

Macintosh and Macintosh Plus

Technical Procedures

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Macintosh and Macintosh Plus

Section 1 – Basics

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□ SAFETY PRECAUTIONS

The built-in video monitor of the Macintosh or Macintosh Plus is harmless as long as you're just watching the display. Removing the cover, however, exposes you to the high-voltage Cathode-Ray Tube (CRT)—the picture tube. The following precautions must be taken to ensure your safety, especially when you are making adjustments on a live monitor.

Safe Electrical Setup

- **Be sure your outlet is properly grounded and wired correctly.**

Polarity and ground testers are available from most electronics stores. Test all outlets in your service shop before working on **any** electrical equipment. If you have any doubts about your building's wiring, consult a qualified electrician.

- **Never use an adaptor plug to connect a monitor's three-prong power plug to a two-prong wall outlet.**

Adaptors defeat the ground pin, which is a safety feature.

- **Use an isolation transformer between the monitor and the outlet when performing live adjustments.**

Order an isolation transformer from your electronics distributor, and make it a practice to use it whenever you are working with **any** charged monitor or other powered system under test. An isolation transformer isolates the circuitry of the system under test from the power company's circuitry, thus reducing the likelihood of a fatal shock should you simultaneously contact high voltage and anything else that is earth-grounded.

Do not connect more equipment to the transformer than the wattage capacity of the transformer will bear. (It is usually best to connect only one piece of equipment at a time.) We recommend an isolation transformer with a minimum wattage capacity of 500 VA, with grounded three-prong cord and receptacle. Two such transformers, available from many electronics stores and distributors, are listed below:

Triad N-57M

Stancor GIS 500

CRT Safety Rules

- **Do not work on a monitor alone.**

If there is an accident, it could save your life to have someone else nearby. We recommend that your staff be trained in cardio-pulmonary resuscitation (CPR).

- **Remove rings, watches, bracelets, necklaces, and other jewelry before performing repairs on a CRT.**

Metal jewelry is an excellent conductor of electricity. Removing it reduces the possibility of electric shock.

- **Never use a grounding wriststrap or heelstrap or work on a grounded workbench mat when discharging a monitor or when performing live adjustments.**

Grounding wriststraps, heelstraps, and mats are used to protect sensitive components from the damaging effects of electrostatic discharge from your own body or clothing. Even though they contain a one-megohm resistor and are designed to conduct only small electrical charges, we recommend that they be used **only** when working on "dead" (uncharged) equipment.

- **Wear safety goggles when working with a CRT.**

The CRT contains a high vacuum. If cracked or broken, it can implode (collapse into itself), then explode. To protect your eyes from serious injury, always wear safety goggles when working on or near a CRT, and be careful of other people in the area.

- **Before working inside a monitor, turn off the power and disconnect the AC power cord.**

Certain parts of a monitor chassis are **hot** (electrified) when the monitor is under power. Except when you **must** have the power on (for example, when making live adjustments), never work on a plugged-in monitor—even if you have the power turned off.

- **Keep one hand in your pocket or behind your back when working on a live monitor.**

This reduces the risk of current passing through your heart, should you accidentally contact high voltage.

- **Always discharge the anode before touching anything inside the monitor.**

High voltage (approx. 12,000 volts DC) can be present on the anode (Figure 1, #2) and other components—even when power is off. Discharging the anode reduces the risk of injury.

- **Never touch the anode connector or the anode aperture.**

Normally the anode aperture (Figure 1, #2) has a connector plugged into it (Figure 1, #1). When a CRT is replaced, the anode connector is removed, exposing the anode. The anode can retain a charge of several thousand volts (even when power is off), and can regain some charge even after it has been discharged.

- **Do not pick up or handle a CRT by its neck.**

To prevent an implosion, you should take every precaution against breaking the tube. Be especially careful with the neck (Figure 1, #3), the area where the tube is the thinnest.

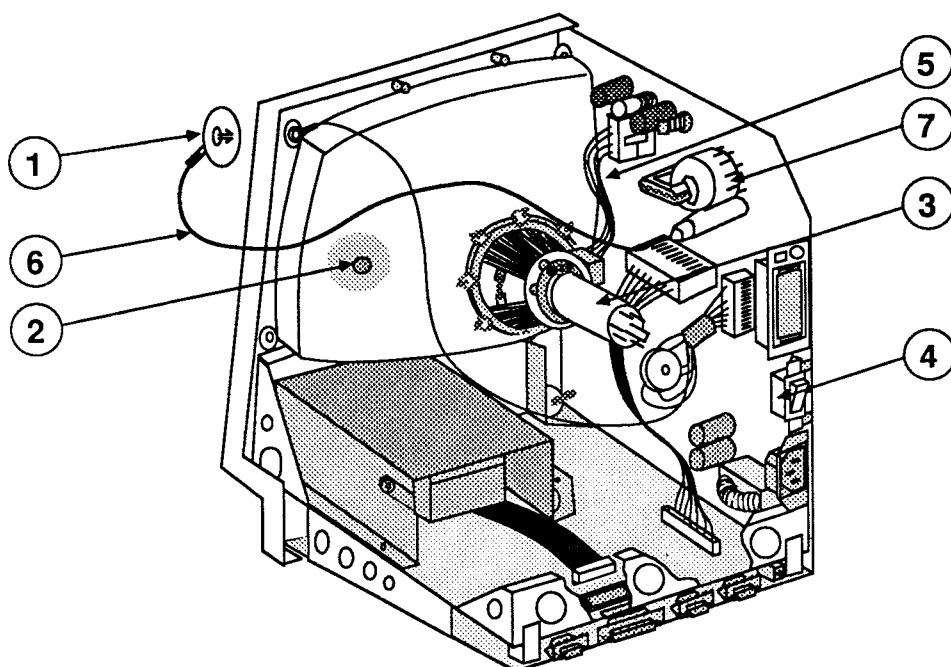


FIGURE 1

Live Adjustment Rules

In addition to the precautions listed on the previous pages, never touch the following components when adjusting a live Macintosh CRT:

- The back of the power switch (Figure 1, #4)
- The yoke wires (Figure 1, #5)
- The anode connector (Figure 1, #1)
- The anode wire (Figure 1, #6)
- The flyback transformer (Figure 1, #7)

❑ DISPOSING OF THE CATHODE-RAY TUBE (CRT)

Remember that a CRT can implode unless it is devacuumed. Putting a defunct CRT into a trash receptacle without devacuuming it can endanger other people.

