Macintosh

Basics

Macintosh

Figure: Macintosh 128k/512K

Overview

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

Specifications

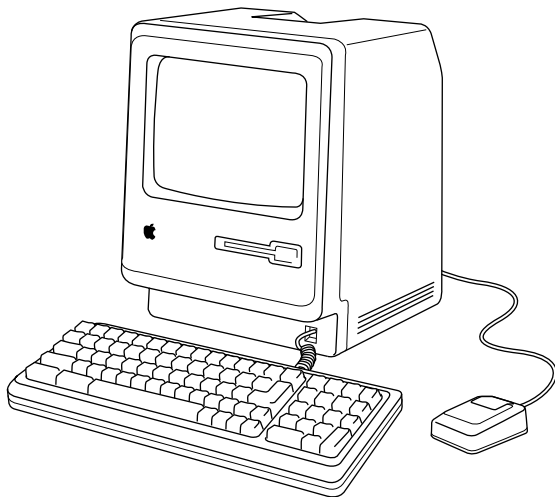Macintosh

Processor

CPU   Motorola 68000 microprocessor
                           7.83 MHz
                           32-bit internal data bus

Memory

RAM	128K or 512K
ROM	64K
PRAM	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

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/sweep 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/sweep 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 ∑∑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

1 Connect mouse.
2 Replace mouse.
3 Replace logic board. Retain customer's SIMMs.

Cursor moves, but
clicking mouse
produces no response

1 Replace mouse.
2 Replace logic board. Retain customer's SIMMs.

No response to any
key on keyboard

1 Replace keyboard cable.
2 Replace keyboard.
3 Replace logic board. Retain customer's SIMMs.

No response from a
particular key

1 Replace keyswitch.
2 Replace keyboard.
3 Replace logic board. Retain customer's SIMMs.

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/sweep board may damage
   new power/sweep board. Replace power/sweep 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/sweep board.
4 Replace logic board. Retain customer's SIMMs.

Miscellaneous **(Continued)**

Smoke/odor issues
from the Macintosh

Caution: Replacing only power/sweep board may damage new
power/sweep board. Replace power/sweep 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/sweep board may damage
    new power/sweep board. Replace power/sweep 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.

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.
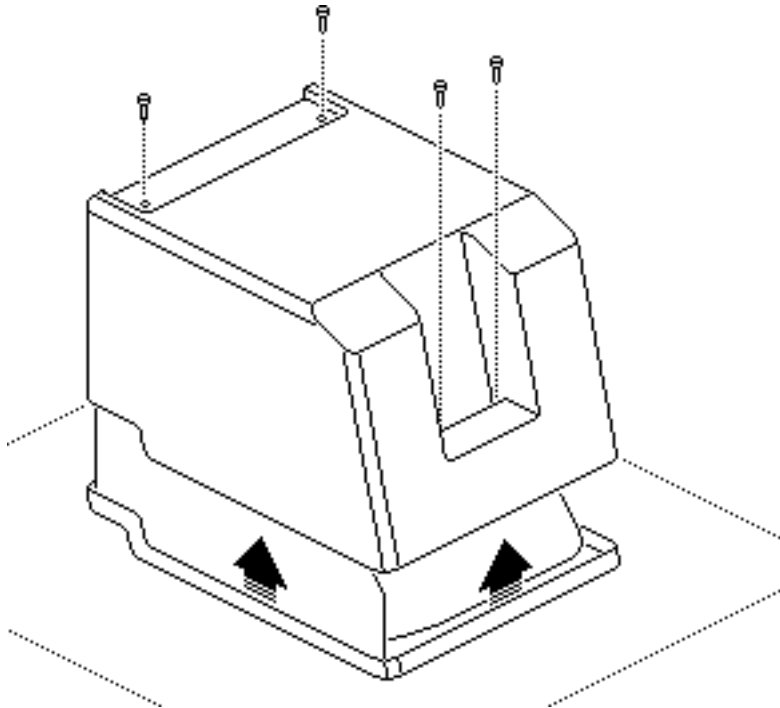
3   Using a Torx screwdriver, remove the four case screws.

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.

RFI Shield

Ground Lug

Anode Cap

Discharge Tool
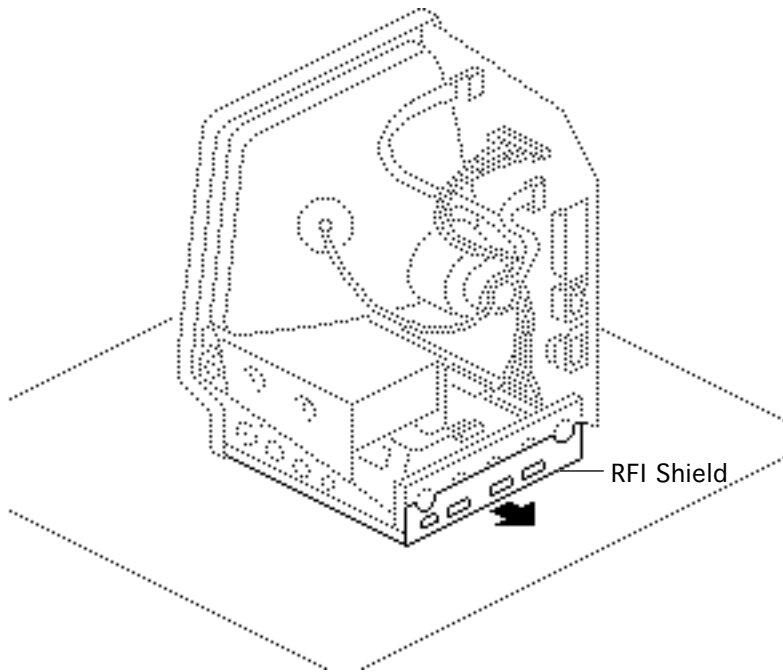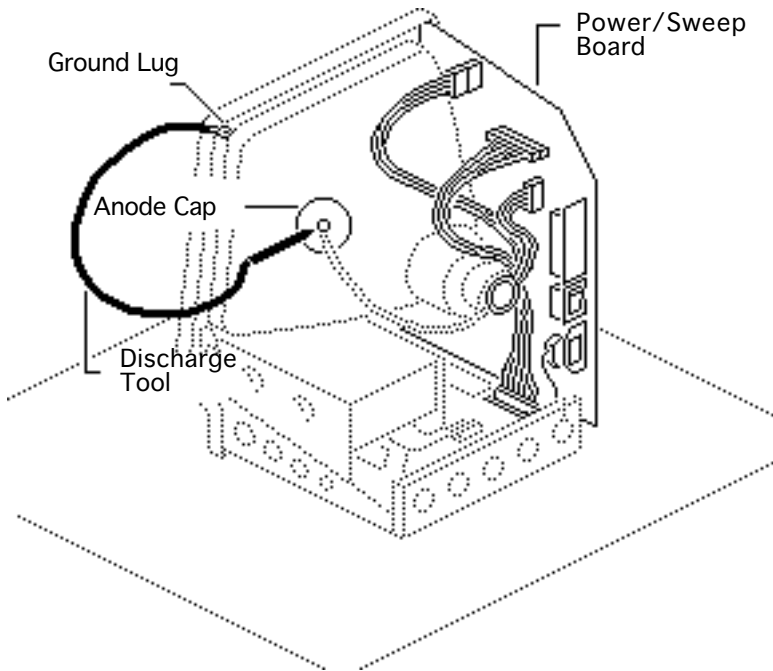
Power/Sweep Board

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.
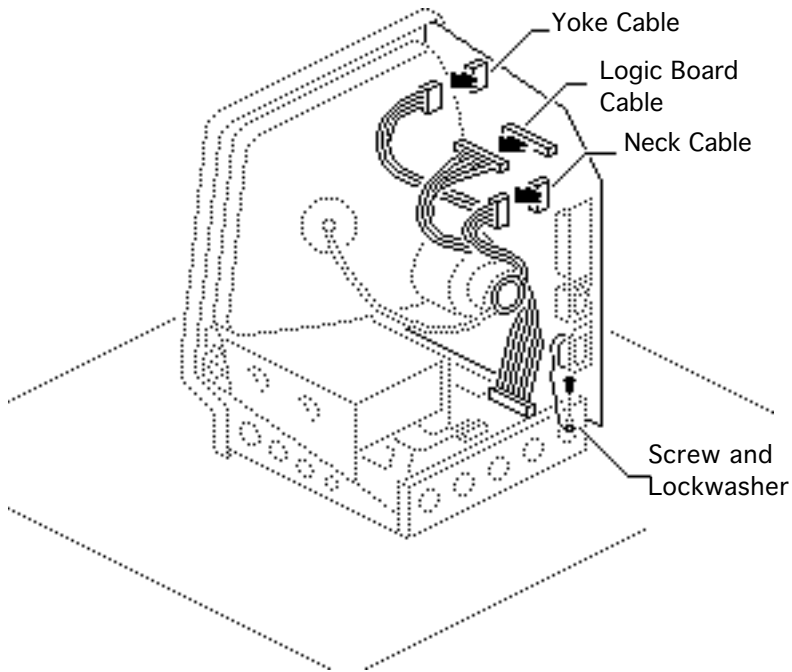
Yoke Cable

