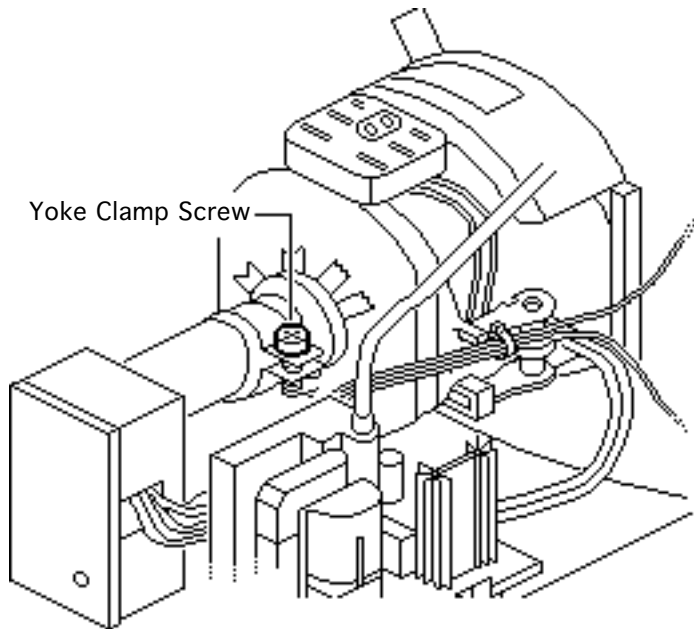


Yoke

Before you begin, 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 must make yoke adjustments from the rear of the computer, use a mirror to view the computer screen. Do not reach around the computer to adjust collars and rings.

Replacement Note: If you replace the CRT, you will probably have to adjust the yoke.

- 1 Using an insulated cross-tip screwdriver, loosen the yoke clamp screw two or three turns.

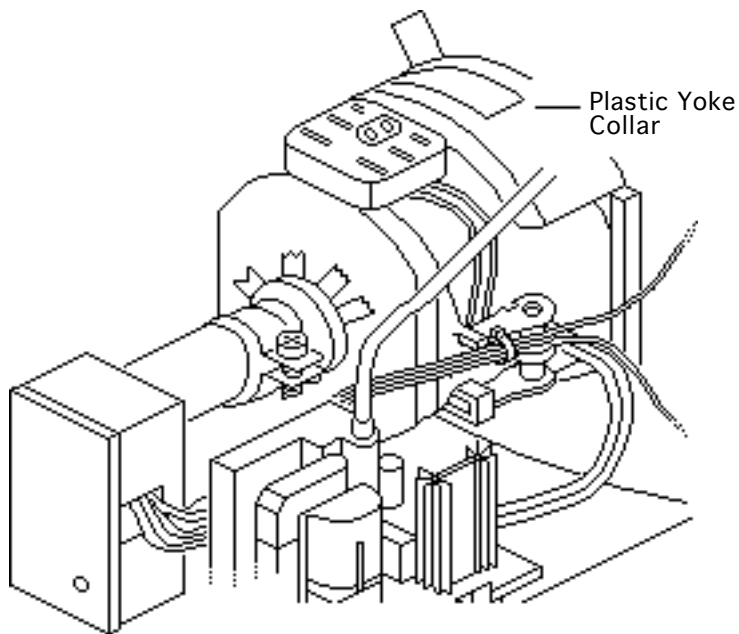




Caution: With the rear housing removed, the metal chassis could short to the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from buckling and touching the logic board, you may want to support the rear corners of the chassis.

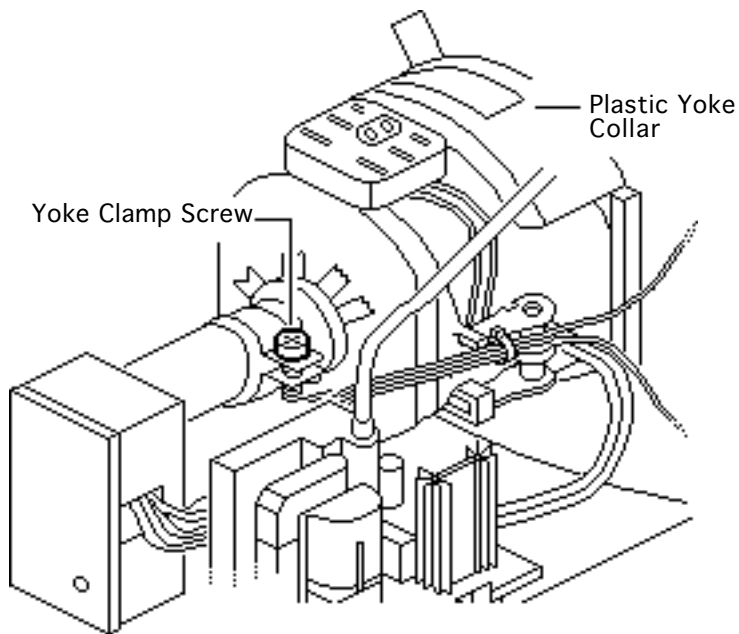
- 2 Switch on the computer.





