



Macintosh

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Basics

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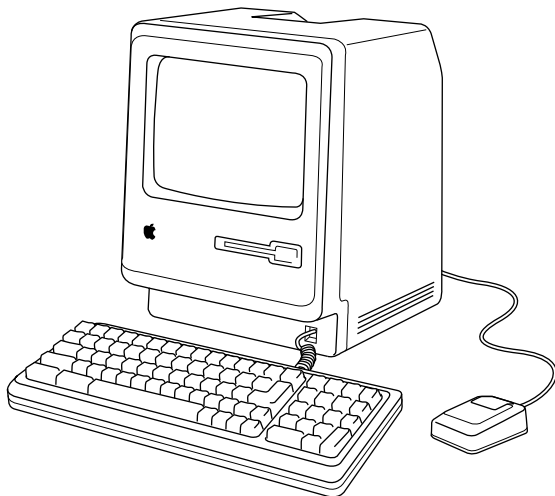
Macintosh





## Overview

This manual includes repair procedures for the earliest Apple Macintosh computers—the Macintosh 128K and Macintosh 512K.



**Figure: Macintosh 128k/512K**





Specifications

Macintosh





## Processor

### CPU

Motorola 68000 microprocessor

7.83 MHz

32-bit internal data bus





## Memory

<b>RAM</b>	128K or 512K
<b>ROM</b>	64K
<b>PRAM</b>	CMOS custom chip with 4.5 V, user-replaceable battery backup (includes 256 bytes of memory; remembers system parameters even with the machine switched off)





## Disk Storage

### **Floppy Drive**

Internal, single-sided drive; uses 3.5-in., hard-case, 400K floppy disks





## I/O Interfaces

### **Floppy Drive**

External drive port; DB-19 connector

### **Mouse**

Mouse port; DE-9 connector

### **Keyboard**

Synchronous serial keyboard bus; RJ-11 connector

### **Serial**

Two RS-232/RS-422 serial ports; DE-9 connectors







## I/O Devices

### **Keyboard**

58 keys; software mapped; RJ-11 connector

### **Mouse**

Mechanical tracking; optical shaft encoding at 3.54 pulses per mm (90 pulses per in.) of travel; DE-9 connector





## Sound and Video

### **Sound Generator**

Four-voice sound with 8-bit digital/analog conversion, using 22-kHz sampling rate

### **Video Display**

9-in. (diagonal) screen; 512 x 342 pixel, bit-mapped display





## Electrical

**Line Voltage** 105-125 VAC

**Frequency** 50-60 Hz

**Maximum Power** 60 W





## Physical

### **Dimensions**

Height: 13.6-in. (34.5 cm)

Width: 9.6-in. (24.4 cm)

Depth: 10.9-in. (27.6 cm)

### **Weight**

16 lb. 8 oz. (7.5 kg)





# Troubleshooting

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## Macintosh





## 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

No video, but audio tone is present and drive operates

- 1 Turn contrast control fully clockwise.
- 2 Check video cable connections.
- 3 Replace power supply board.
- 4 Replace neck cable.
- 5 Replace logic board. Retain customer's SIMMs.

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

- 1 Replace power supply board.
- 2 Replace logic board. Retain customer's SIMMs.





## Drives

Disk ejects; display shows disk icon with blinking "X"

- 1 Replace bad disk.
- 2 Replace floppy drive cable.
- 3 Replace drive.
- 4 Replace logic board. Retain customer's SIMMs.

Unable to insert disk all the way

- 1 Insert opened paper clip into small hole beside drive slot, or switch off system power and hold mouse  $\Sigma\Sigma$  button down while switching system power back on to complete eject cycle. Then insert disk with metal slot forward and write-protect tab on bottom.
- 2 Replace floppy drive.







## Drives (Continued)

Drive does not eject disk

Insert opened paper clip into small hole beside drive slot, or switch off system power and hold mouse button down while switching system power back on to complete eject cycle.

Does not read disks on internal drive

- 1 Replace bad disk.
- 2 Replace floppy drive cable.
- 3 Replace Mylar RFI shield.
- 4 Replace floppy drive.
- 5 Verify ROMs on the logic board (refer to Additional Procedures).
- 6 Replace logic board. Retain customer's SIMMs.





## Peripherals

Cursor does not move	<ol style="list-style-type: none"><li>1 Connect mouse.</li><li>2 Replace mouse.</li><li>3 Replace logic board. Retain customer's SIMMs.</li></ol>
Cursor moves, but clicking mouse produces no response	<ol style="list-style-type: none"><li>1 Replace mouse.</li><li>2 Replace logic board. Retain customer's SIMMs.</li></ol>
No response to any key on keyboard	<ol style="list-style-type: none"><li>1 Replace keyboard cable.</li><li>2 Replace keyboard.</li><li>3 Replace logic board. Retain customer's SIMMs.</li></ol>
No response from a particular key	<ol style="list-style-type: none"><li>1 Replace keyswitch.</li><li>2 Replace keyboard.</li><li>3 Replace logic board. Retain customer's SIMMs.</li></ol>





## Peripherals (Continued)

Known-good  
ImageWriter or  
ImageWriter II does  
not print

- 1 Make sure that Chooser and Control Panel are set correctly
- 2 Check that system software version is compatible. Replace software with known-good version.
- 3 Reset PRAM.
- 4 Replace interface cable.
- 5 Replace logic board. Retain customer's SIMMs.

Known-good  
LaserWriter does not  
print

- 1 Make sure that Chooser and Control Panel are set correctly.
- 2 Check that system software version is compatible. Replace software with known-good version.
- 3 Reset PRAM.





## Miscellaneous

When turned on, the Macintosh continuously beeps and tries to power up

- 1 Perform voltage adjustment. Refer to Adjustments chapter.
- 2 Disconnect internal disk drive. If this eliminate problem, replace drive.
- 3 Replace logic board. Retain customer's SIMMs.
- 4 **Caution:** Replacing only power supply board may damage new power supply board. Replace power supply board, logic board, and internal drive, then turn on Macintosh.

Clicking or chirping sound

- 1 Connect logic board cable.
- 2 Perform voltage adjustment. Refer to Adjustments chapter.
- 3 Replace power supply board.
- 4 Replace logic board. Retain customer's SIMMs.





## Miscellaneous (Continued)

Smoke/odor issues  
from the Macintosh

**Caution:** Replacing only power supply board may damage new power supply board. Replace power supply board, logic board, and internal drive, then turn on Macintosh.

No video, no audio  
tone, and no drive  
operation

- 1 Connect power cord.
- 2 Turn on power.
- 3 Replace power cord.
- 4 Check fuse.
- 5 **Caution:** Replacing only power supply board may damage new power supply board. Replace power supply board, logic board, and internal drive, then turn on Macintosh.
- 6 Replace logic board. Retain customer's SIMMs.





## Miscellaneous (Continued)

When developer's switch is installed, Macintosh sometimes resets intermittently

Remove switch and file it down about 1/16 inch.

Macintosh 512K enhanced has two RFI shields

Some machines have two RFI shrouds installed. Two RFI shields can be replaced by one RFI shield, which can be ordered as a service part.





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Take Apart  
Macintosh





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







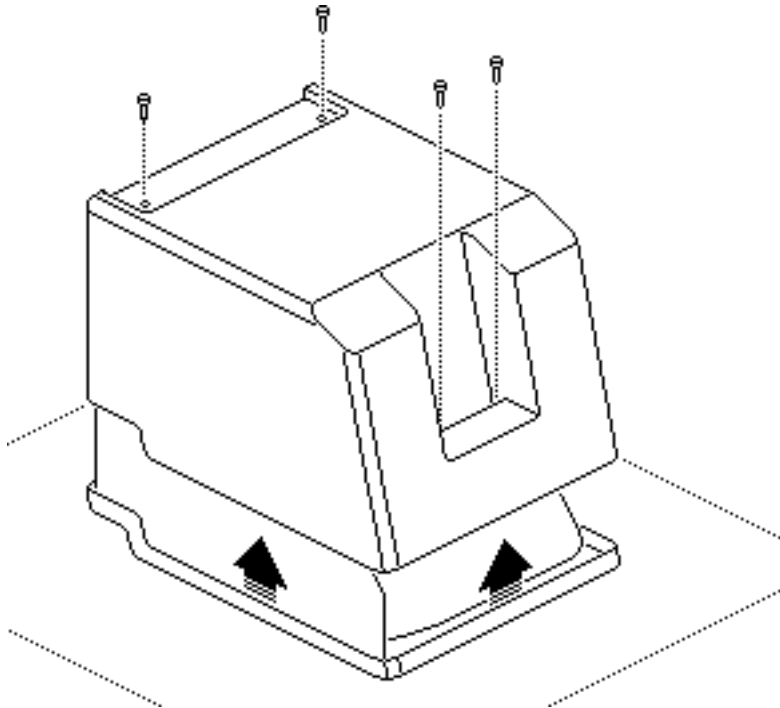
Cover

Battery  
Compartment  
Cover

Reset/Interrupt  
Switch

- 1 Remove the battery compartment cover.
- 2 Remove the reset/interrupt switch, if present.





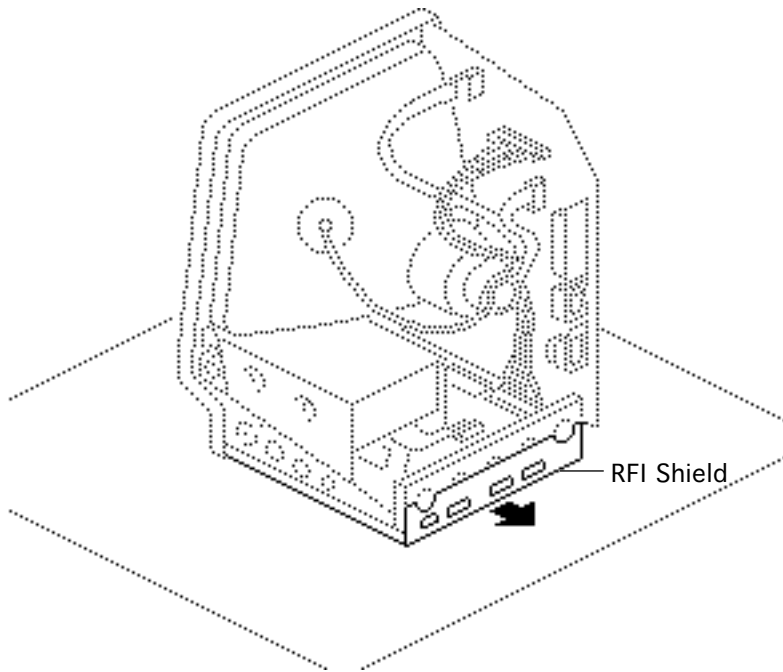
- 3 Using a Torx screwdriver, remove the four case screws.
- 4 Using the pull-apart tool, gently pry off the cover.