Logic Board Cable

Neck Cable

Screw and Lockwasher

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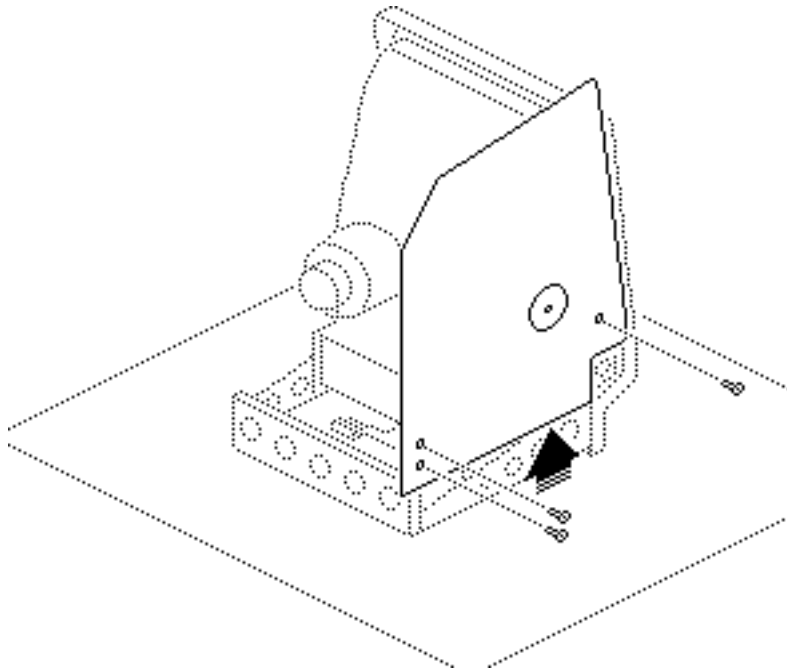
3 **Note:** You may need to remove the insulating paper from the power/sweep board to access the mounting screws.

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

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.

Logic Board Cable
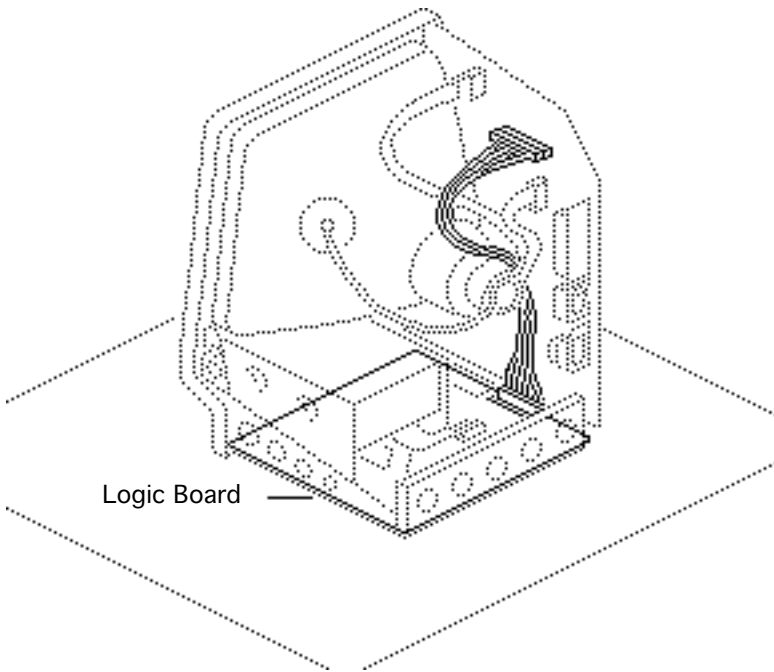
Floppy Drive Cable

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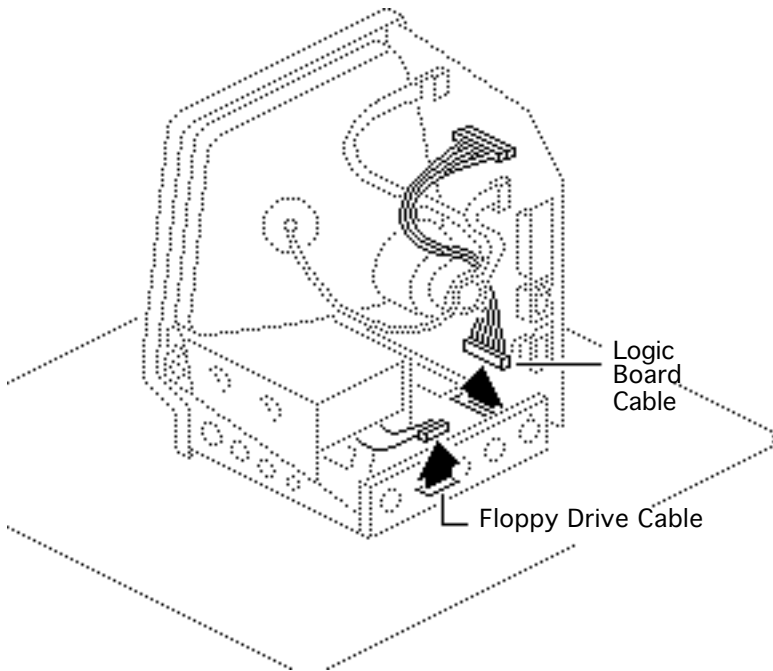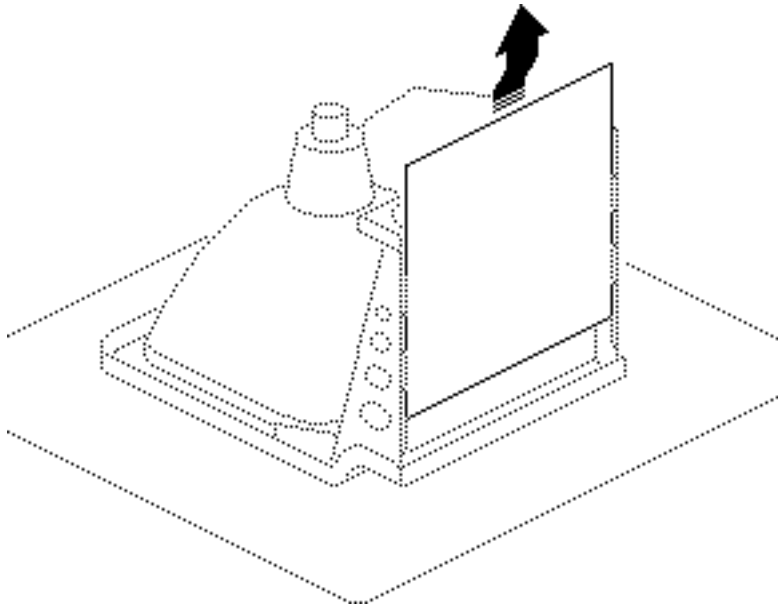
2 **Caution:** When removing the logic board, be careful not to damage the SIMMs — especially the larger DIP SIMMs that may be installed on the board.