Materials Required

Thick cardboard box, large enough to conceal the CRT
Large, sharp, diagonal cutters
Large pliers
Duct tape
Safety goggles
Gardening gloves
12-inch square of cloth or heavy paper

Devacuuming the CRT

1. Put on safety goggles.
2. In the side of the box about six inches from the bottom, cut or drill a hole just large enough to accommodate the very tip of the CRT neck.
3. Place the CRT inside the box with the tip of the neck protruding through the hole, and tape the box flaps down with the duct tape (Figure 2).

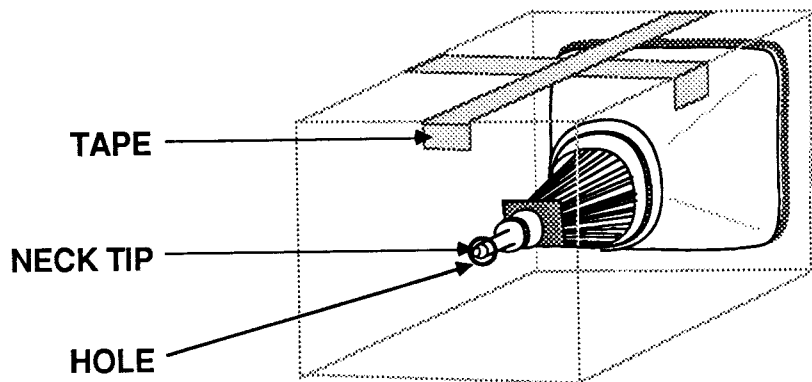


FIGURE 2

WARNING: Only the very tip of the CRT neck should be protruding through the hole in the box. The box must not have any other openings.

4. Put on the gloves.
5. If there is a plastic guide on the end of the CRT neck, pull it off. Using the diagonal cutters, carefully clip off the connector pins on the end of the CRT neck.
6. Tape the piece of cloth or paper onto the box (Figure 3, #1) so that it forms a veil over the opening (Figure 3, #2) but allows your hand access to the tip of the CRT. The veil's purpose is to catch bits of glass that may fly during the following step.

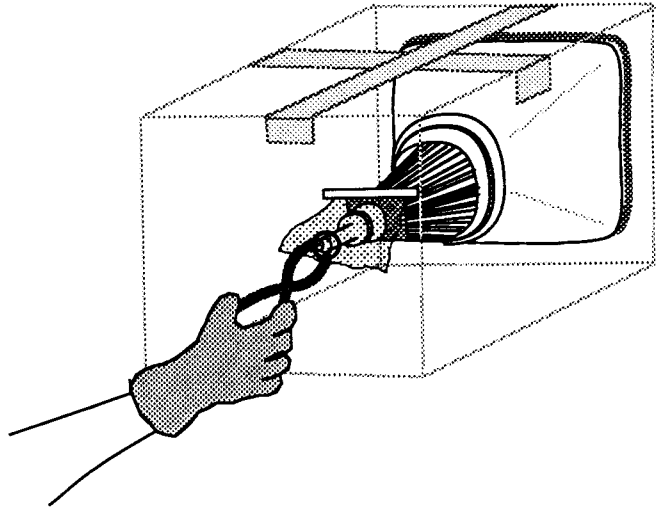


FIGURE 3

7. Make sure no one is standing nearby. Place the pliers under the veil, stand to one side, and look away while you use the pliers to snip off the exposed tip of the CRT.

WARNING: Do not look directly at the box when cutting off the tip of the CRT!

Note: You will probably hear a rush of air entering the CRT when the CRT vacuum breaks—but even if you don't, the procedure is complete if the interior of the CRT is clearly visible through the opening created by the removed tip.

KEYBOARD AND KEYSWITCH IDENTIFICATION

The Macintosh keyboard without the numeric keypad uses Alps keyswitches (Figure 2). The locking keyswitch is used for the Caps Lock key, the other keyswitch for all other keys on the keyboard.

The Macintosh Plus keyboard with the numeric keypad uses two versions of keyswitches, Alps and Mitsumi. The keyswitches are not interchangeable between boards. They can be identified by referring to Figure 2 below.

The procedure to replace a keyswitch is in Section 3 of "You Oughta Know."

Note: Macintosh foreign language keyboards use the same type of keyswitches as the U.S. Macintosh.

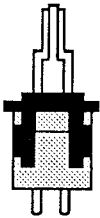
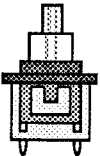
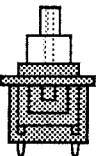
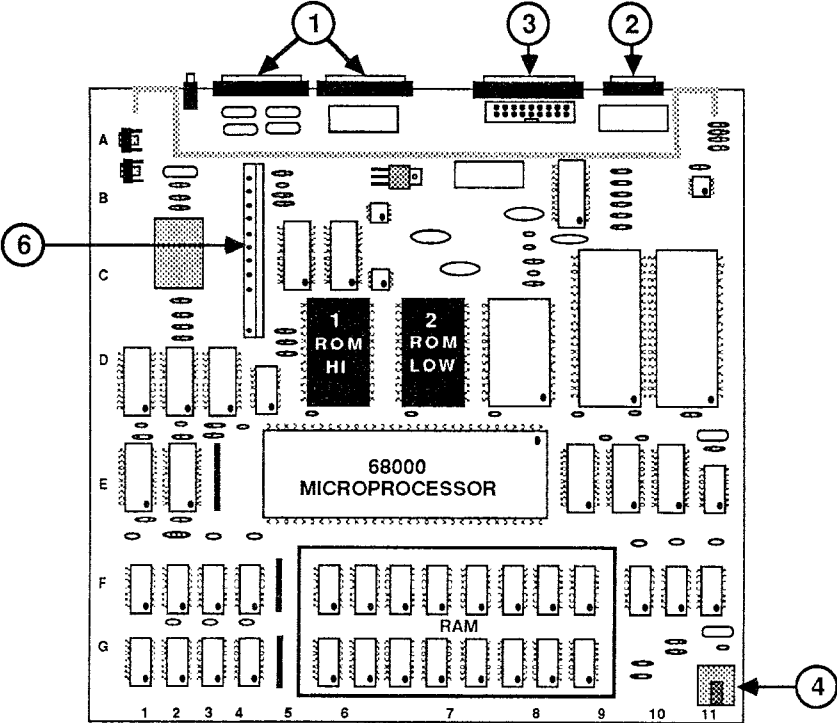
KEYSWITCH				KEYBOARD
	705-0070 ALPS LONG STEM ("Extended")		705-0077 ALPS ALPHA LOCK ("Alternate Action")	661-96154 661-0322
	705-0104 MITSUMI KEYSWITCH		705-0044 MITSUMI ALPHA LOCK KEYSWITCH	661-0362