- 3 With one hand, grasp the plastic yoke collar and rotate it until the top and bottom edges of the picture are parallel with the top and bottom of the bezel.
- 4 Switch off and unplug the computer.
- 5 Discharge the CRT.





- 6 Hold the plastic yoke collar in position and carefully tighten the yoke clamp screw so that the collar cannot slip. Do not overtighten the screw.
- 7 Replace the rear housing and switch on the computer.
- 8 Verify that the top and bottom edges of the picture are parallel with the top and bottom of the bezel.





Light Meter Setup

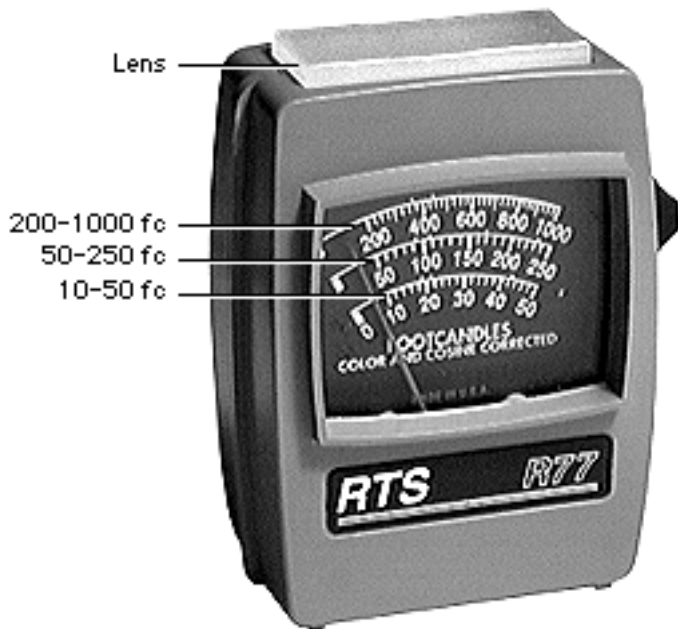
This topic covers setup for three light meter models: R77, L-248, and 246. Model R77 (Apple part number 076-0310) is the newest model available.

Model R77

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

Before you begin, remove the 10X multiplier plate





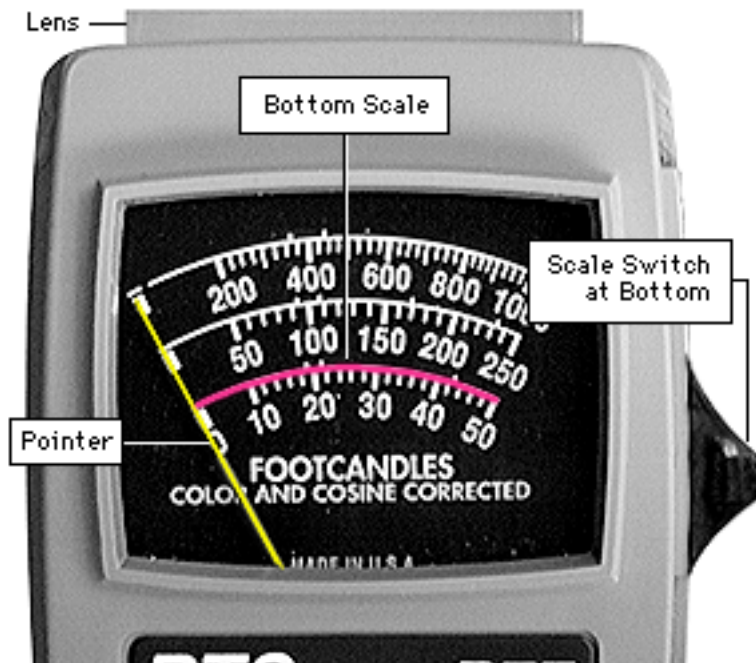
from the lens.