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.
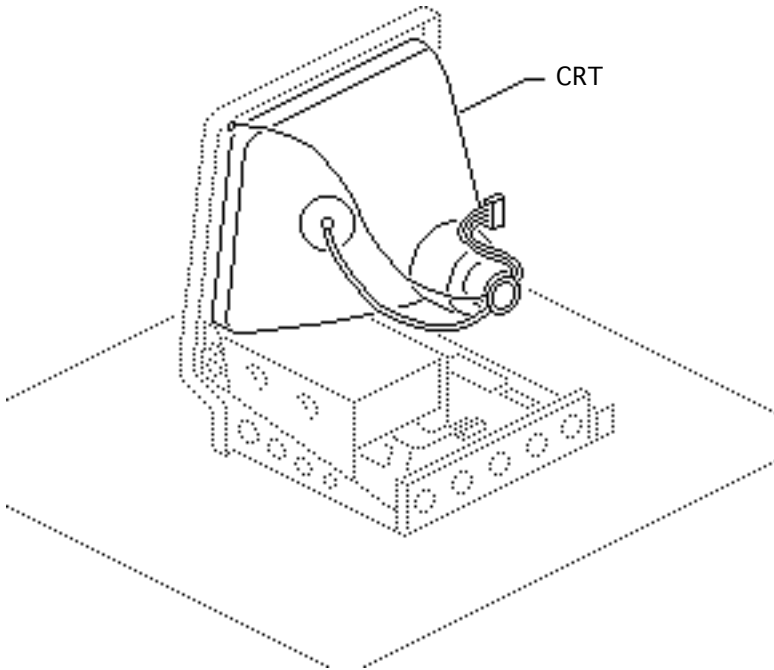
CRT

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.
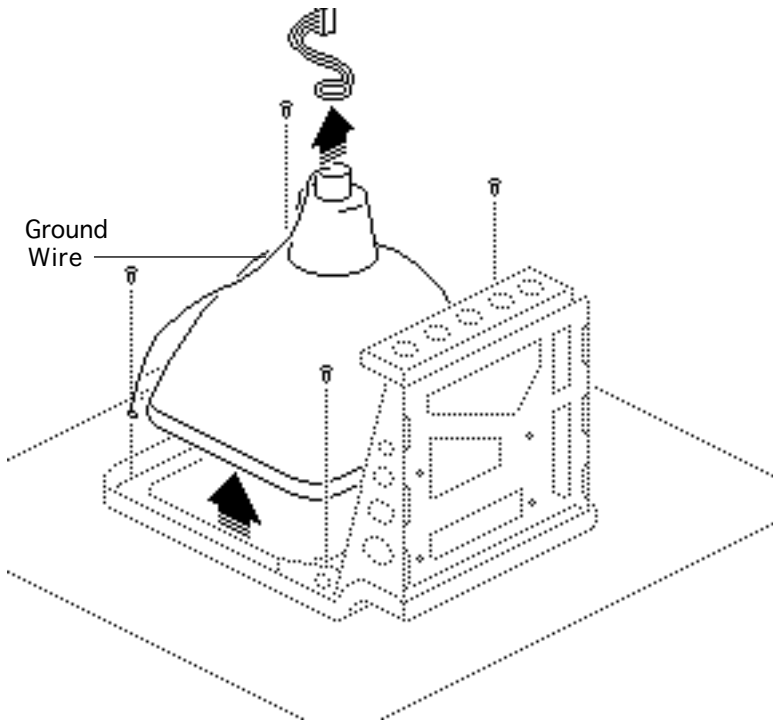
Ground
Wire

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.
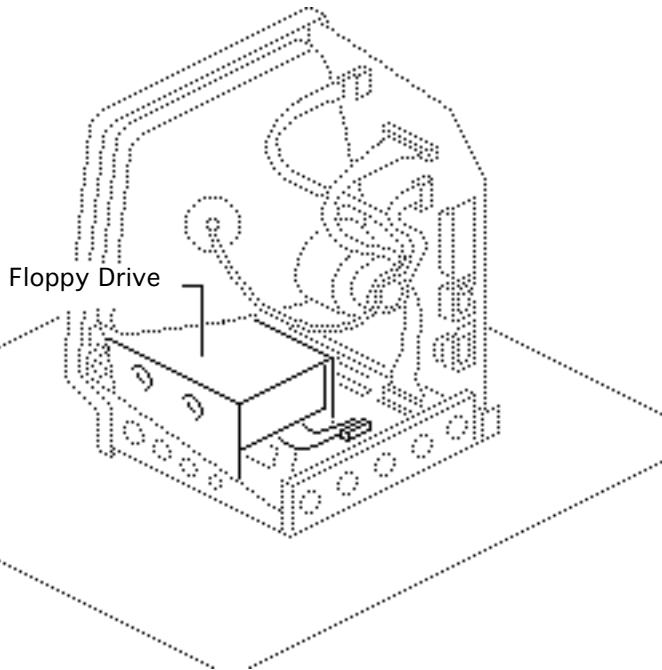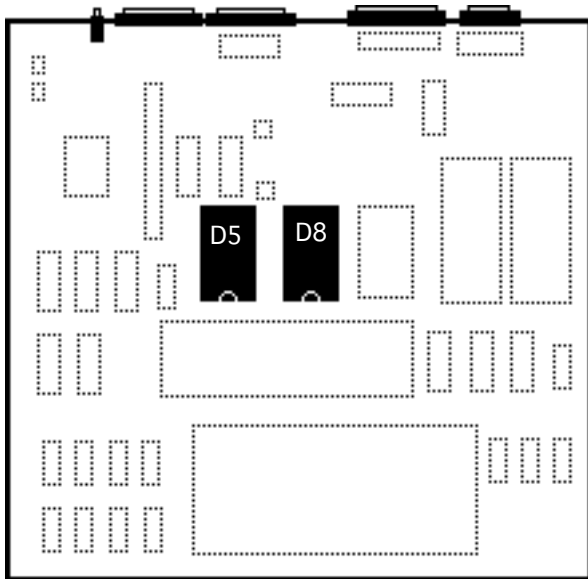
Floppy Drive

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.

Floppy Drive
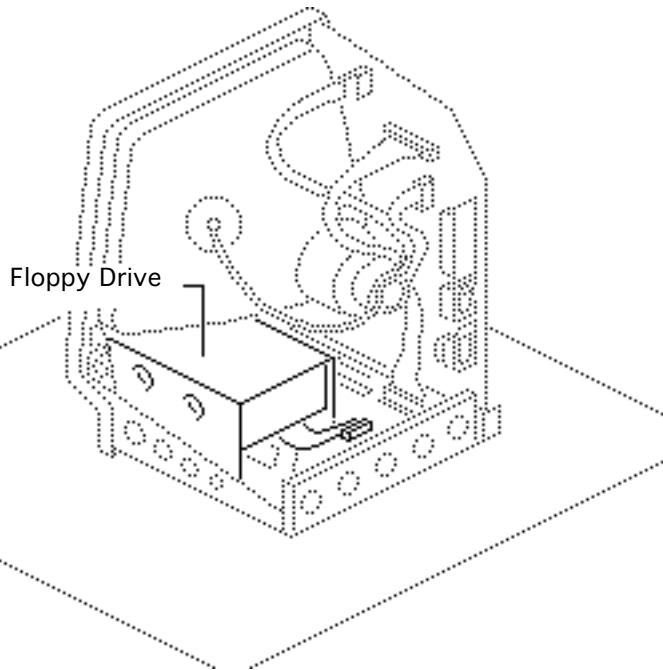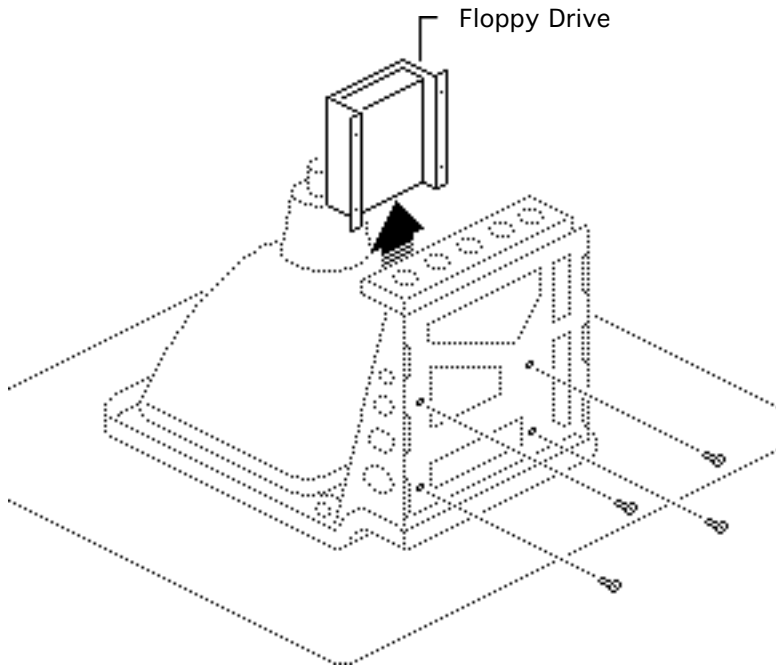
Floppy Drive