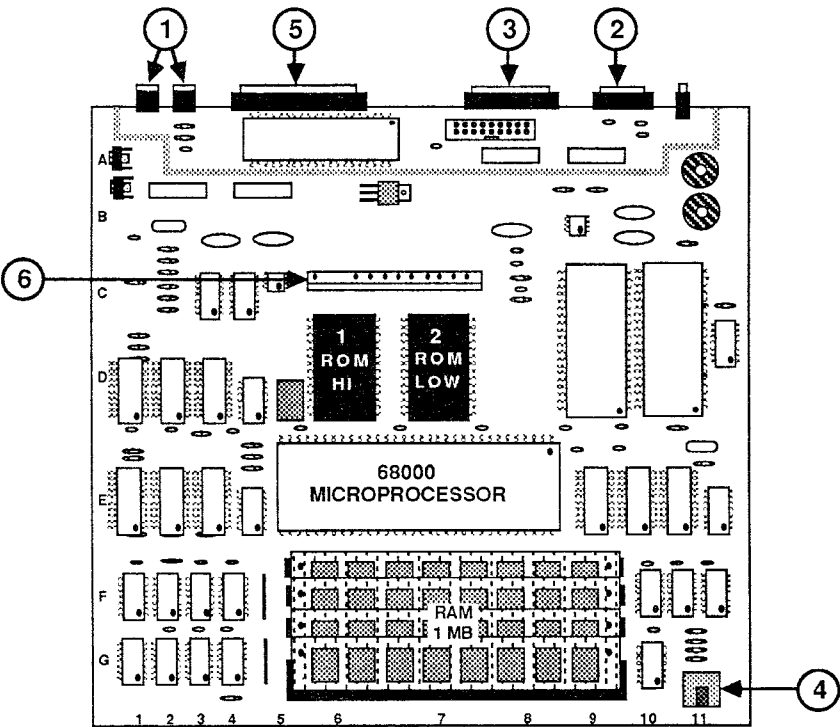
FIGURE 2: MACINTOSH KEYBOARD

MACINTOSH AND MACINTOSH PLUS – DIFFERENCES



MACINTOSH 128K/512K LOGIC BOARD

FIGURE 3



MACINTOSH PLUS 1 MEGABYTE LOGIC BOARD

FIGURE 4

Memory**Macintosh**

128K or 512K bytes RAM
64K bytes ROM

Macintosh Plus

1 Mb RAM
128K ROM
256 bytes of
user-selectable
parameter memory

Disk Capacity**Macintosh**

400K bytes per diskette
single-sided

Macintosh Plus

800K bytes per
diskette
double-sided

Keyboard**Macintosh**

58 key, software mapped

Macintosh Plus

78 key, software
mapped, with
built-in numeric
keypad and
direction keys

Interfaces

The numbers at the left of the list below correspond to the locations on both Figure 3 (Macintosh) and Figure 4 (Macintosh Plus) unless otherwise noted.

- #1 Two RS232/RS422 Serial Ports
Macintosh uses DB-9 connectors
Macintosh Plus uses 8 Pin DIN connectors
- #2 Mouse Interface
- #3 External Disk Interface
- #4 Synchronous serial keyboard bus

Macintosh Plus only (Figure 4)

- #5 Small Computer Standard Interface (SCSI) Port:
an industry-standard interface that provides
extremely high-speed access to hard disks, tape
backup systems, and other mass storage devices.

Internal Connections

The connector that runs from the Power/Sweep Board to the Logic Board has been moved for the Macintosh Plus, as shown in Figures 3 and 4, #6.

□ THEORY OF OPERATION OVERVIEW

Introduction

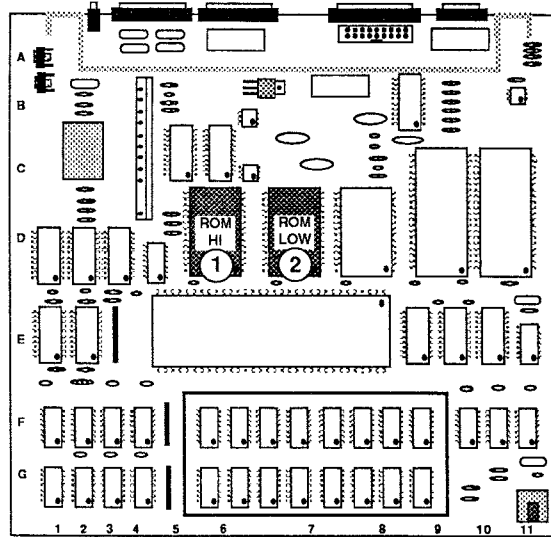
Troubleshooting can be approached in many different ways. Apple recommends two methods in particular: logical troubleshooting, and module swapping in a particular order for a particular symptom. Most troubleshooting charts in *Apple Technical Procedures* manuals are based upon the module-swapping method, but you can often save repair time by using logical troubleshooting before you start swapping.

Logical troubleshooting involves knowing the function of each module in the machine, and using that knowledge to narrow down your search for the problem. This section will give you the information necessary to perform logical troubleshooting of the Macintosh and Macintosh Plus. The information here includes a description of each module in the Macintosh and Macintosh Plus and the various functions it performs. (For definitions of basic terms, refer to "Simplified Overview of a Microcomputer System" under the tab *You Oughta Know....*)

Unless otherwise noted, all information included here is the same for the Macintosh and Macintosh Plus.

Modules and Functions

Logic Board



The Macintosh Logic Board shown above is the heart of the system. It contains the components described below. A number after an IC in the descriptions that follow corresponds to a number in the figure to the left (indicating its general location on the logic board).

The CPU, or 68000 microprocessor, gets instructions from memory, translates them, and carries them out. It communicates with all components on the Logic Board.