Three scales are shown on the light meter:

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

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





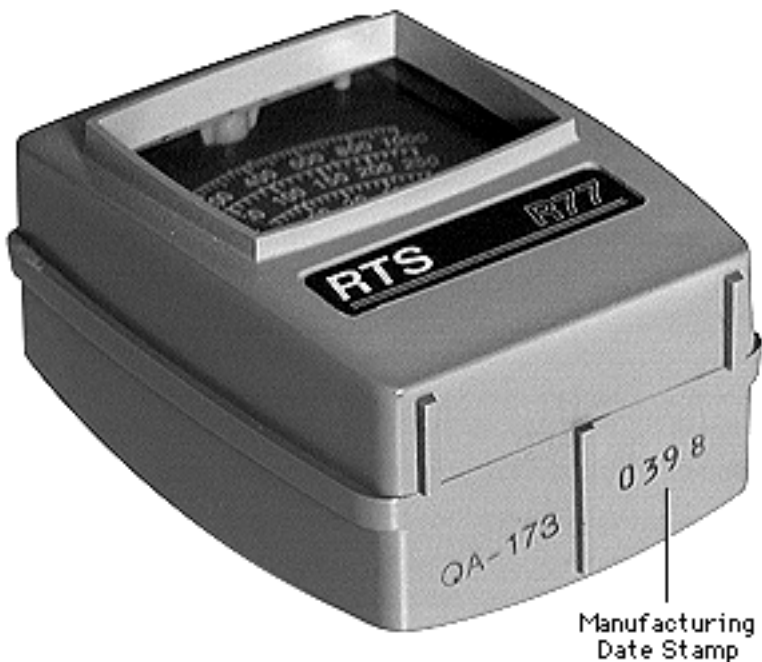
To measure a display screen's luminance,

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

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

Important: If you suspect the light meter is giving false

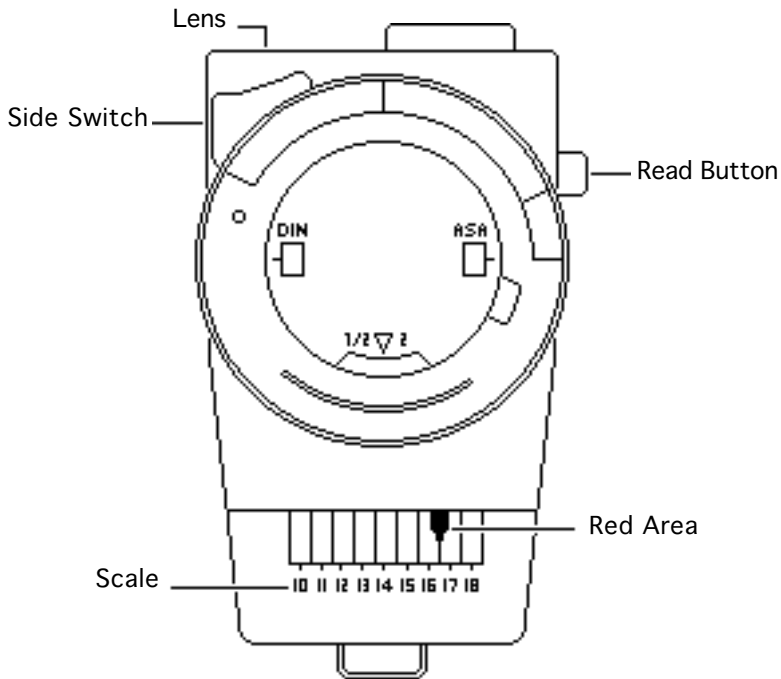




readings, verify the readings with a known-good light meter or photometer. Also check the age of the R77 light meter by its four-digit manufacturing date stamp (such as 0398 for March 1998).

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

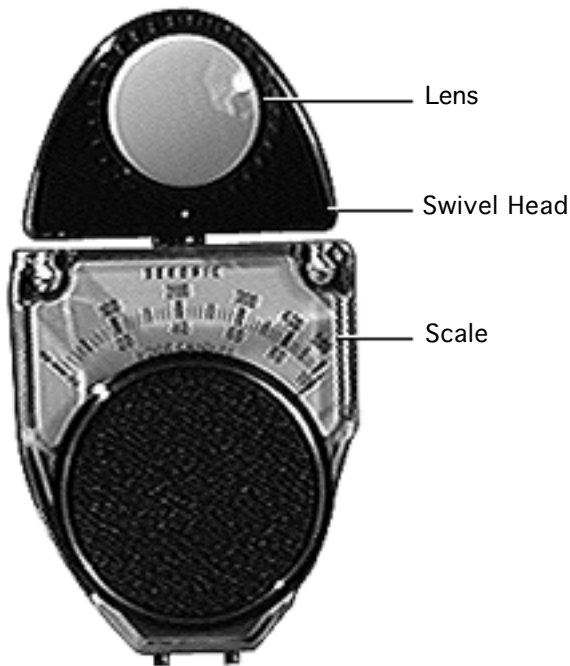




Model L-248

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





Model 246

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

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





Exploded View

Color Classic





Exploded View