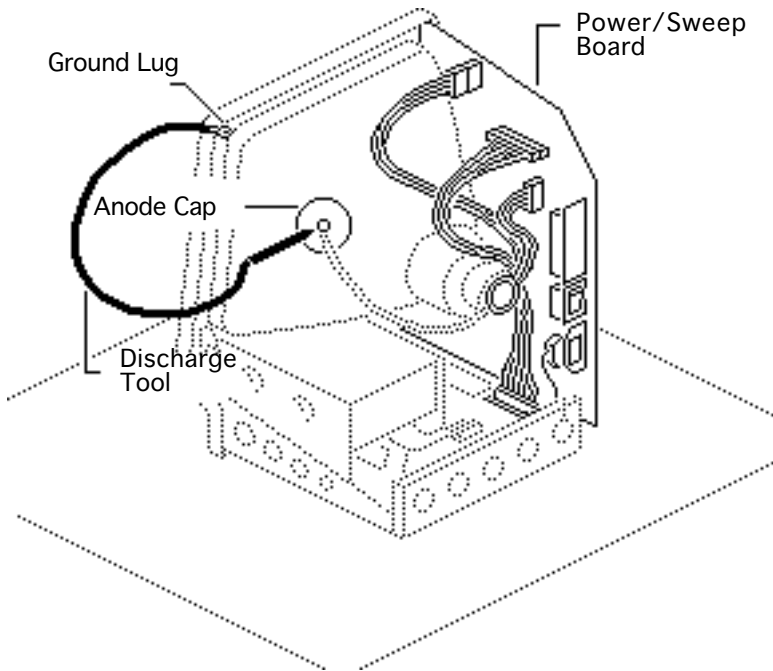
**⚠ Warning:** The edges of the metal chassis may be sharp. When moving the computer with the cover off, be sure to handle the chassis carefully.





- 5 Remove the RFI shield.





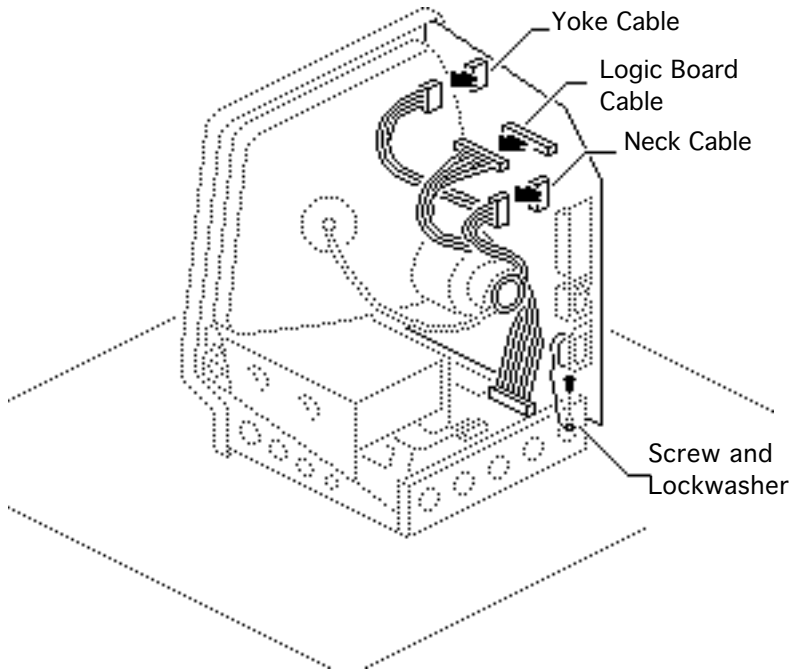
## Power/Sweep Board

Before you begin,

- Remove the cover
- 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 Bulletins/Safety.

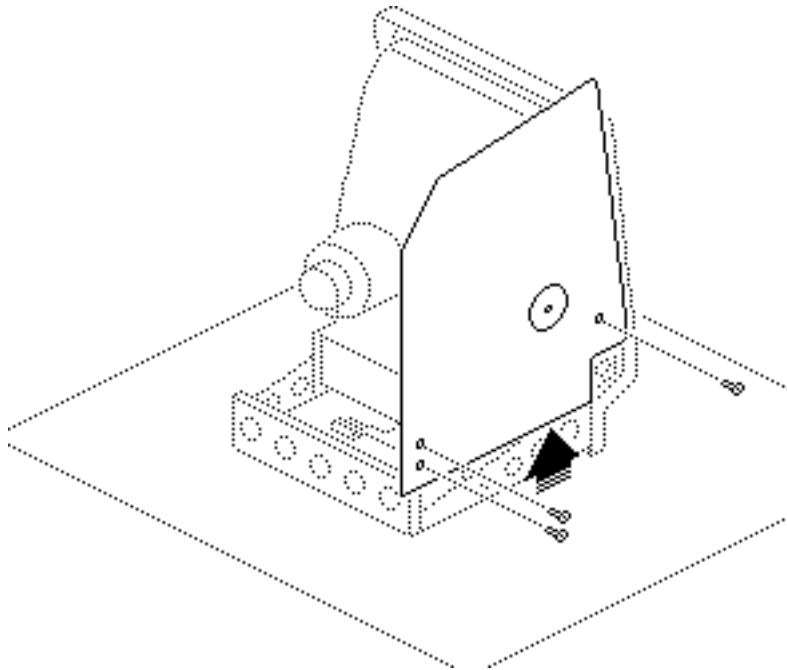




**⚠ Warning:** Never use a grounding wriststrap until after discharging the CRT.

- 1 Disconnect the following cable connectors from the power/sweep board:
  - Yoke cable
  - Logic board cable
  - Neck cable
- 2 Remove the screw and lockwasher that hold the ground wire to the chassis.





- 3 **Note:** You may need to remove the insulating paper from the power/sweep board to access the mounting screws.

Remove the three mounting screws and washers, and lift the power/sweep board from the chassis.

**Replacement Note:** After replacing all parts except the cover, perform the voltage and video adjustment procedures. See “Voltage” and “Video” in the Adjustments chapter.





**Replacement Note:** When sending a defective power/sweep board to Apple, be sure to include the cable that connects to the logic board. Be sure the contrast control knob and battery have been removed from the defective board and reinstalled onto the exchange board.