The RAM, or storage capability, varies. The Macintosh can have 128K or 512K. The Macintosh Plus has 1 megabyte of RAM installed on SIMM modules, which are mounted on the Logic Board.

The ROMs (1 is HI, 2 is LO) contain the operating code for the 68000. The Macintosh ROMs and the Macintosh Plus ROMs are different. Refer to Section 6, Additional Procedures, for specifics.

The IWM, or Integrated Woz Machine (named after Steve Wozniak), is a self-contained disk controller card on one IC. This IC supports both the internal and external disk drives.

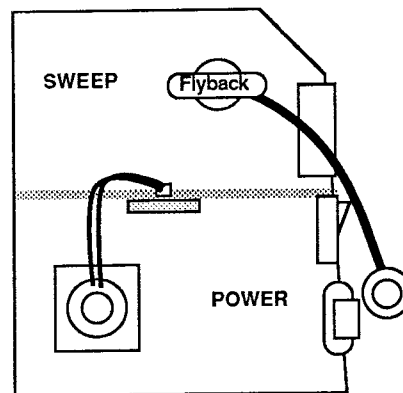
The SCC, or Serial Communications Controller, handles the information received and sent from the two serial ports on the rear of the machine. The Macintosh has two nine-pin serial ports. The Macintosh Plus has two eight-pin DIN connectors.

The VIA, or Versatile Interface Adapter, is a dual-port parallel interface. This IC converts serial data (from input devices) to parallel data, so that the logic board can interpret the information correctly. It provides an interface for the mouse and the keyboard.

The PALs, or Programmable Array Logic (customized ICs), replace from five to ten ICs. They perform various control and synchronizing functions for the rest of the Logic Board.

The Oscillator (timing device), generates the master clock pulse. The master clock pulse is broken down into various timing clocks needed by the ICs on the Logic Board.

Power/Sweep Board



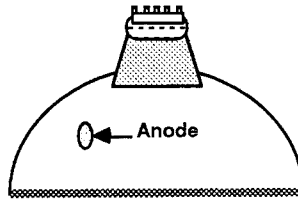
The Power/Sweep Board is divided into two sections, described below.

The speaker and the battery compartment are located on the power/sweep board. However, all the signals that operate these components are generated on the Logic Board; the power/sweep board does not use either of these items.

The power supply section is located on the bottom half of the board. This is where the AC voltage is converted to DC voltage for use by the entire system.

The sweep section is located on the upper half of the board. There are circuits for both the horizontal and the vertical signals that are fed to the CRT. The flyback transformer is part of the sweep section and delivers high voltage directly to the CRT through the anode connector.

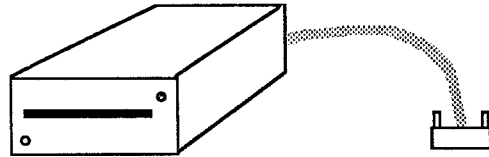
CRT



The CRT (Cathode Ray Tube) provides the high resolution video display. The power/sweep board connects to the anode to apply high voltage to the CRT.

The power/sweep board connects to the neck and to the yoke to supply various voltages and signals to the CRT to create the video display.

Disk Drives

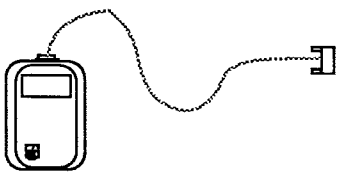


The internal disk drive connects to the main logic board through an internally installed connector. The external drive connects to the port on the back of the logic board.

Reading and writing operations are controlled by the Integrated Woz Machine on the logic board. The data passes through this IC on its way from the logic board to the diskette in the drive, or from the disk drive to the logic board.

The Macintosh has 400K disk drives. The Macintosh Plus has 800K disk drives. The 400K diskettes work on the 800K drives. The 800K diskettes do *not* work on the 400K drives.

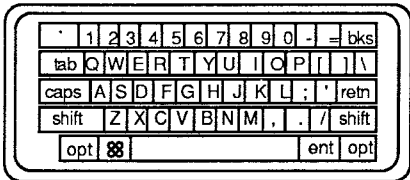
Mouse



The mouse connects to a nine-pin connector on the main logic board. The mouse is used to position the cursor on the screen.

The assemblies inside the mouse send a series of pulses to the Serial Communications Controller and the Versatile Interface Adapter. These ICs interpret and translate the information so that the logic board can utilize it.

Keyboard



The keyboard connects to the logic board through a four-wire coil with a telephone-type connector. The keyboard has its own microprocessor, which is used to implement a serial bus for communicating with the logic board.

The keyboard data is sent in serial form to the Versatile Interface Adapter, where it is converted into parallel data and translated so that the logic board can use it.

Macintosh and Macintosh Plus

Section 2 – Take-Apart

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2.5	Remove
2.7	Discharge the Anode
2.7	Replace
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2.16	Internal Disk Drive
2.17	Keyboard

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in that section.

Note: In the Macintosh spares kit is a useful videotape that demonstrates a complete take-apart of a Macintosh (the Macintosh Plus is not covered). The videotape, entitled *Servicing Macintosh*, shows the procedures in a somewhat different order from that given in these written procedures.

□ ESD PREVENTION

Introduction

ESD (Electrostatic Discharge) can cause severe damage to sensitive microcircuits. Just touching a chip or brushing it with a nylon sleeve can degrade a circuit so that it never performs again to specifications. Some microcircuits are sensitive to as little as 500 volts, or about one-sixth as much static electricity as you can feel.

The Macintosh and the Macintosh Plus contain C-MOS components, and the Macintosh Plus RAM memory is installed on four small separate boards called SIMM modules. Both the C-MOS and the SIMM modules are very susceptible to ESD damage.

Follow the instructions below to prevent ESD damage to the Macintosh or the Macintosh Plus components.

WARNING: *Discharge the Macintosh CRT before following these instructions. Never perform live monitor adjustments or discharge the Macintosh CRT while wearing a grounding wriststrap or working on a grounded workbench mat. Read the safety precautions in Section 1, Basics, before working inside the Macintosh.*

1. Before handling boards or ROMs, ground yourself

Wear a grounding wriststrap and attach it to your workbench pad. The pad must then be grounded to a workbench that is grounded to the building's ground.