⚠ 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.
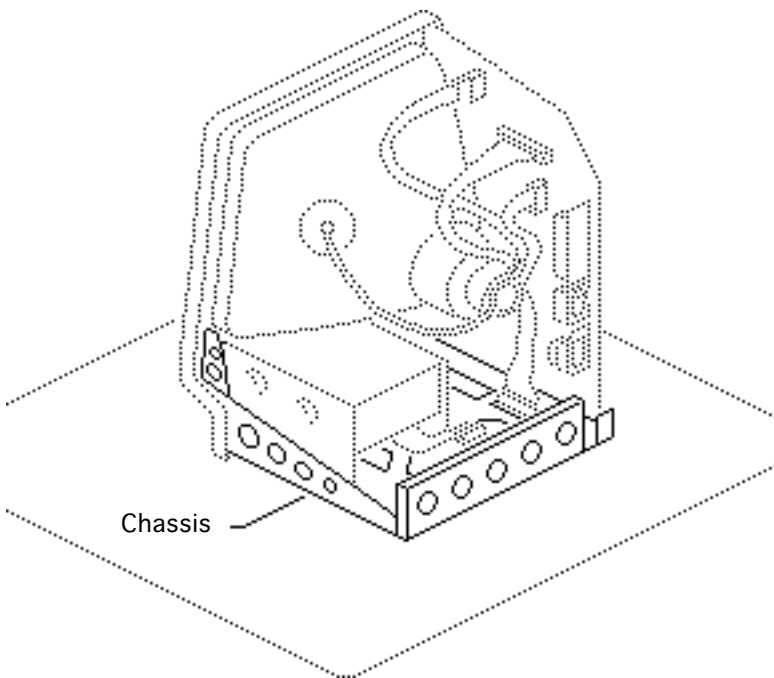
Chassis

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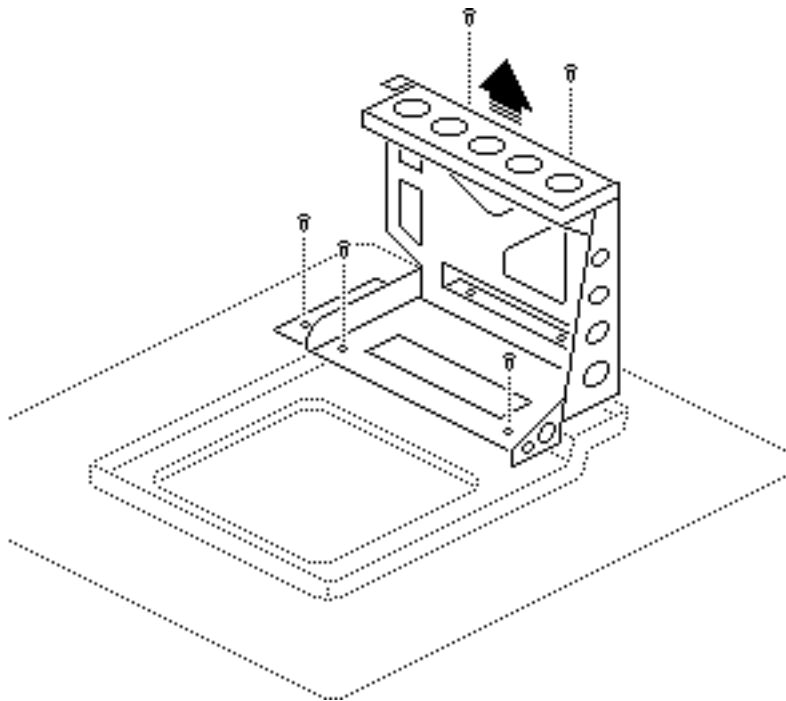
Warning: Never use a grounding wriststrap until after discharging the CRT.

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

Upgrades

Macintosh

Floppy Drive

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.
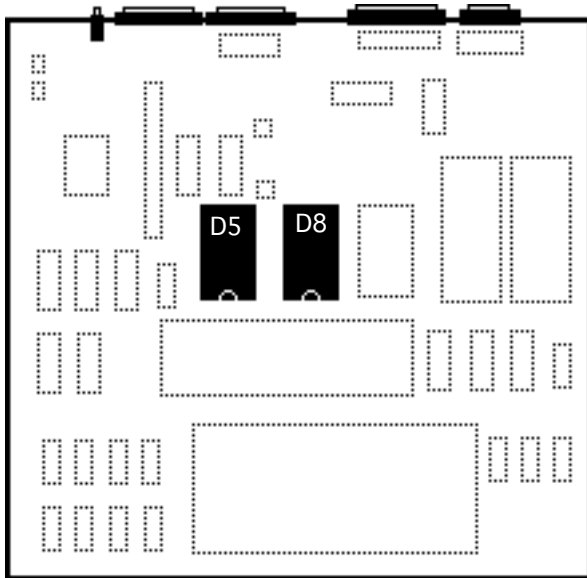
1 Using an IC extractor, remove the old ROMs from locations D5 and D8.

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.
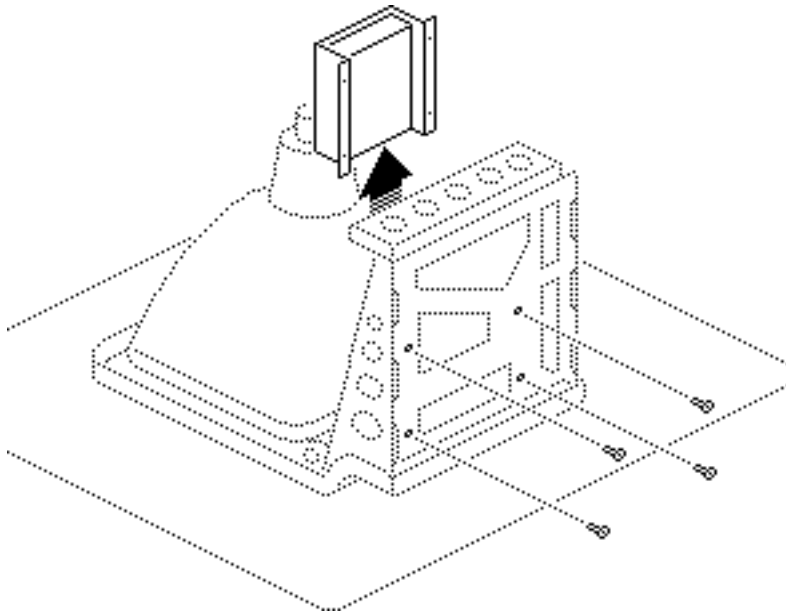
4 Reinstall the logic board.
See "Logic Board" in
the Take Apart chapter.
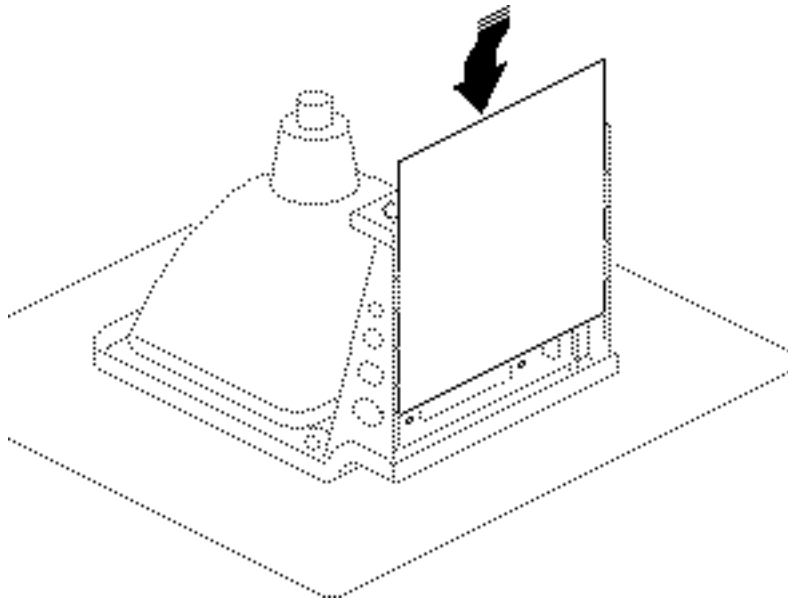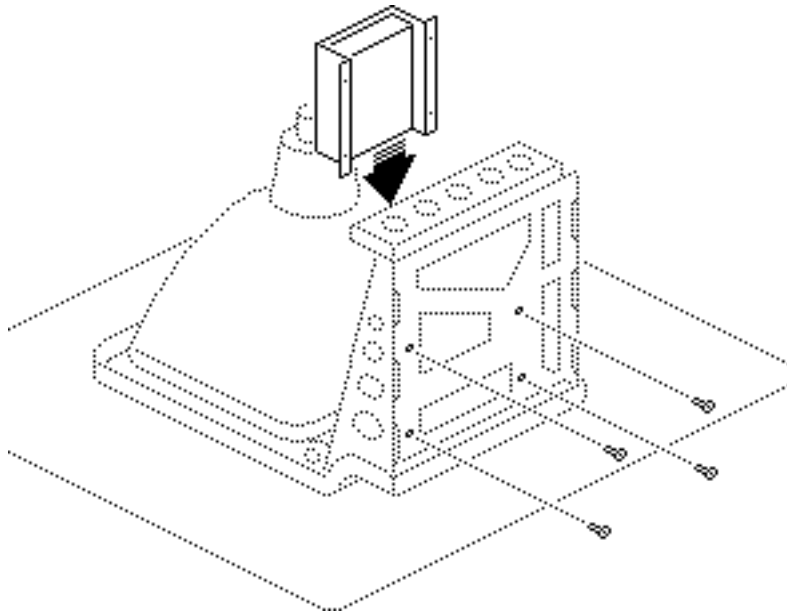
5 Install the new 800K floppy drive. See "Floppy Drive" in the Take Apart chapter.