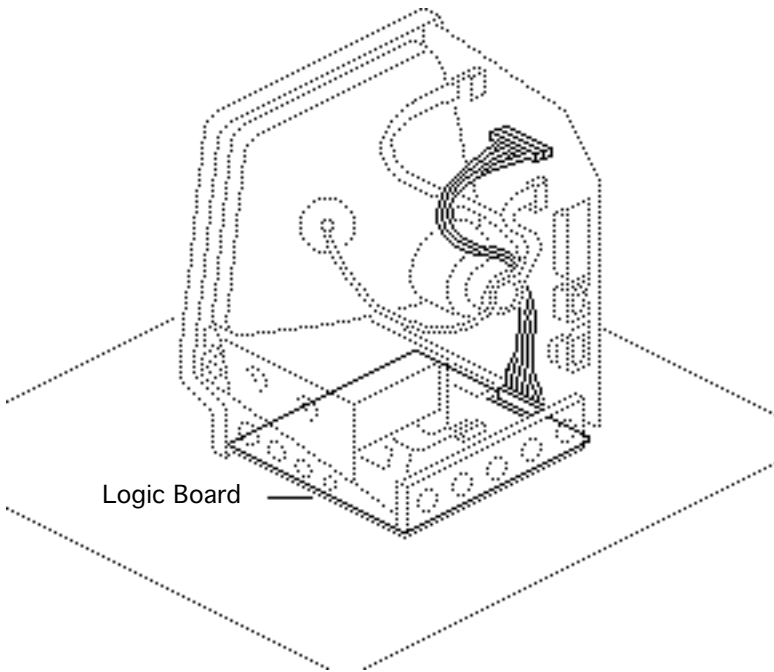


## Logic Board

Before you begin,

- Remove the cover
- Discharge the CRT

**⚠ 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.

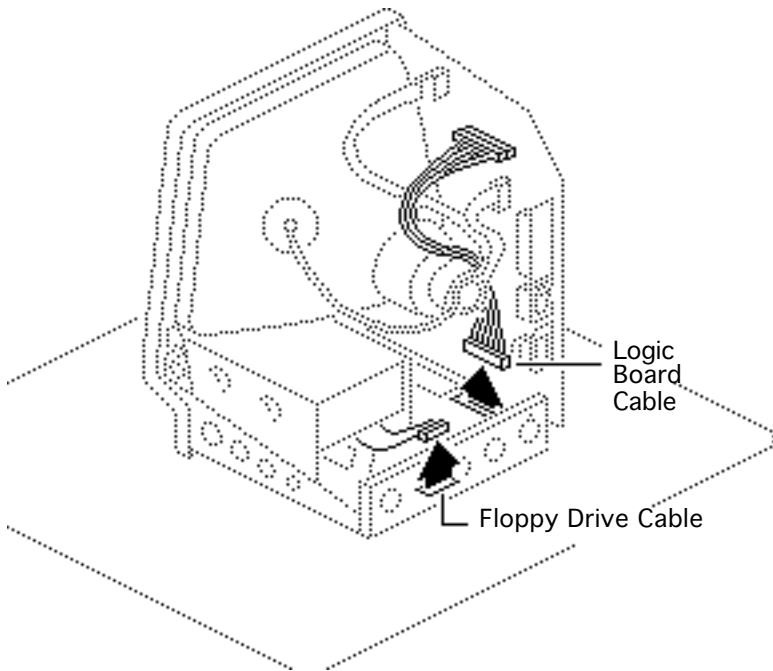


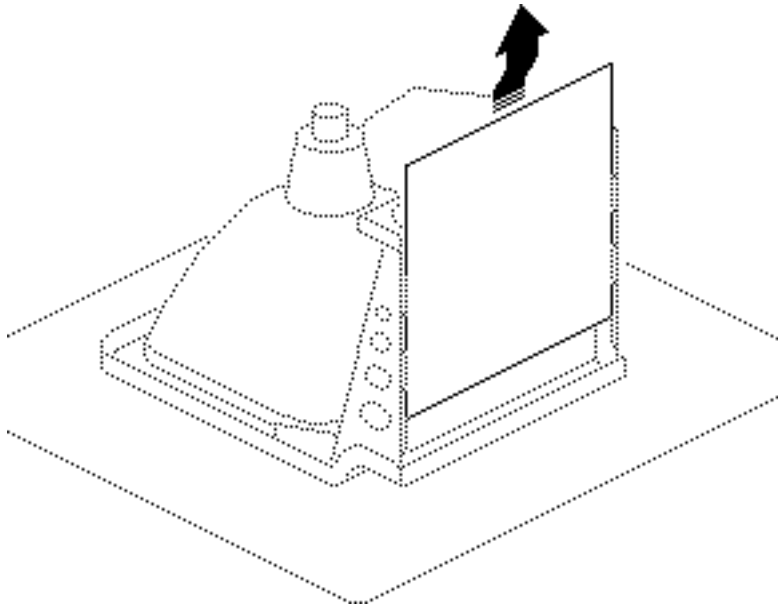




**⚠ Warning:** Never use a grounding wriststrap until after discharging the CRT.

- 1 Disconnect the following cable connectors from the logic board:
  - Floppy drive cable
  - Logic board cable





- 2 **Caution:** When removing the logic board, be careful not to damage the SIMMs — especially the larger DIP SIMMs that may be installed on the board.

Pull back on the top of the logic board, and carefully slide out the logic board.

**Replacement Note:** After replacing all parts except the cover, perform the voltage and video adjustment procedures. See “Voltage” in Adjustments.

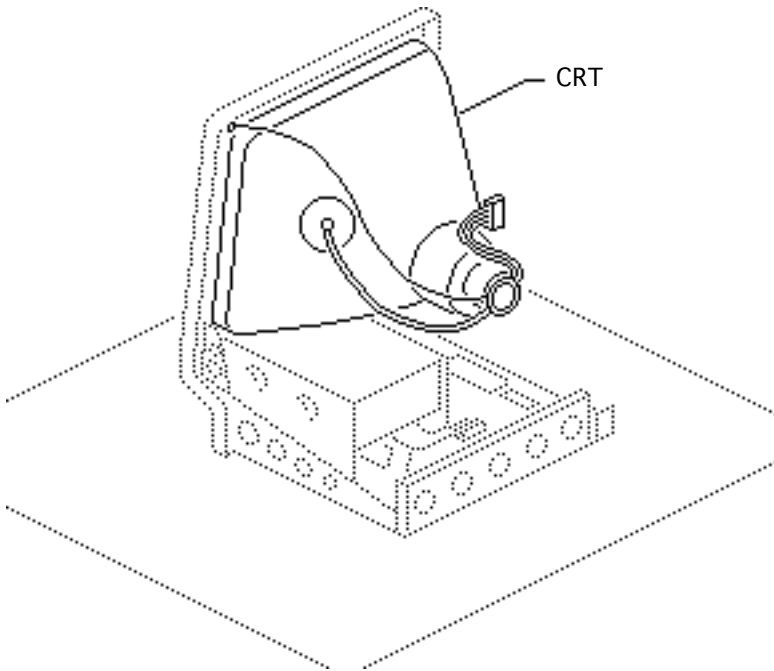




**Replacement Note:** When exchanging the 512K logic board, you must swap ROMs to the new logic board.

**Replacement Note:** Remove the SIMMs from the defective logic board and install them on the replacement logic board. See Hardware/Memory.





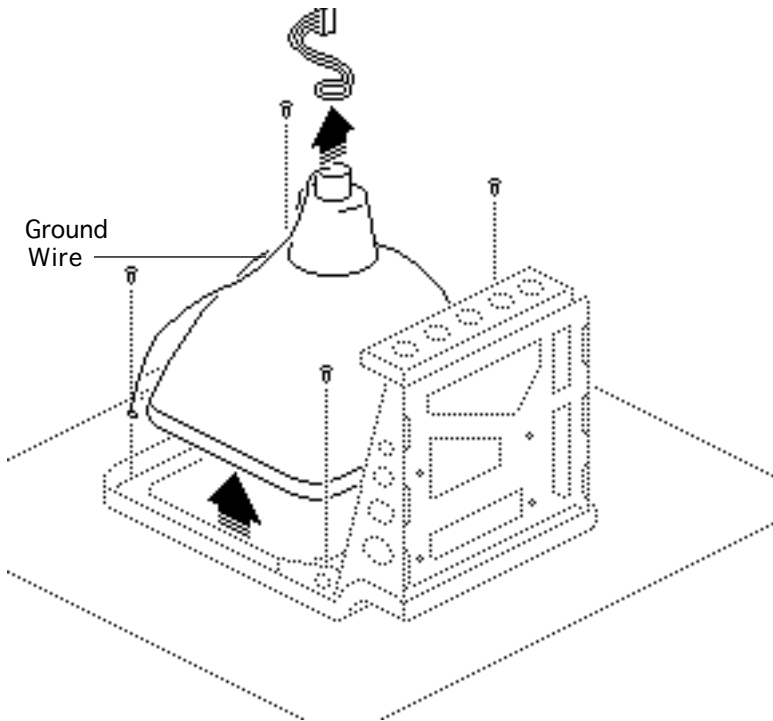
## CRT

Before you begin,

- Remove the cover
- Discharge the CRT
- Remove the Power/  
Sweep board

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





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

**⚠ Warning:** Handle the CRT by its sides only. Do not grasp the neck on the CRT or touch the anode.

- 1 Slide the CRT socket cable straight off the neck of the CRT.
- 2 Remove the four mounting screws and the ground wire, and lift the CRT off the bezel.





**⚠ Warning:** If you must dispose of the CRT, refer to “CRT Disposal” in Bulletins/Safety.

**Replacement Note:** If you replace the CRT, perform the video and yoke adjustment procedures. See “Video” and “Yoke” in the Adjustments chapter.



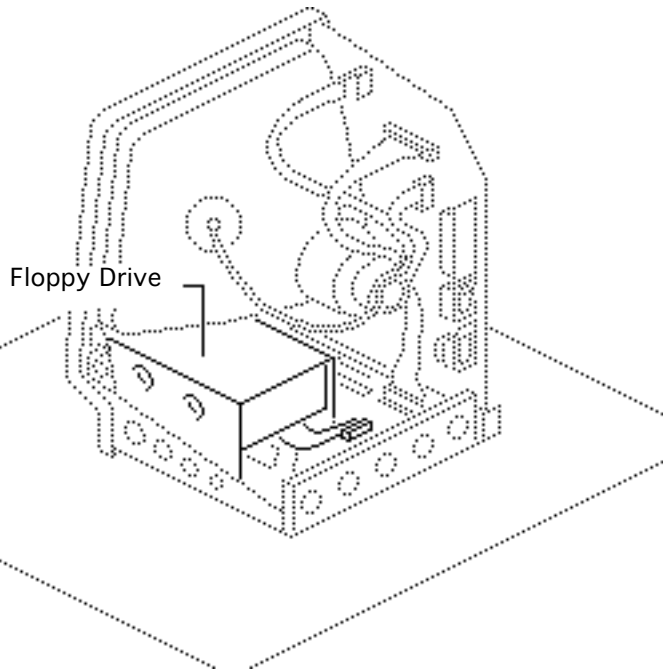


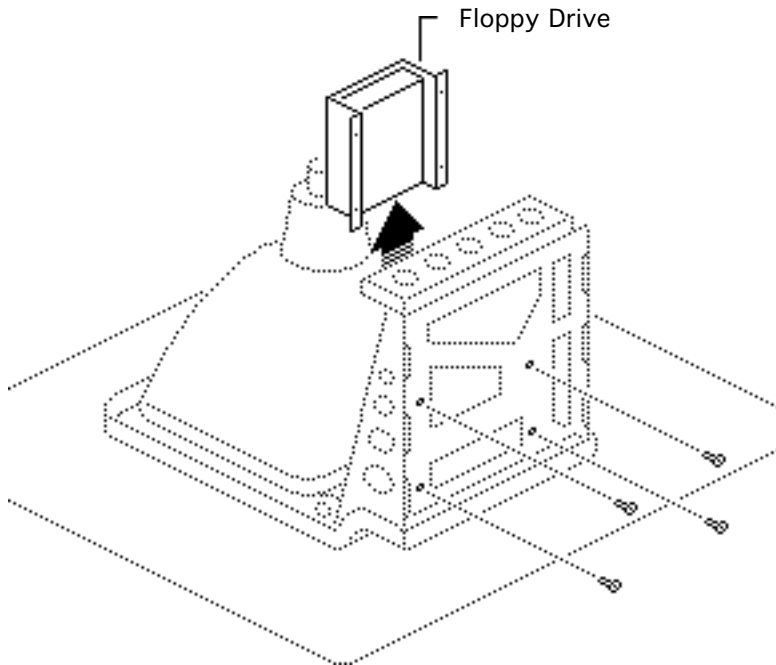
## Floppy Drive

Before you begin,

- Remove the cover
- Discharge the CRT
- Remove the logic board

**⚠ 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.





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

Remove the four mounting screws, and slide the floppy drive out of the chassis.