2. Ground the Macintosh chassis to the same potential you hold.

Place the discharged Macintosh/Macintosh Plus on the grounded workbench pad. Be sure the chassis is in contact with the workbench pad at all times **or** connect the chassis to the workbench pad with alligator clips.

3. Use antistatic bags for carrying boards and ROMs.

Whenever the ROMs or board are to be stored or moved anywhere, first put them in an antistatic bag. Be sure to touch the bags before touching the ROMs.

4. **Handle ROMs by the body, not the leads.** You may safely touch the leads only if you are grounded.
5. **Do not wear polyester clothing or bring plastic, vinyl, or styrofoam into the area.** The static field around these items cannot be removed.
6. **Do not place board or ROMs on any metal surface.** Place them on the grounded workbench pad or an antistatic or nonconductive foam.

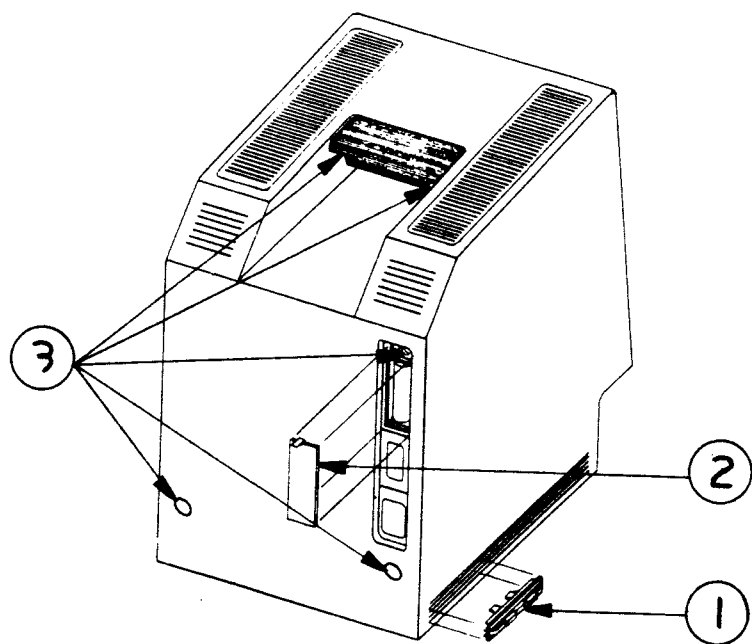


FIGURE 1

□ COVER

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

WARNING: *Macintosh and Macintosh Plus computers contain high voltage and a high vacuum picture tube. To prevent serious personal injury and property damage, make sure you read and understand the safety precautions in Section 1, Basics, before you remove the back cover. Failure to follow the safety rules could result in serious injury.*

Remove

1. Turn the power off and disconnect the AC power cord from the source and from the back of the computer.
2. Disconnect the mouse and all other external cables from the back of the computer. Disconnect the keyboard.
3. Remove the reset/interrupt switch (if installed) by prying it off with a small flatblade screwdriver (Figure 1, #1).
4. Press down the tab at the top of the battery compartment cover (Figure 1, #2) and pull it toward you.
5. Carefully place the computer face down on a soft cloth or foam pad (to prevent scratching the bezel).
6. Use a Torx screwdriver to remove the five screws (Figure 1, #3).
7. Use the pull-apart tool to gently pry the cover loose. Carefully lift up the cover (there is a fragile picture tube inside), and set it out of the way.

WARNING: *Remove your grounding wriststrap before continuing with the procedure for discharging the anode on the next page.*

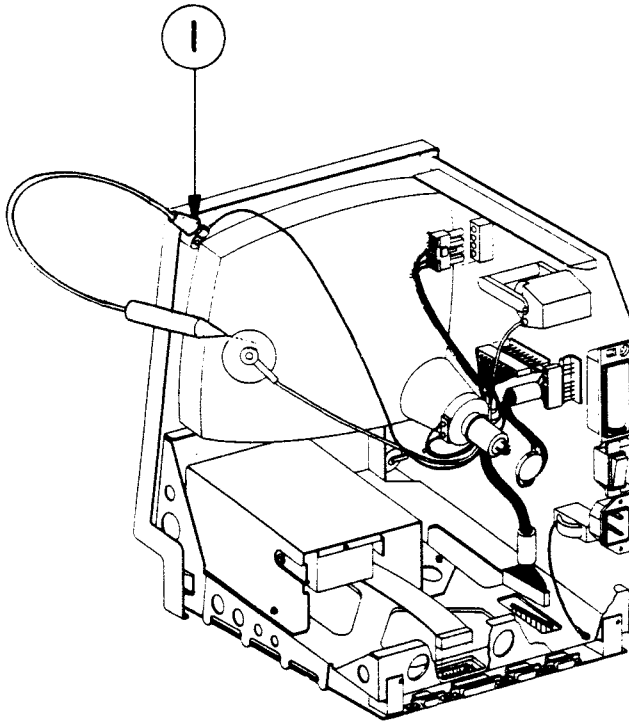


FIGURE 2

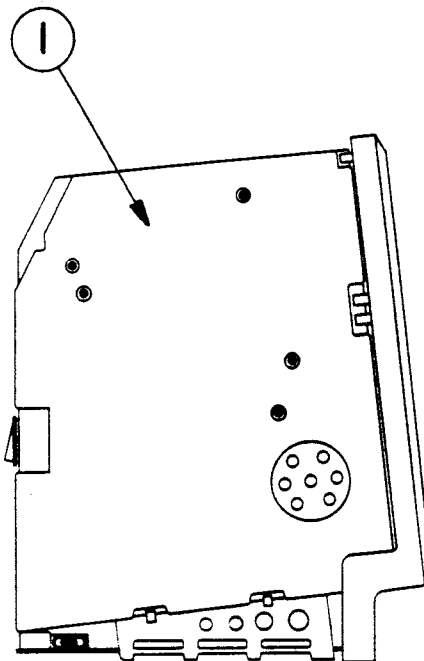


FIGURE 3

Discharge the Anode

In the following steps, you will discharge the high voltage (12,000 volts) from the picture tube. This lessens the chance of your receiving an electrical shock. Read through all the steps before performing the discharge procedure.