6 Return the old ROMs and the 400K drive to Apple (refer to the instructions in the kit).
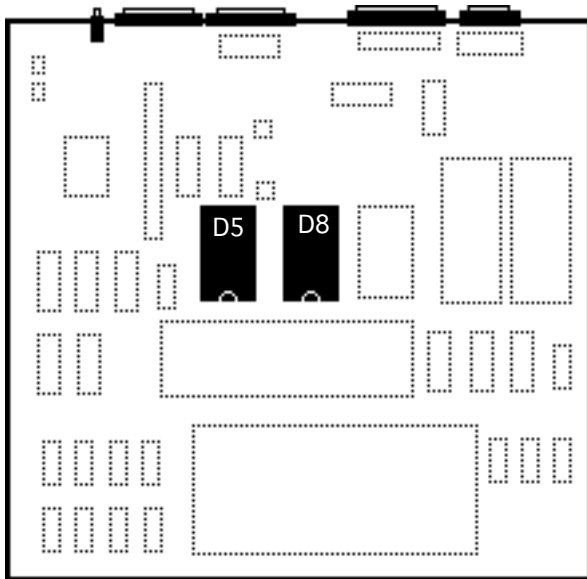
Logic Board Upgrade Kit

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.
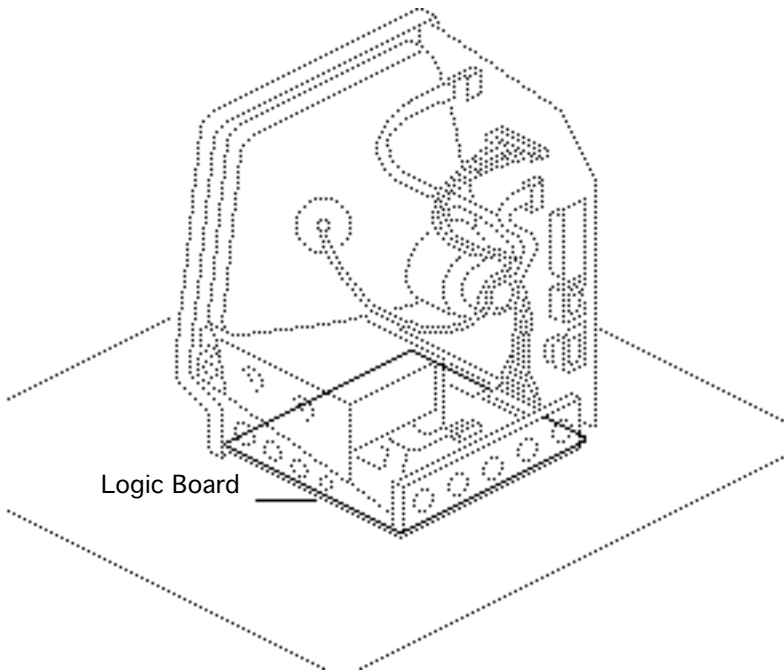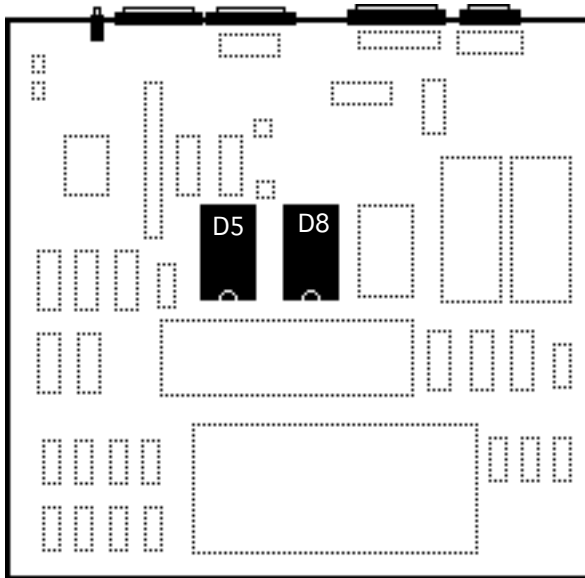

Logic Board

⚠ 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.
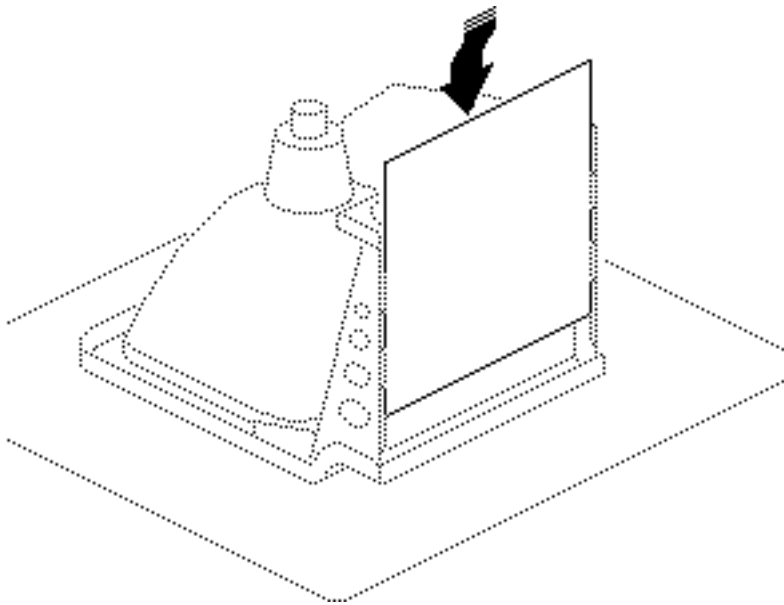
1 Using an IC extractor, remove the ROMs from locations D5 and D8 on the 512K logic board.

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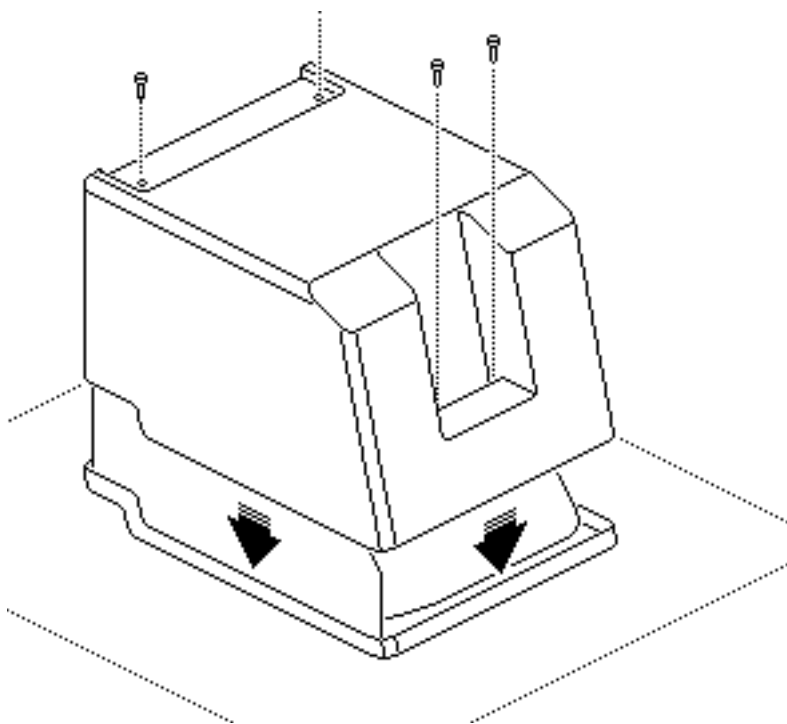 • ROM HI at location D5
  • ROM LOW at location D8

   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.
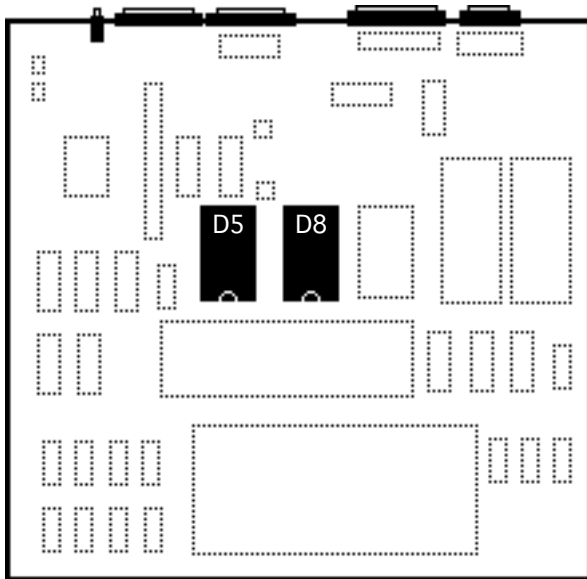
400K Drive ROM Upgrade