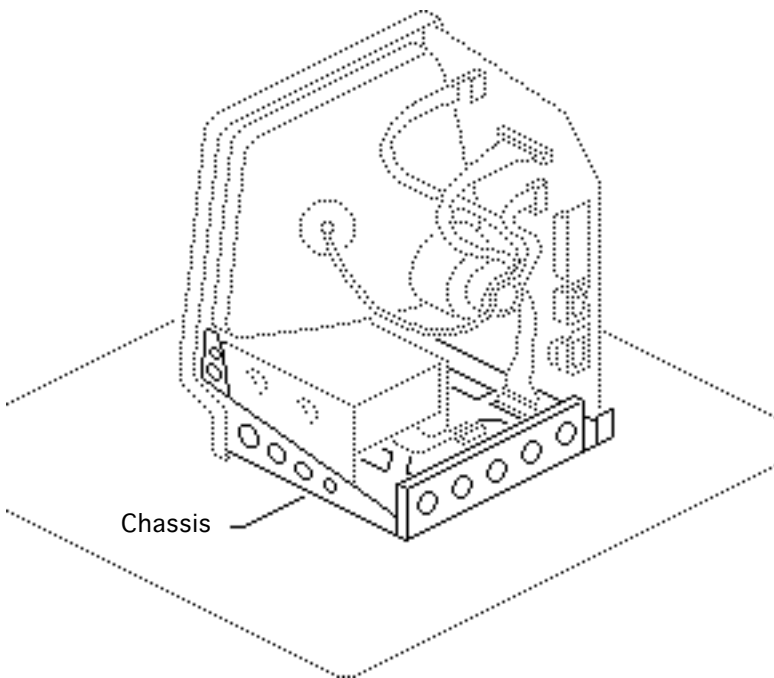




**Replacement Note:** All 400K drives are shipped in their original drive shields. When installing a new 800K drive, remove the shipping fixture, plastic dust shield (if any), and packing disk from the new drive. Install the new drive in the customer's original drive shield.

**Note:** Before you install a replacement drive, remove the dust shield, if there is one.





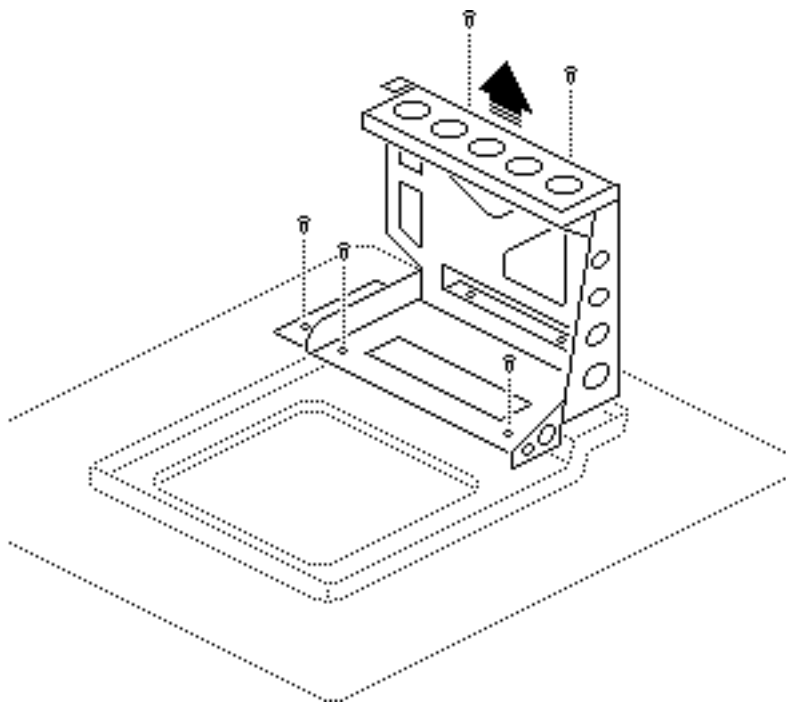
## Chassis

Before you begin,

- Remove the cover
- Discharge the CRT
- Remove the logic board
- Remove the Power/Sweep board
- Remove the floppy drive

**⚠ 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.





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

Remove the five mounting screws and lift the chassis off the bezel.





Upgrades  

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Macintosh



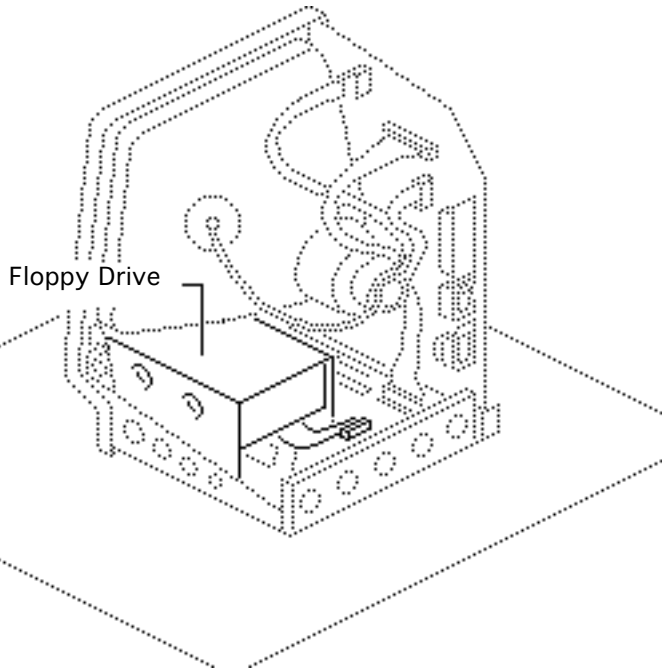


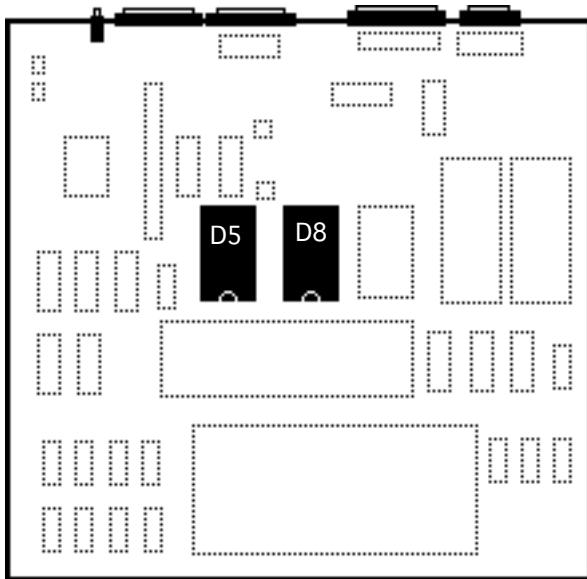
## Floppy Drive Upgrade Kit

Before you begin,

- Remove the cover
- Discharge the CRT
- Remove the logic board

**⚠ 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.

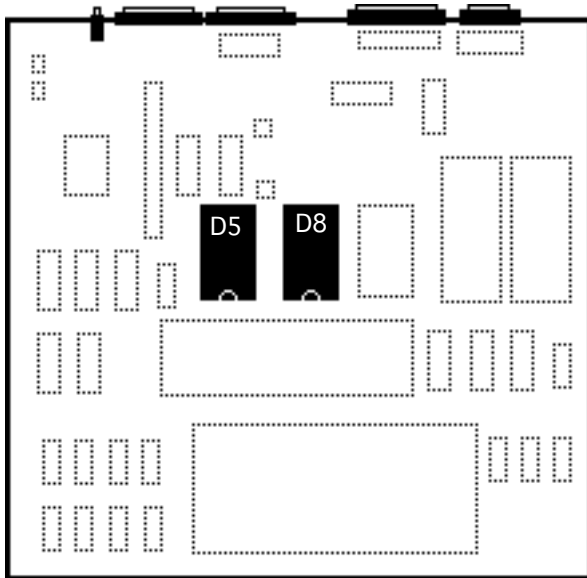




**⚠ Warning:** Never use a grounding wriststrap until after discharging the CRT.

**Note:** This kit replaces the 400K floppy drive on a 512K Macintosh with an 800K floppy drive. The kit contains the new drive and two new ROMs for the logic board. The new ROMs support both the 400K and the 800K drives. This upgrade is not recommended for the 128K Macintosh.





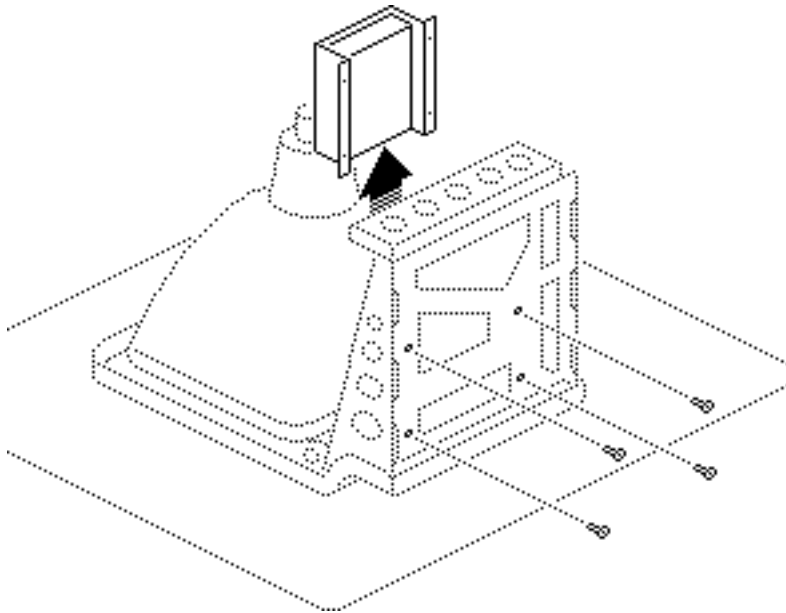
- 1 Using an IC extractor, remove the old ROMs from locations D5 and D8.
- 2 Install the two new ROMs as follows:
  - ROM HI at location D5
  - ROM LOW at location D8

**Note:** Be sure that the notched ends of the ROMs face the front of the computer.





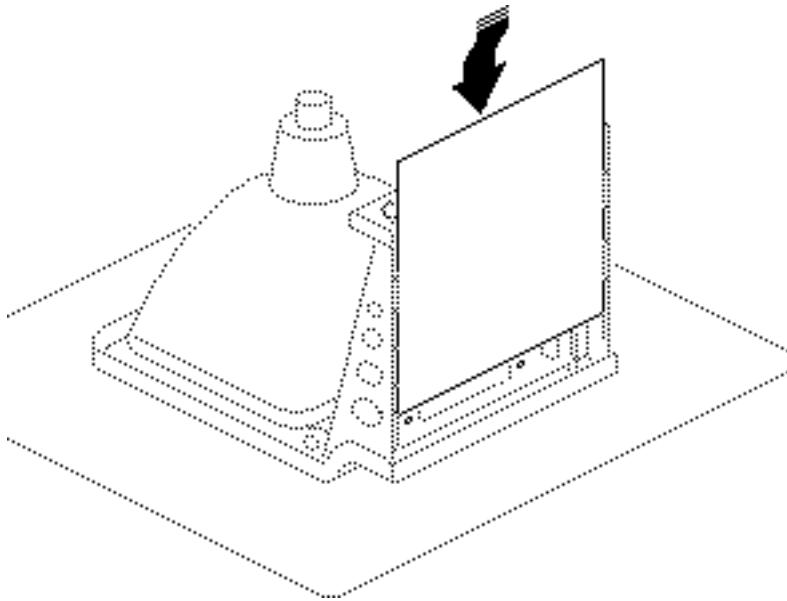
- 3 Remove the floppy drive. Refer to “Floppy Drive” in the Take Apart chapter.