CAUTION: *Discharge the anode to the metal part of the ground lug displayed in Figure 2, #1. Failure to do so will damage the Logic and or Power/Sweep Board.*

1. Remove any jewelry (rings, bracelets, necklaces, watches, etc.) and set it aside. Put on safety goggles.
2. Attach the alligator clip on the CRT discharge tool to the metal part of the ground lug (Figure 2, #1).
3. Put one hand in your pocket or behind your back and grasp the insulated handle of the screwdriver (don't touch the metal) with your other hand.
4. Hold the CRT discharge tool to the tube surface and insert it under the anode cap (Figure 2, #2) until it touches the anode ring.
5. Remove the CRT discharge tool from under the anode cap. To be sure the CRT is discharged, repeat step 4.
6. Remove the alligator clip from the ground lug. Set the tool aside where it will be out of the way.

Note: The anode can build up voltage over a period of time, so if repairs are not finished within 30 minutes, the anode should be discharged again.

Replace

1. Make sure that the insulating paper is in the proper position (Figure 3, #1) and that all cables are connected. Carefully slide the cover back onto the computer and check to see that it is properly seated.
2. Replace the five screws on the back of the computer.
3. Replace the battery compartment cover.
4. Replace the reset/interrupt switch if it was installed.

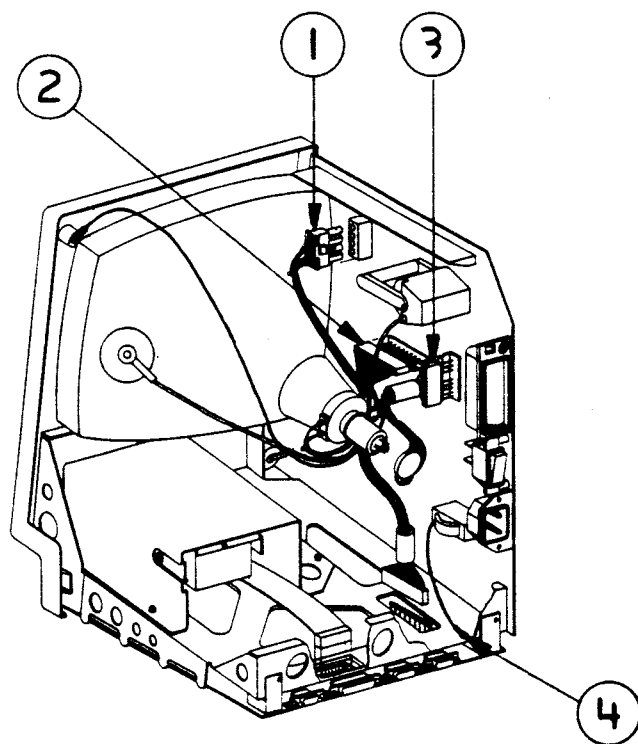


FIGURE 4

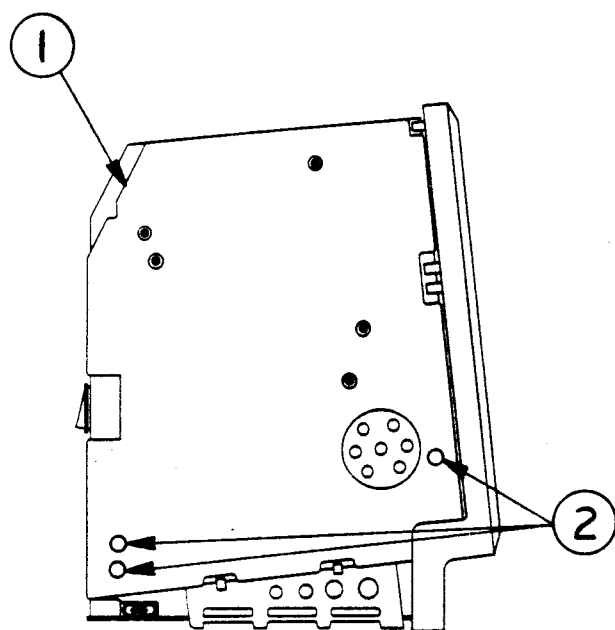


FIGURE 5

□ POWER/SWEEP BOARD

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

If a new power/sweep board is installed, perform the voltage adjustment as indicated in Section 5, Adjustments.

Remove

1. Remove the cover and discharge the CRT to the ground lug.

WARNING: Make sure the anode has been discharged before continuing. Failure to discharge the anode could result in serious injury.

2. When the high voltage has been discharged from the anode, use your fingers to peel back the sides of the rubber anode cap. Notice the two prongs extending into the anode ring. Squeeze one prong against the edge of the anode ring to bring them together, then gently pivot them out of the anode ring.
3. Depress the tab on the yoke cable and unplug it (Figure 4, #1).
4. Remove the main logic cable from the power/sweep board (Figure 4, #2).
5. Remove the neck connector from the power/sweep board (Figure 4, #3).
6. Turn the computer upright and remove the screw, lockwasher, and ground wire at the bottom of the chassis (Figure 4, #4).
7. There are several versions of the insulating paper (Figure 5, #1). If there are no access holes for the three screws (Figure 5, #2), note how the paper is installed and then remove it.
8. Remove the three screws and washers (Figure 5, #2) holding the power/sweep board.
9. Lift up and pull out the power/sweep board.