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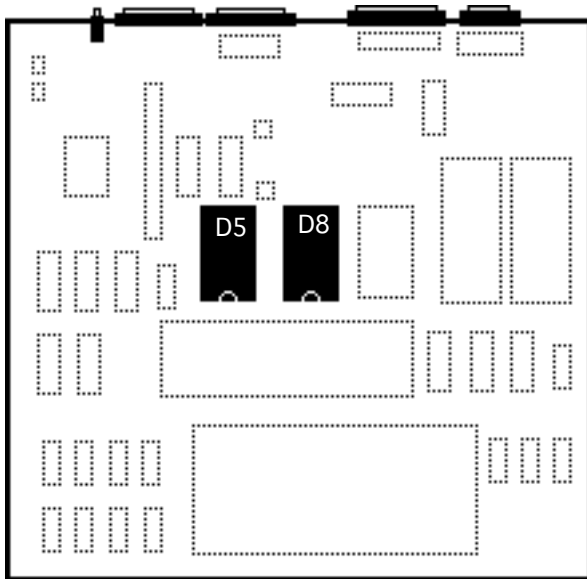
Logic Board
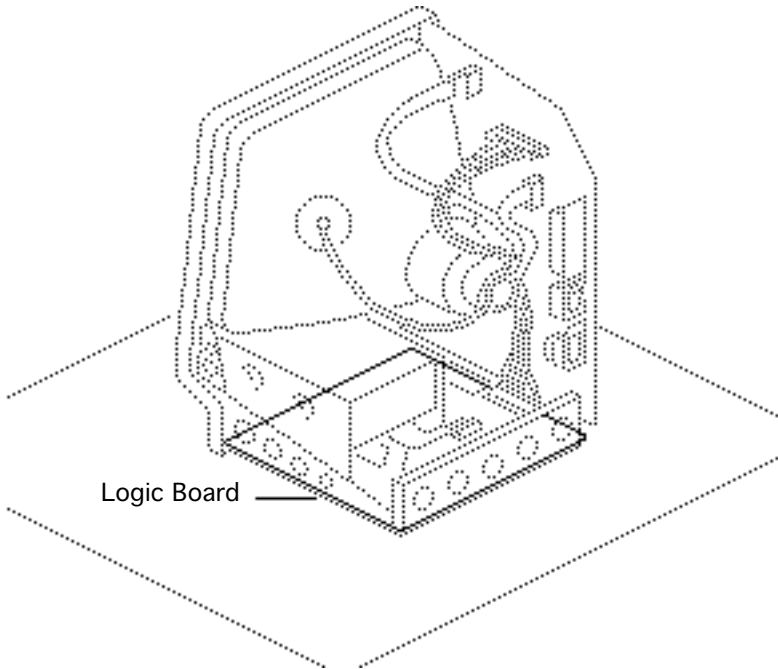
⚠ Warning: Never use a grounding wriststrap until after discharging the CRT.

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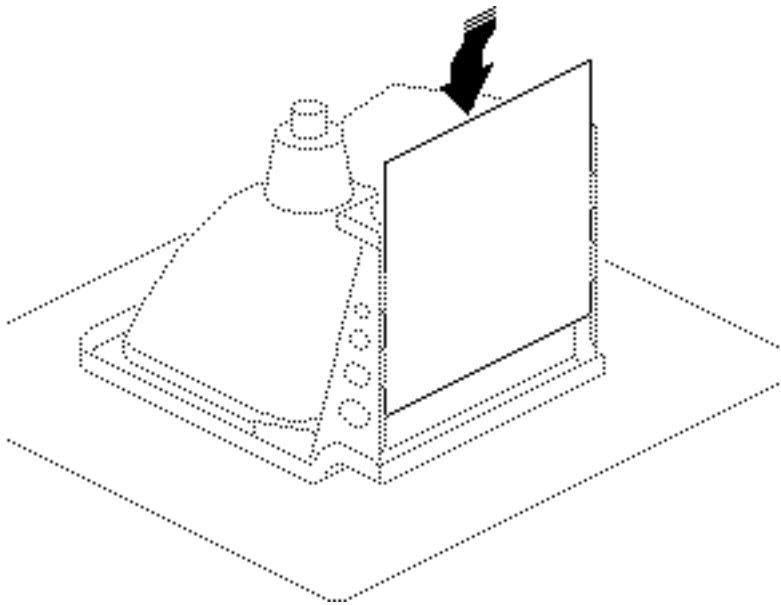
2 Install the two new ROMs
  on the logic board:
  • ROM HI at location D5
  • ROM LOW at location
    D8

  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.
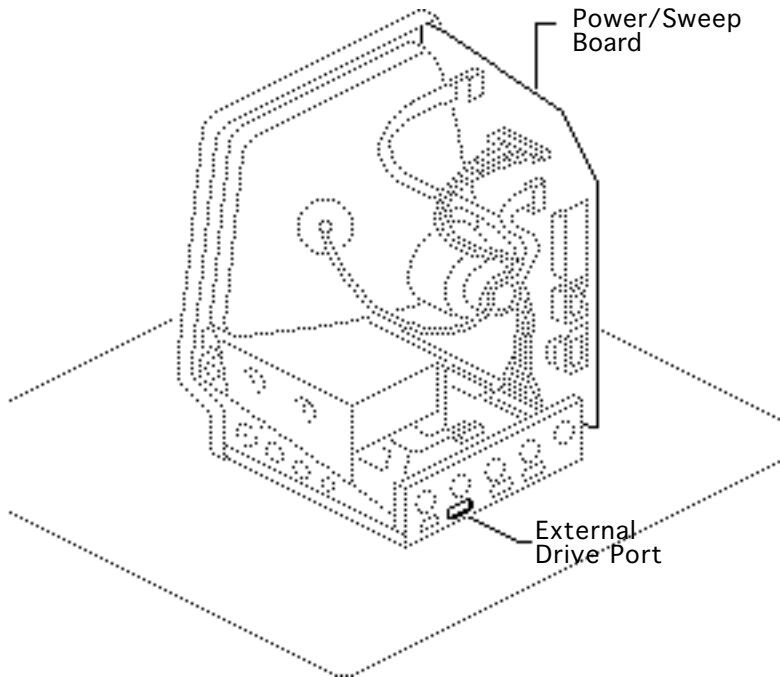
Adjustments

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.
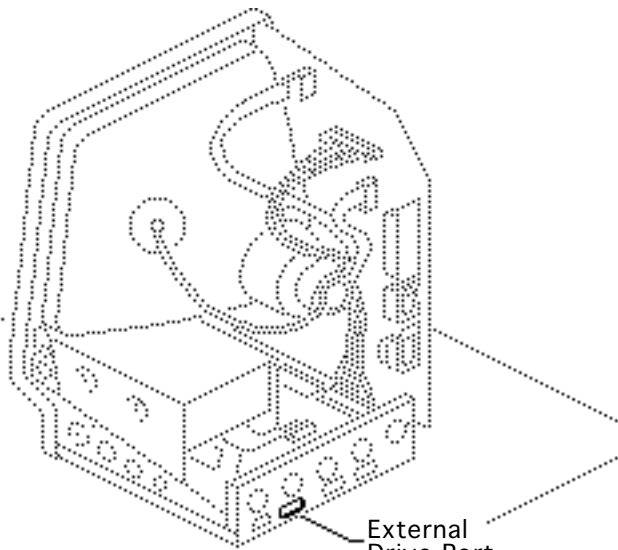
Power/Sweep
Board

External
Drive Port

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.
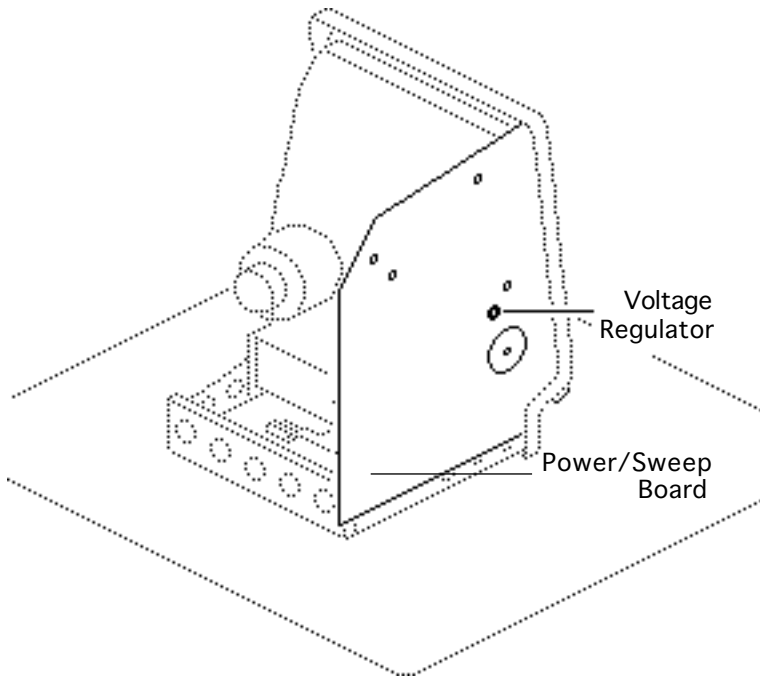
External Drive Port

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

Voltage Regulator

Power/Sweep Board

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.