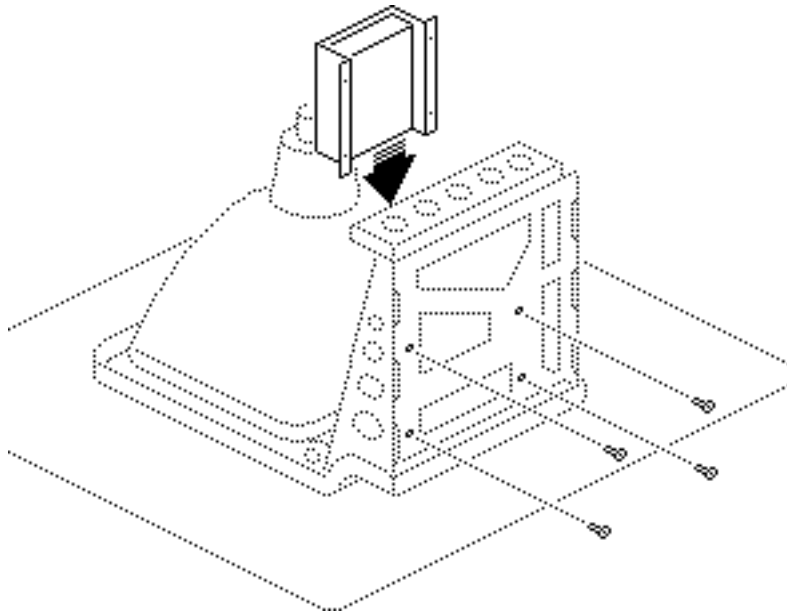






- 4 Reinstall the logic board.  
See “Logic Board” in  
the Take Apart chapter.





- 5 Install the new 800K floppy drive. See “Floppy Drive” in the Take Apart chapter.
- 6 Return the old ROMs and the 400K drive to Apple (refer to the instructions in the kit).



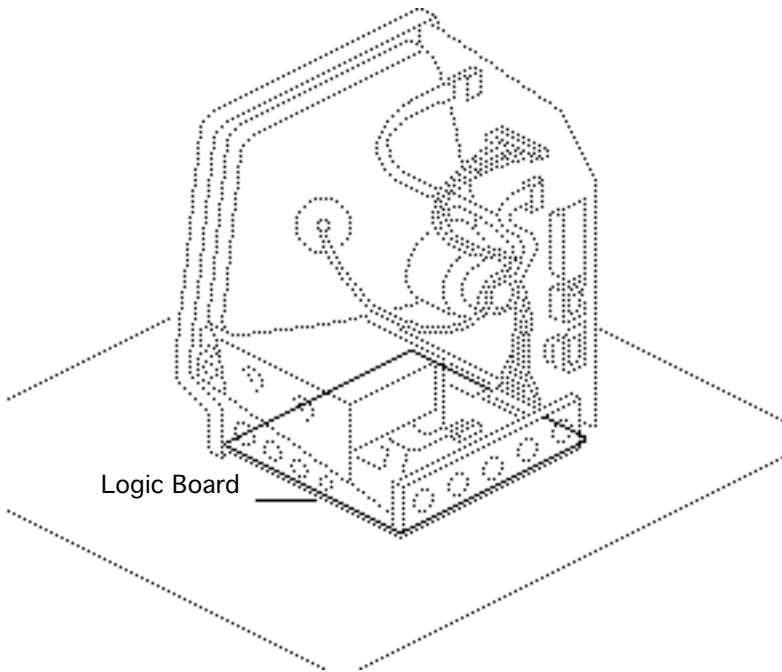


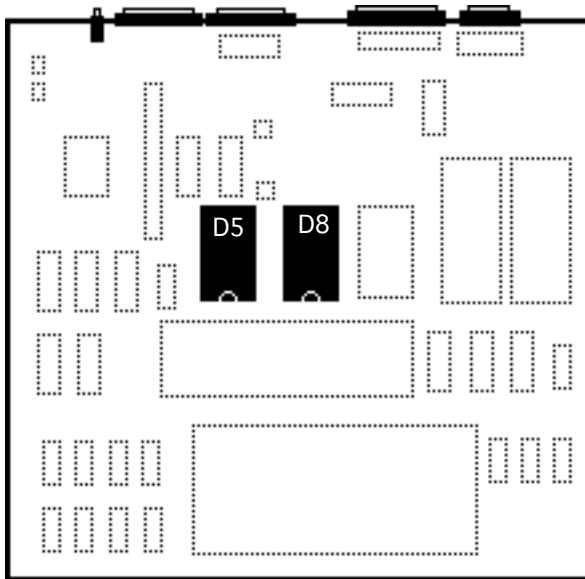
## Logic Board Upgrade Kit

Before you begin,

- Remove the cover
- Discharge the CRT
- Remove the logic board

**⚠ 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.

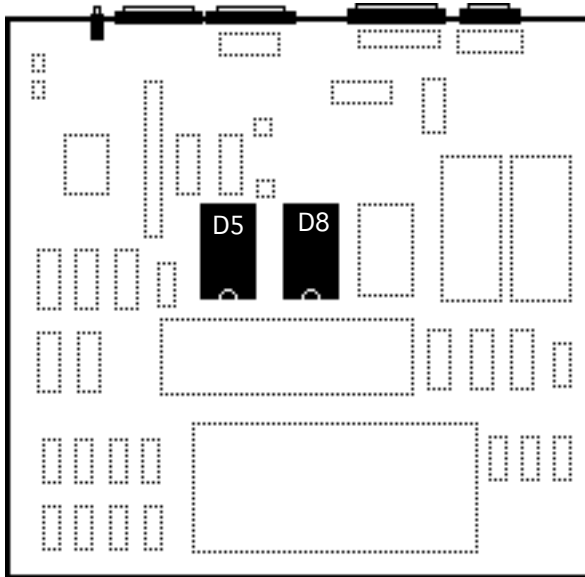




**⚠ Warning:** Never use a grounding wriststrap until after discharging the CRT.

**Note:** This kit cannot be installed unless the Floppy Drive Upgrade Kit has been installed. The Logic Board Upgrade Kit upgrades the logic board of a 512K Mac to a Mac Plus. The kit contains a new logic board with 1 MB of RAM, an RFI shield, and a new rear cover.

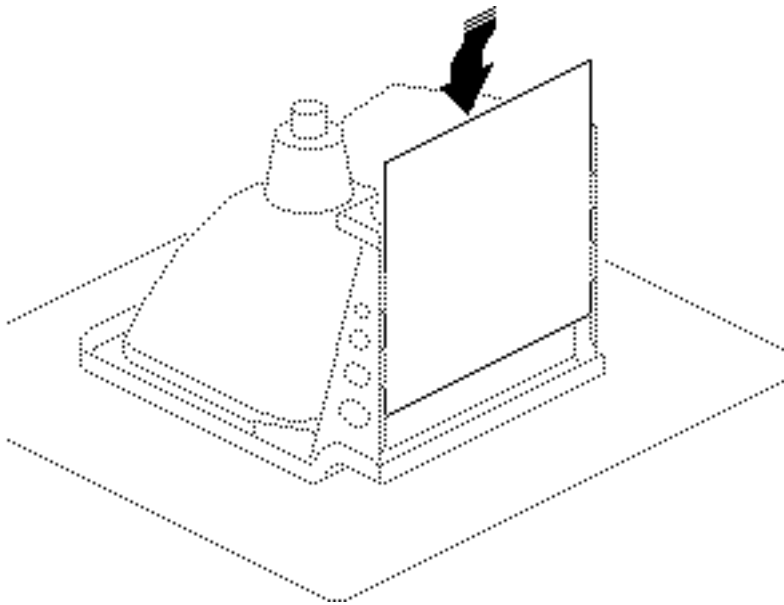




- 1 Using an IC extractor, remove the ROMs from locations D5 and D8 on the 512K logic board.
- 2 Install the two ROMs in the new logic board:
  - ROM HI at location D5
  - ROM LOW at location D8

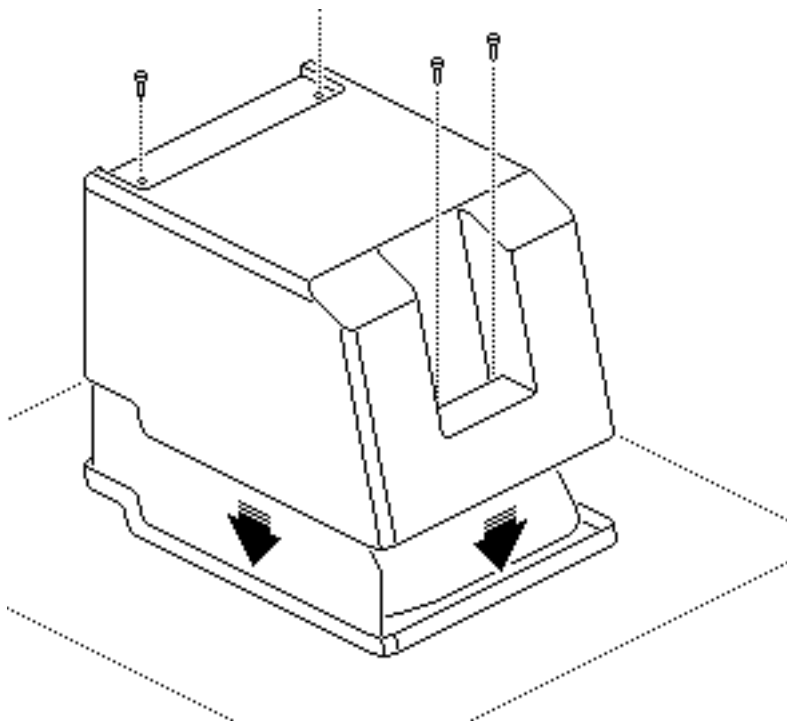
**Note:** Be sure that the notched ends of the ROMs face the front of the computer.