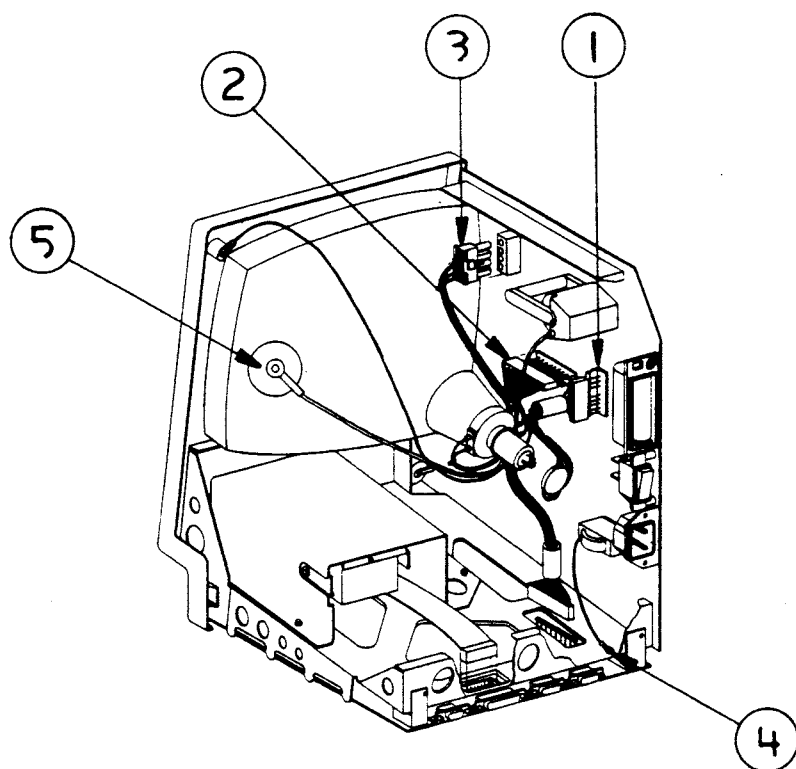


FIGURE 6

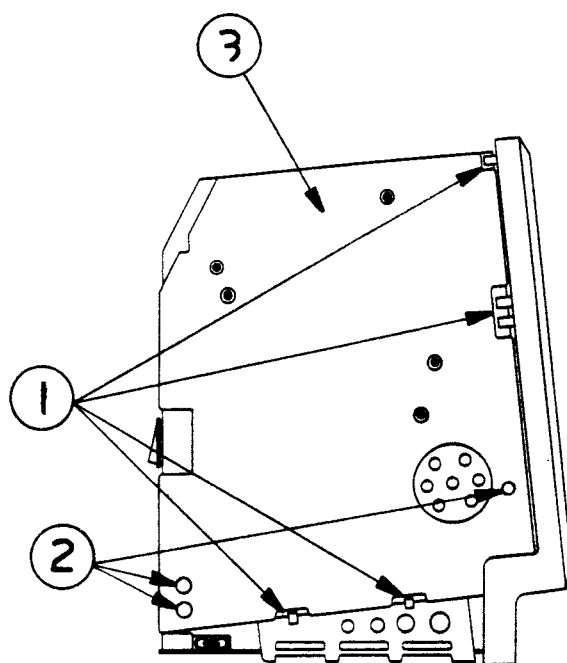


FIGURE 7

Replace

1. Turn the computer upright and position the power/sweep board at the right hand side of the chassis.
2. Connect the yoke cable (Figure 6, #1).
3. Connect the main logic cable (Figure 6, #2).
4. Slide the board into the slotted holders (Figure 7, #1) so that the three screw holes line up with the holes on the chassis (Figure 7, #2).
5. Connect the CRT socket cable to the power/sweep board (Figure 6, #3).
6. Replace the ground wire at the bottom of the chassis using a washer and Phillips head screw (Figure 6, #4).
7. Replace the three screws and washers (Figure 7, #2). If replacement screws are needed, refer to Section 6, Additional Procedures.
8. Replace the insulating paper if it has been removed (Figure 7, #3).
9. Connect the anode connector to the CRT (Figure 6, #5). Put one prong of the connector in at an angle and push it against the edge of the anode ring. Then insert the other prong.
10. Perform the voltage adjustment (refer to Section 5, Adjustments).
11. Replace the cover.

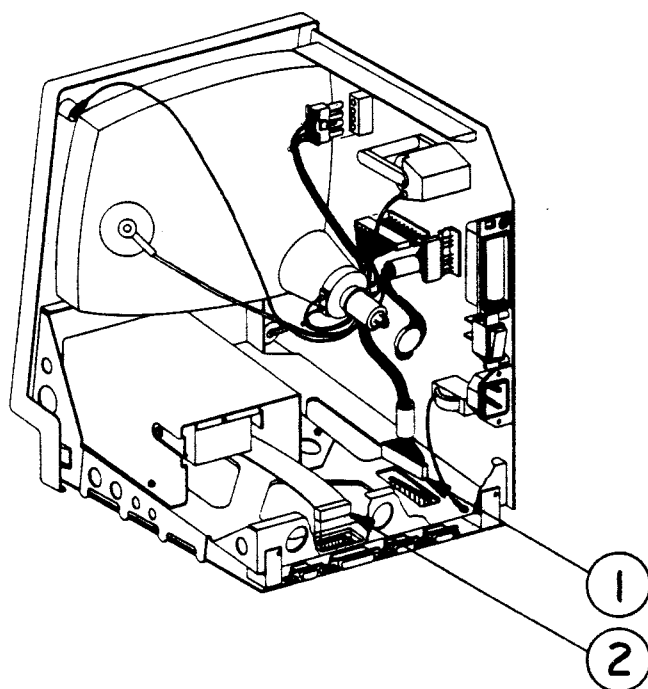


FIGURE 8

□ LOGIC BOARD

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

If a new logic board is installed, perform the voltage adjustment as indicated in Section 5, Adjustments.

Remove

1. Remove the cover and discharge the CRT to the ground lug.

WARNING: Make sure the anode has been discharged before continuing. Failure to discharge the anode could result in serious injury.

2. Remove the main logic cable from the main logic board (Figure 8, #1).
3. Remove the disk drive cable from the main logic board (Figure 8, #2).
4. Turn the computer face down and gently slide the main logic board up and out of the chassis.

Replace

1. Gently slide the main logic board into the chassis until it is firmly seated.
2. Replace the main logic cable (Figure 8, #1).
3. Plug in the disk drive cable (Figure 8, #2).
4. Perform the voltage adjustment (refer to Section 5, Adjustments).
5. Replace the cover (be sure the insulating paper is installed).