Voltage Regulator
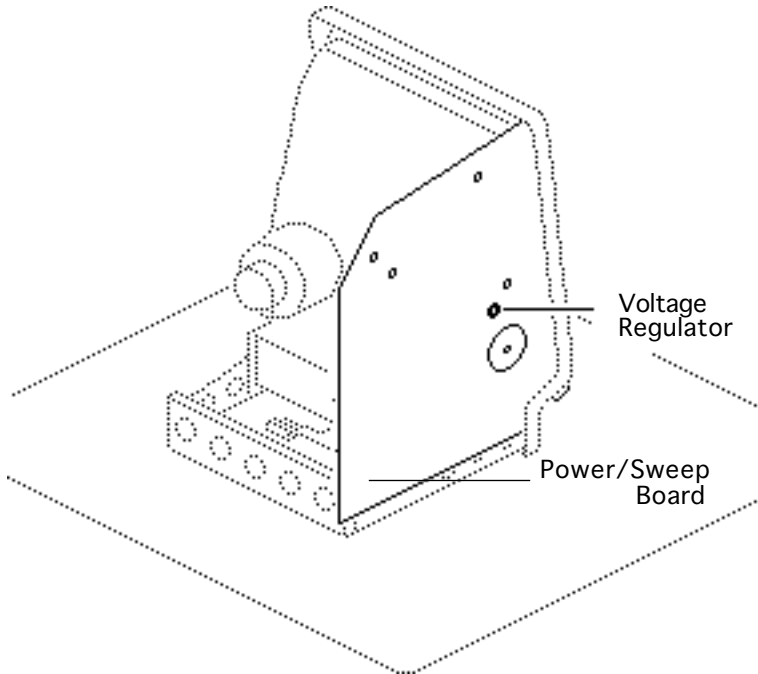
Power/Sweep Board

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.

Voltage Regulator
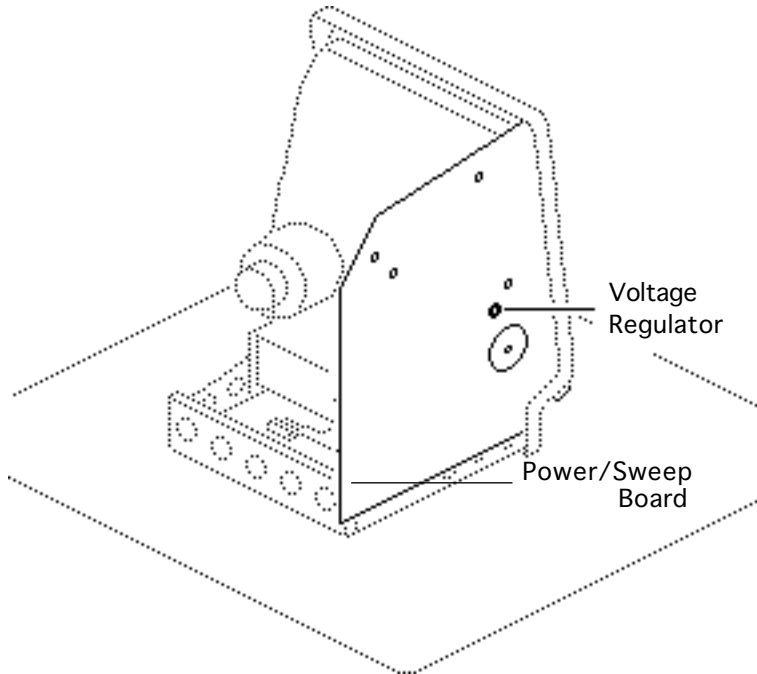
Power/Sweep Board

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.
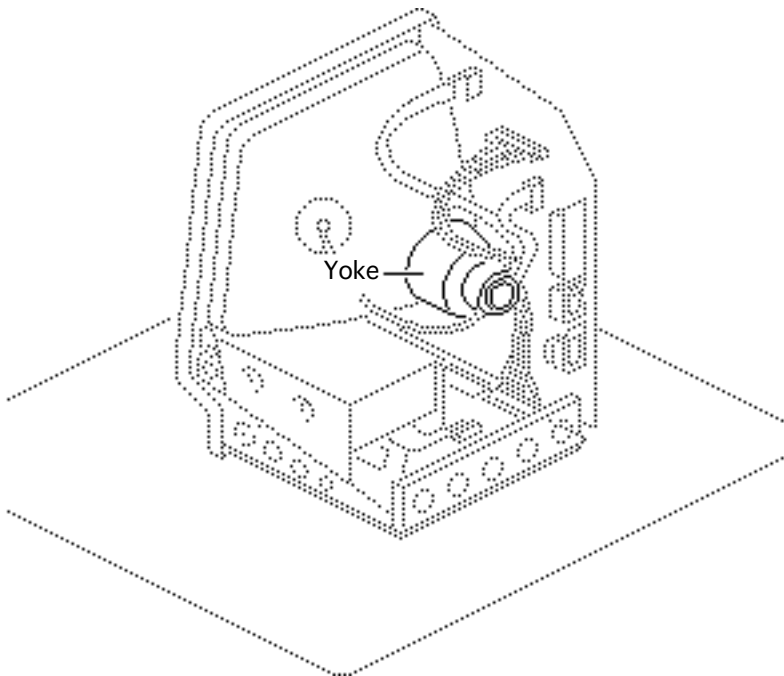
Yoke

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.
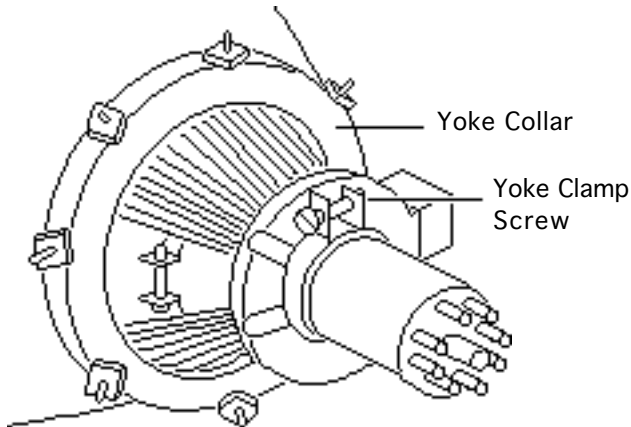
Yoke Collar
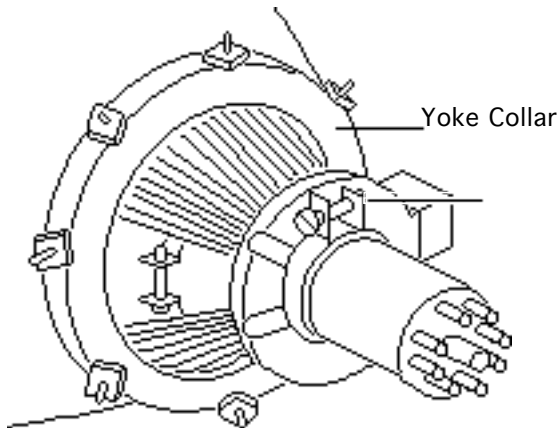
Yoke Clamp
Screw

Tilt Adjustment

Note: If glue holds the yoke collar in place, use an art knife to cut through the glue.
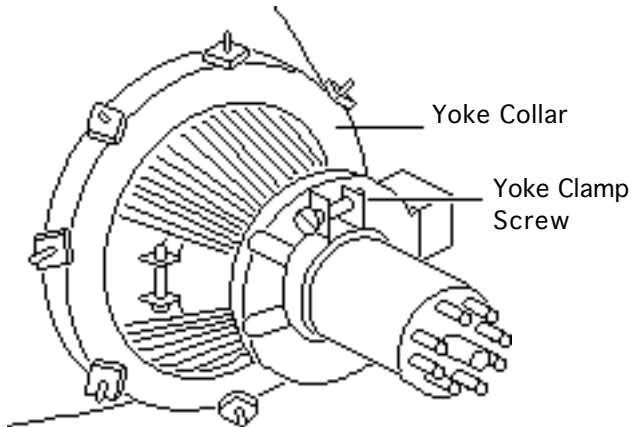
1   Loosen the yoke clamp screw two or three turns.