- 3 Install the new logic board in the computer. See “Logic Board” in the Take Apart chapter.





- 4 Install the new RFI shield.
- 5 Install the new cover. See “Cover” in the Take Apart chapter.
- 6 Return the old logic board, old RFI shield, and old cover to Apple.



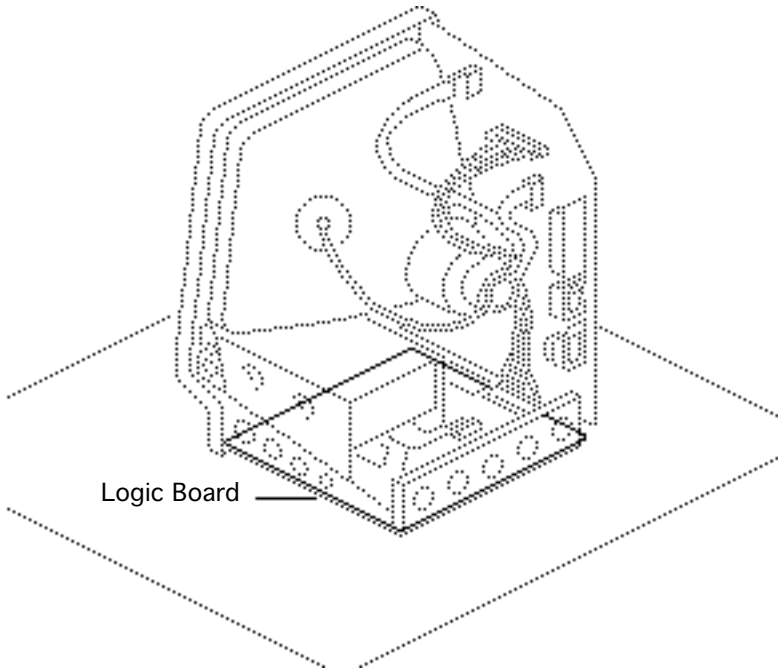


## 400K Drive ROM Upgrade

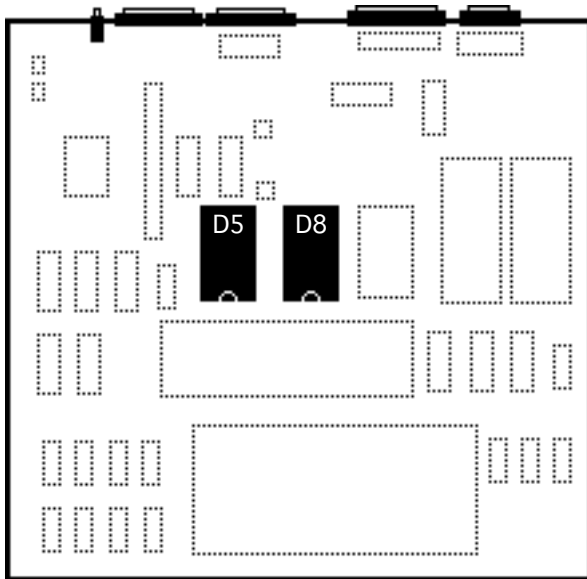
Before you begin,

- Remove the cover
- Discharge the CRT
- Remove the logic board

**⚠ 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.





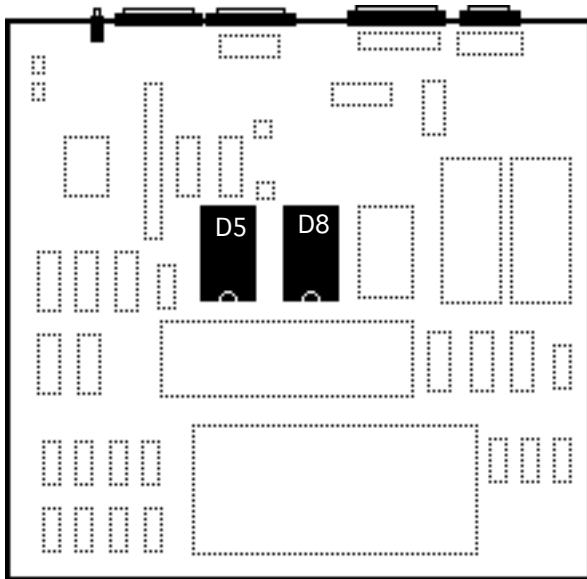


**⚠ Warning:** Never use a grounding wriststrap until after discharging the CRT.

**Note:** Current 400K drives contain a new stepper motor that requires the replacement of the two boot ROMs on the Macintosh 128K and 512K. The new ROMs are compatible with new and old stepper motors.

- 1 Using an IC extractor, remove the ROMs at locations D5 and D8.





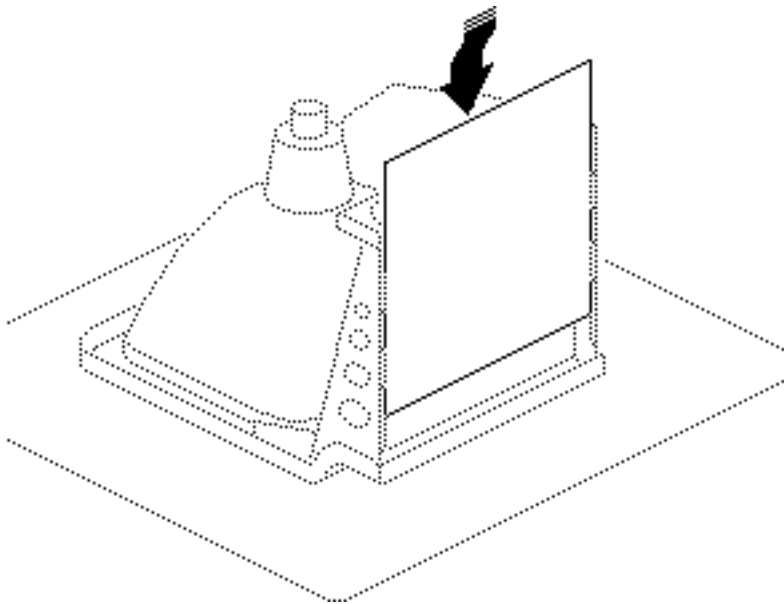
- 2 Install the two new ROMs on the logic board:
  - ROM HI at location D5
  - ROM LOW at location D8

**Note:** Be sure that the notched ends of the ROMs face the front of the computer.





- 3 Reinstall the logic board in the computer. See “Logic Board” in the Take Apart chapter.





Adjustments

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Macintosh



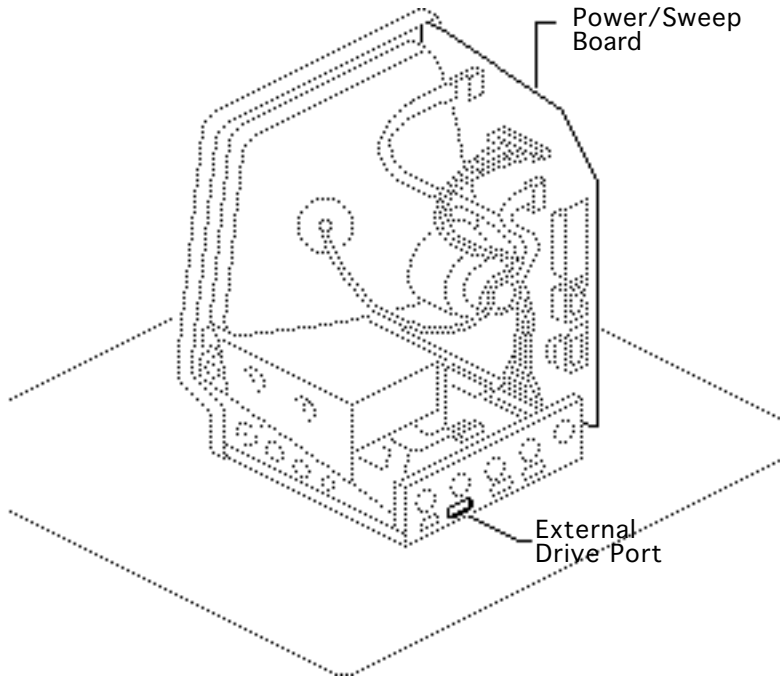


## Voltage

Before you begin, remove the cover.

**⚠ 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.

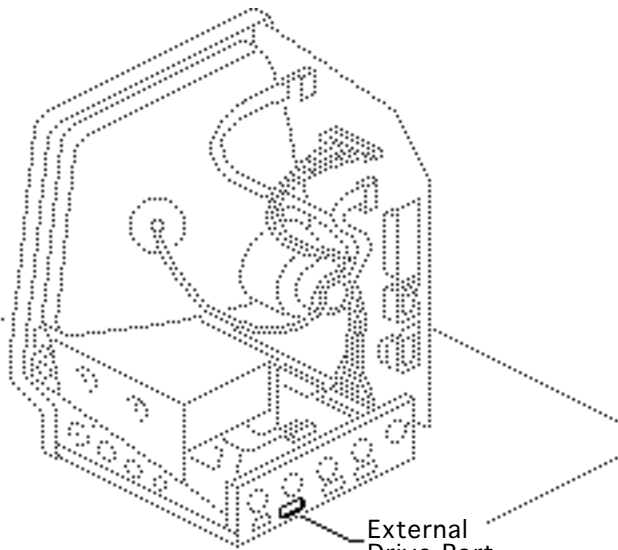




**Caution:** Because you must make voltage adjustments from the rear of the computer, use a mirror to view the computer screen. Do not reach around the computer to adjust the controls.

**Note:** You must verify voltages after you replace the logic board or the power/sweep board.



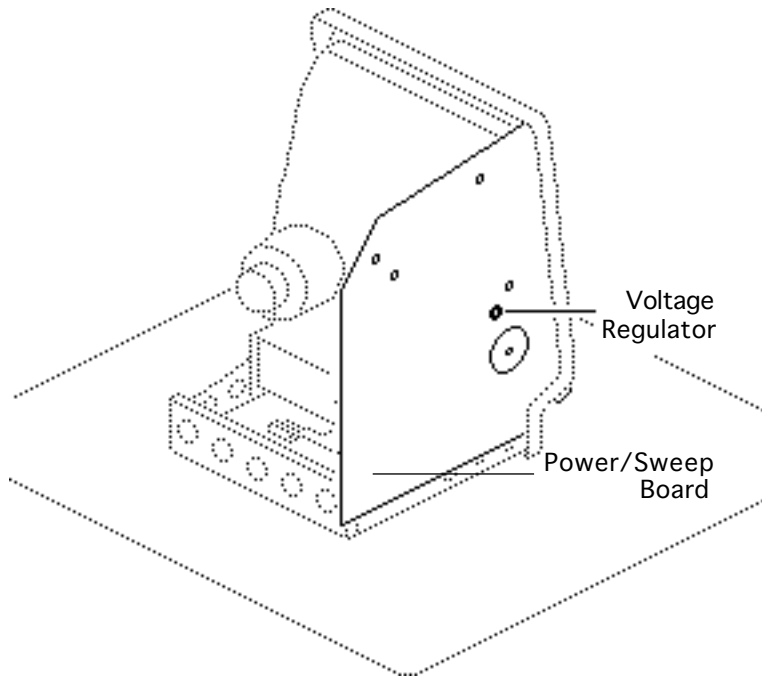


- 1 Set the voltmeter to 20 V scale.
- 2 Connect the Macintosh voltage test cable (Apple part number 077-0135) to the external drive port.

**Caution:** Shorting the test cable plugs to each other can damage the Macintosh computer. Pull the rubber hoods over the plugs.

- 3 Connect the black voltmeter test lead between the voltmeter

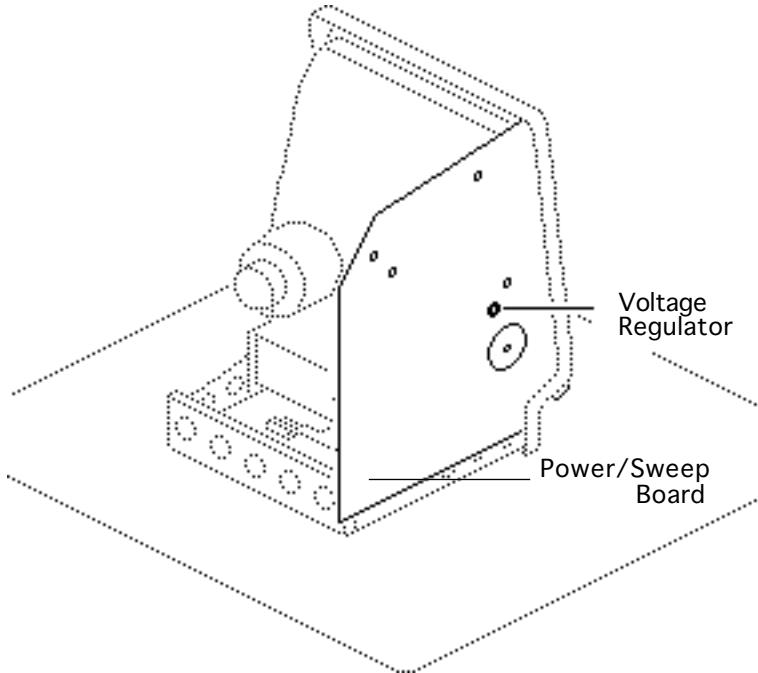




- ground terminal and the computer chassis.
- 4 Connect the orange test cable lead to the voltage input terminal on the voltmeter.
- 5 Switch on the computer.
- 6 Adjust the voltage regulator on the power/sweep board to between 11.90 V and 12.75 V.
- 7 Switch off the power.
- 8 Disconnect the orange test lead and pull the insulated hood over the plug.

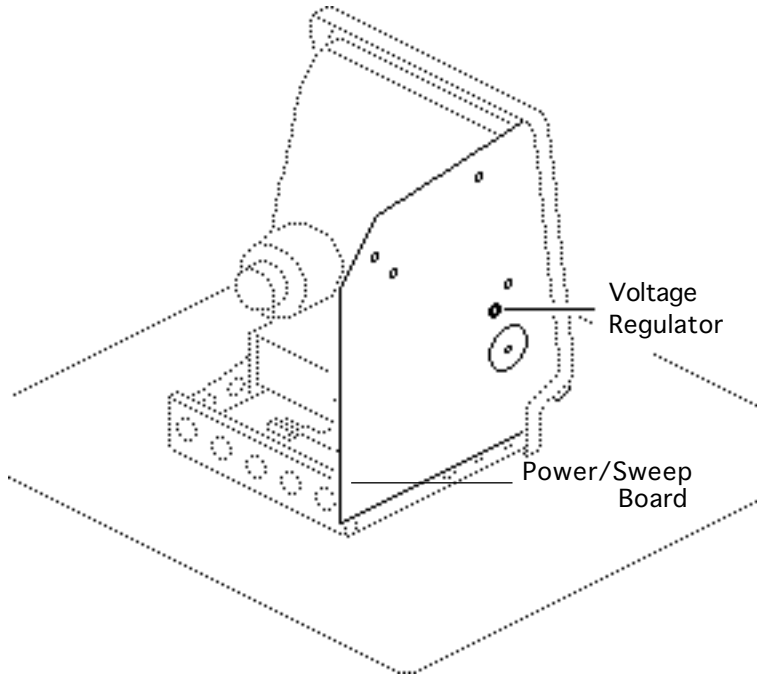






- 9 Connect the red test cable lead to the voltage input terminal on the voltmeter.
- 10 Switch on the computer.
- 11 Adjust the voltage regulator on the power/sweep board to between 4.85 V and 5.15 V.

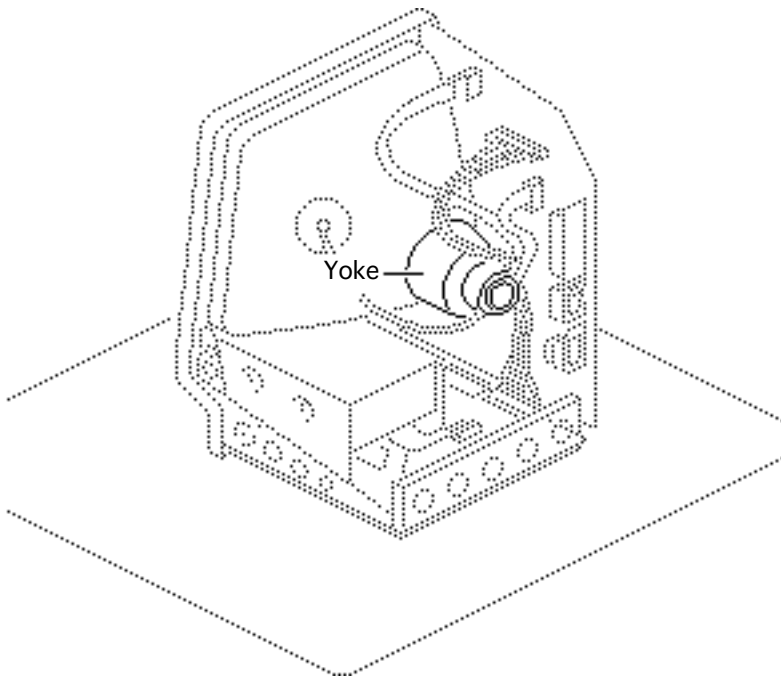




- 12 Switch off the power.
- 13 Disconnect the red test lead
- 14 and pull the insulated hood over the plug.
- 15 Repeat the tests to verify that both voltages are within the specified tolerances.

**Note:** If the power/sweep board will not adjust so that both voltages fall within tolerance, replace the board.





## Yoke

Before you begin,

- Remove the cover
- Discharge the CRT

**⚠ 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.





**Caution:** 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 the controls.

**Note:** If you replace the CRT, you may need to adjust the yoke.

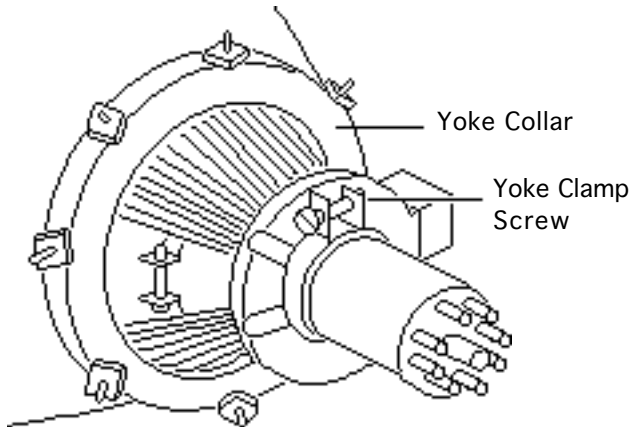


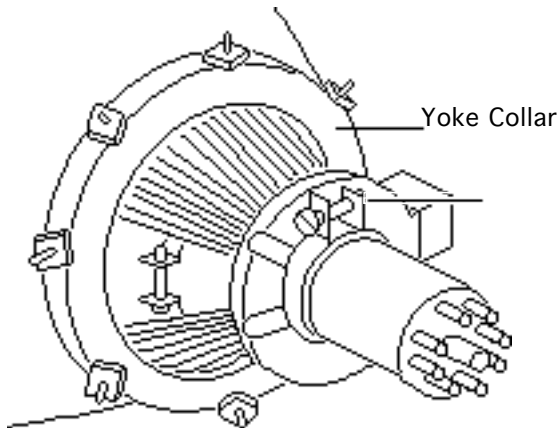


## Tilt Adjustment

**Note:** If glue holds the yoke collar in place, use an art knife to cut through the glue.

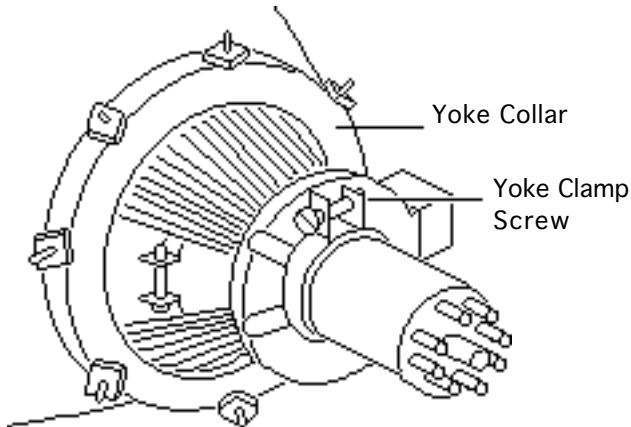
- 1 Loosen the yoke clamp screw two or three turns.
- 2 Switch on the computer.