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.

Yoke Collar

Yoke Collar

Yoke Clamp
Screw

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 Rings

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.

Power/Sweep Board
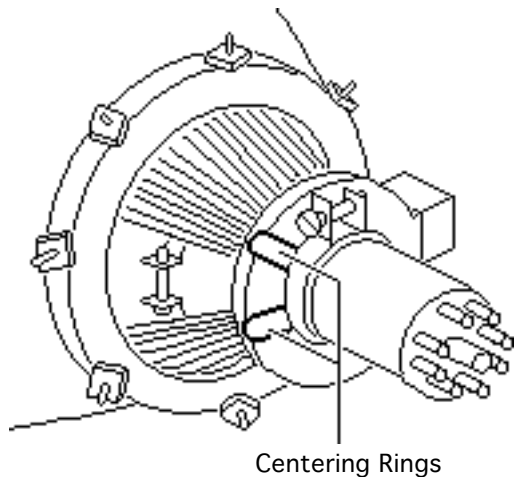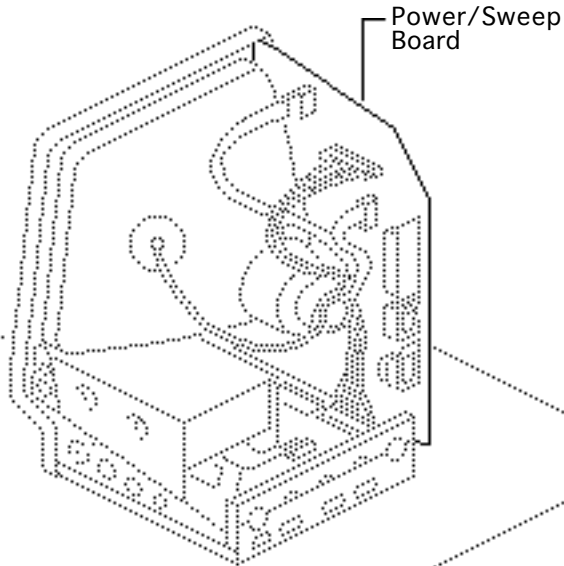
Video

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.

Brightness Control

External Contrast Control
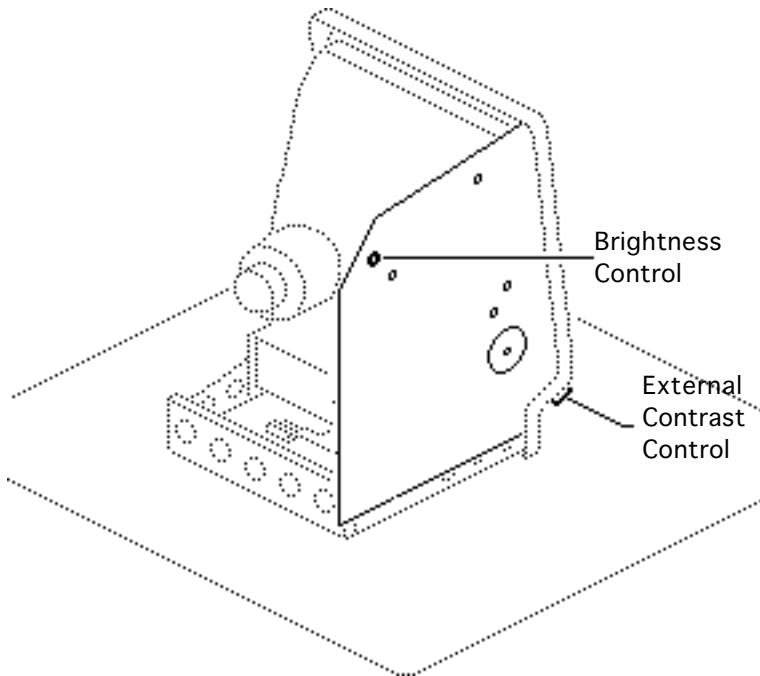
Contrast and Brightness

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.
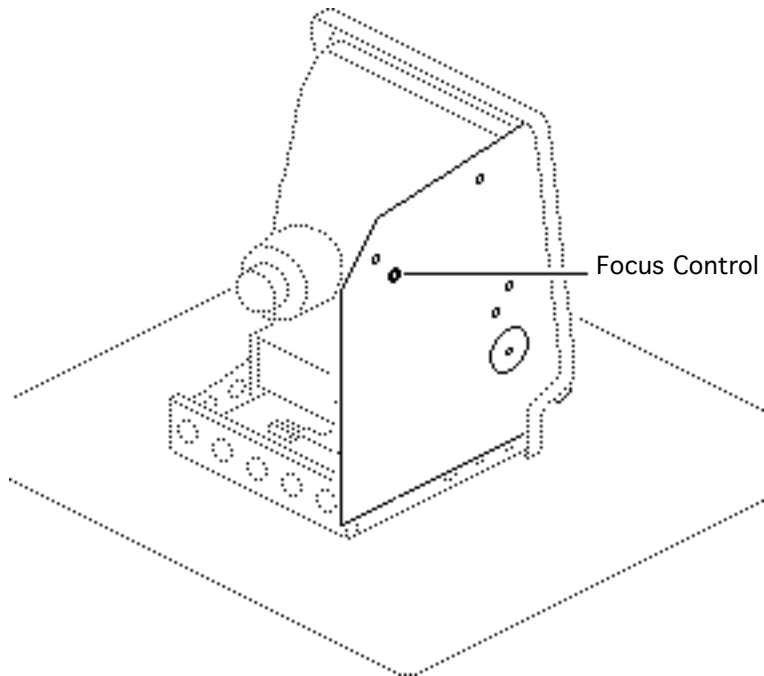
Width Control
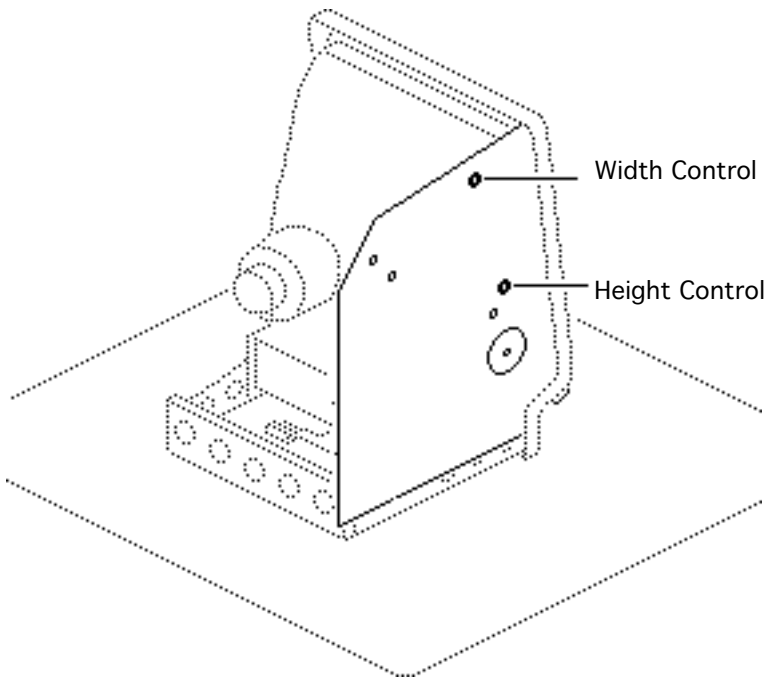
Height Control

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 Control

Focus Adjustment

1 Turn the focus control clockwise to its limit.

2 Turn the focus control counterclockwise 1/8 of a turn.

Exploded View

Macintosh

Exploded View

Internal Drive Shield
805-0765 (400K)
805-0217 (800K)

CRT and Yoke Assembly 076-0103

CRT Socket Cable 590-0160

Floppy Drive
661-7615 (400K)
661-0345 (800K)

Front Bezel 810-0373

Internal Drive Cable
590-0167 (red)
590-0437 (yellow)

Insulator Shield 725-0011

Power/Sweep Board 661-76214

Chassis 805-0766

462-3100

426-1001

Logic Board 661-06236

Rear Housing 630-5139

RFI Shroud 805-0577

426-1007

435-5002