- 3 With one hand, grasp the plastic spokes of the yoke collar and rotate the yoke collar 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 **Caution:** Do not overtighten the yoke clamp screw.

Hold the plastic collar in position and slowly tighten the yoke clamp screw so that the collar cannot slip.





- 7 Replace the cover and switch on the computer.
- 8 Make sure the top and bottom edges of the picture are parallel with the top and bottom of the bezel.





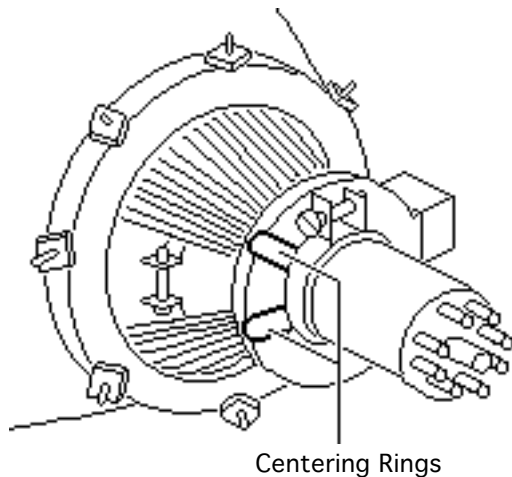


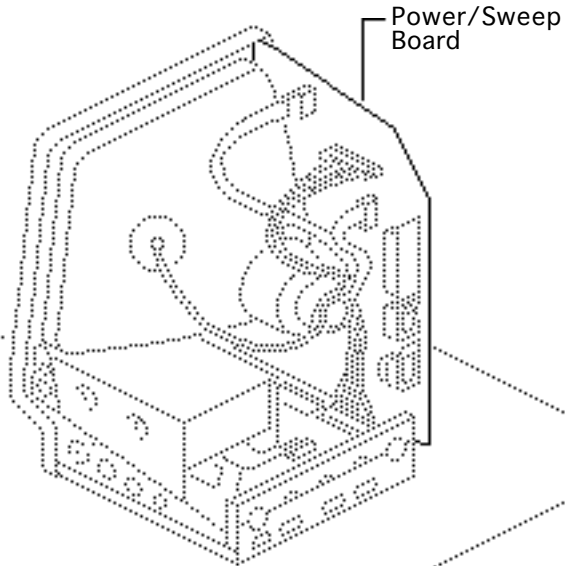
## Centering Ring Adjustment

- 1 Turn off the computer and remove the cover.
- 2 Turn on the computer

**Note:** If glue holds the yoke collar in place, use an art knife to cut through the glue.

- 3 To center the picture, hold the front centering ring steady and move the rear ring. Then hold the rear centering ring steady and move the front ring.





## Video

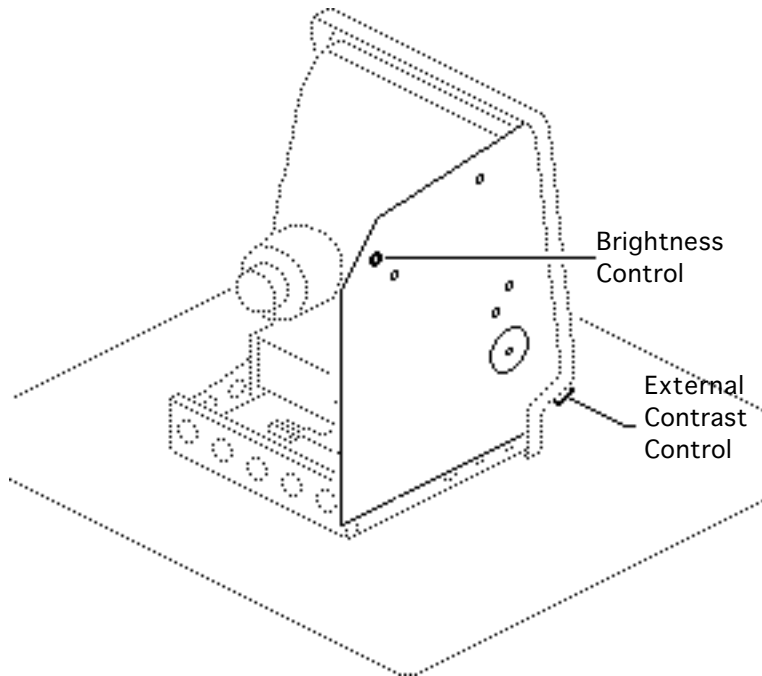
Before you begin, remove cover.

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

**Note:** You must perform the video adjustments whenever the CRT or the power/sweep board is replaced.

Switch on the computer.

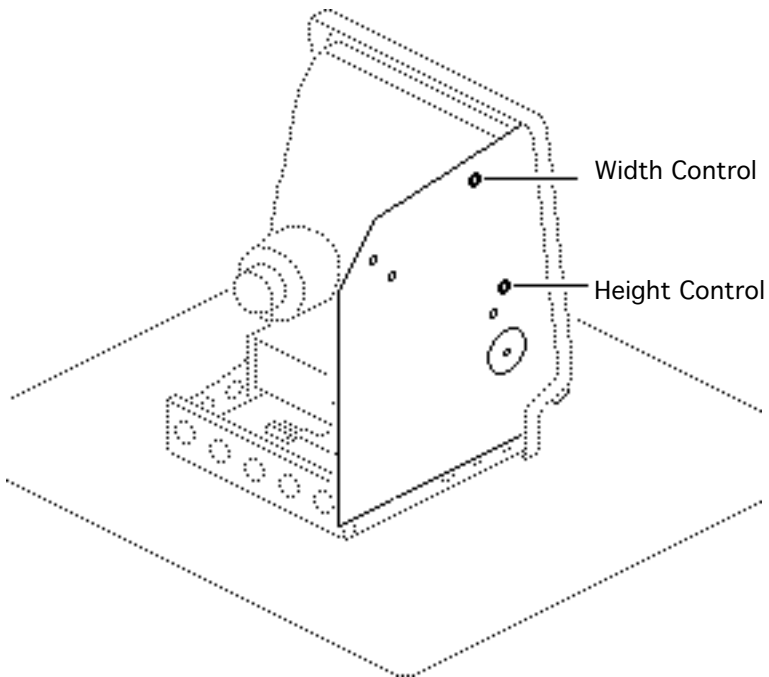




## Contrast and Brightness

- 1 Turn the external contrast control fully clockwise.
- 2 Turn the brightness control fully counterclockwise so that white lines are visible.
- 3 Turn the brightness control clockwise until the white lines just disappear.
- 4 Turn the external contrast control  $1/8$  of a turn counterclockwise.

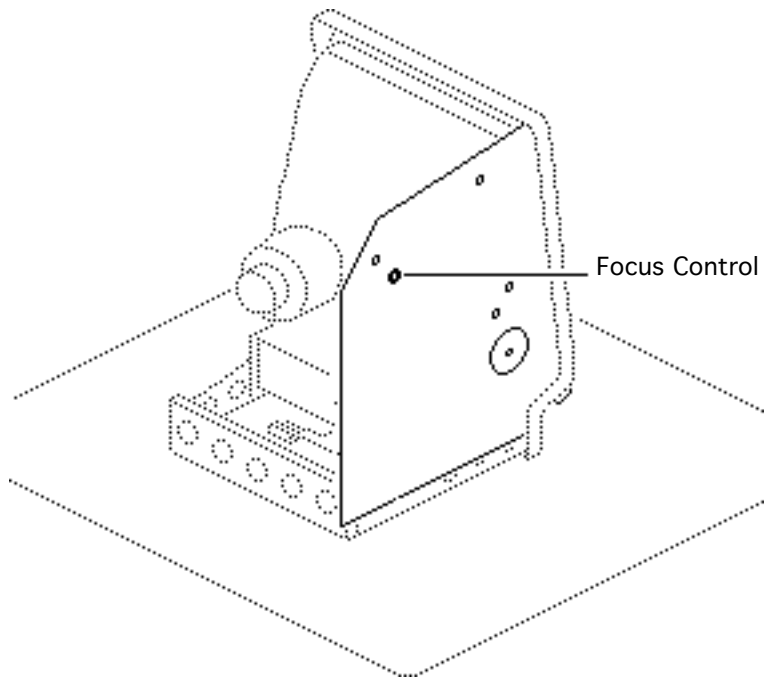




## Size Adjustment

- 1 Using an alignment tool, adjust the width control until the raster is 7 inches (177.8 mm) wide.
- 2 Using an alignment tool, adjust the height control until the raster is 4.7 inches (119.4 mm) high.





## Focus Adjustment

- 1 Turn the focus control clockwise to its limit.
- 2 Turn the focus control counterclockwise 1/8 of a turn.





Exploded View

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Macintosh





# Exploded View