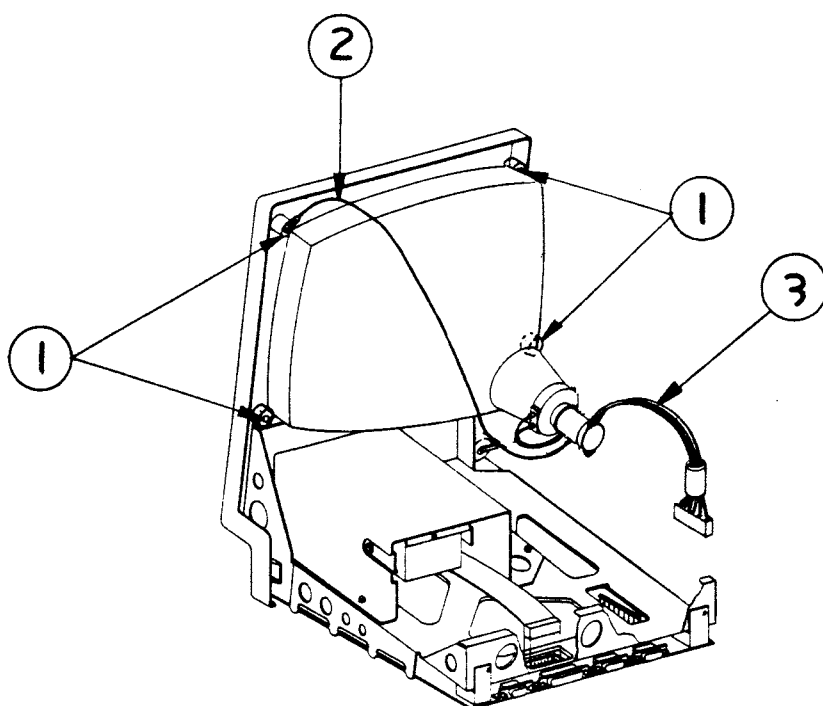


FIGURE 9

□ CRT

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

Remove

1. Remove the cover and discharge the CRT to the ground lug.

WARNING: Make sure the anode has been discharged before continuing. Failure to discharge the anode could result in serious injury.

2. Remove the power supply/sweep board.
3. Place the computer face down on a soft cloth or foam pad. Remove the four screws fastening the CRT (Figure 9, #1) and the ground wire (Figure 9, #2).
4. Gently remove the CRT socket cable (Figure 9, #3) by sliding it straight out from the neck.

WARNING: Handle the CRT by its sides only. Do not touch the anode.

5. Remove the CRT. A defective CRT should be placed in its original shipping container. A CRT should not be discarded unless it is devacuumed (refer to Section 1, Basics, for instructions).

Replace

1. Set the CRT in the case with the anode facing away from the power/sweep board (see Figure 9).
2. Connect the original CRT socket cable. A new CRT may have a small retainer on the neck pins. Remove it before replacing the CRT socket cable.
3. Replace the four CRT screws (Figure 9, #1). Be sure to reinstall the ground wire (Figure 9, #2).

□ INTERNAL DISK DRIVE

Materials Required

CRT discharge tool
Pull-apart tool
15-inch Torx screwdriver
Safety goggles
Small flatblade screwdriver
Soft cloth or foam pad

Remove

1. Remove the cover and discharge the CRT to the ground lug.

WARNING: *Make sure the anode has been discharged before continuing. Failure to discharge the anode could result in serious injury.*

2. Remove the main logic board. Verify that the correct revision of ROM is installed. (refer to Section 6, Additional Procedures).
3. Turn the computer over and place it face down on a foam pad or soft cloth.
4. Locate the four Phillips screws that hold the disk drive and mounting bracket in position. Remove them from the chassis.
5. Slide the disk drive out of the chassis.

Replace

Read the "800K Diskette Ejection Problems" in Section 6, Additional Procedures, before replacing the disk drive.

Examine the chassis and determine whether the mounting holes for the screws are *round* or *oval*. Then perform the appropriate procedure below.

Round Mounting Holes

1. Slide the new drive into position.
2. Align the mounting screw holes and tighten the four screws.

Verify the placement of the disk drive by inserting a diskette into the disk drive and checking that the diskette slides in and out of the drive without rubbing against the case.

*Oval
Mounting Holes*

1. Slide the new drive into position.
2. Align the front of the drive with the plastic stops on the front of the bezel. Insert and tighten the four mounting screws.

Verify the placement of the disk drive by inserting a diskette into the disk drive and checking that the diskette slides in and out of the drive without rubbing against the case.

□ KEYBOARD

Exchanging the Keyboard

If you are exchanging the keyboard, **do not** remove the keyboard mechanism. Send the entire unit (**without** the cable) in for exchange. The procedure below is to be used for replacing keyswitches only.

Materials Required

Medium Phillips screwdriver

Remove

1. Disconnect the keyboard from the Macintosh or Macintosh Plus
2. Remove the six screws from the back of the keyboard. Remove the top plastic cover.
3. Lift the mechanical assembly out of the bottom case.
4. Use the replacement procedures for Macintosh keyswitches in *You Oughta Know*. To identify the keyswitches, refer to Section 1, Basics.

Replace

1. Set the mechanical assembly back into the bottom case.
2. Position the top plastic cover.
3. Hold the cover in place, turn the keyboard over, and install the six screws.

Macintosh and Macintosh Plus

Section 3 – Diagnostics

□ CONTENTS

3.2	Introduction
3.2	MacTest
3.2	How to Use It
3.3	Things to Remember
3.5	Backup Procedure
3.10	Running MacTest
3.11	Materials Required
3.12	Pull-down Menus and Icons
3.12	512K
3.12	Select Test
3.14	Options
3.15	Apple
3.16	Miscellaneous Icons
3.16	Running the Diagnostic
3.19	Error Codes

Note: Always use the most recent revision of *MacTest*. Refer to the *Apple Service Programs Manual* for the number of the latest revision.

□ INTRODUCTION

MacTest

This section describes general procedures for using the *MacTest* diagnostic diskette to test the Macintosh and Macintosh Plus logic board and disk drives. *MacTest* is a pass/fail diagnostic test, which indicates the area being tested and the kind of test being performed when a failure occurs.

How to Use It

The *MacTest* diskette is used to identify module failures of the main logic board, keyboard, keypad, and disk drives on the 128K and 512K Macintosh as well as the 1024K Macintosh Plus.

Before running *MacTest*, read the section entitled "Things To Remember."

If you cannot boot the diskette, check the power cable and internal cable connections. If all the cables are secure, turn to Section 3, Troubleshooting, and replace the module(s) specified for the problem you are experiencing. Attempt to boot the diskette after each module swap to check whether the problem has been solved.

Replace modules when indicated by test results. Verify that the problem has been corrected by retesting with the diagnostic diskette. If correct operation is still not obtained, turn to the Troubleshooting section and follow its instructions.

If you receive an error code while attempting to run *MacTest*, check the list at the end of this section for what you can do to correct the problem.

□ THINGS TO REMEMBER

Backup Information

1. Make a backup diskette before you begin! When testing a defective Macintosh or Macintosh Plus, it is possible to erase and/or damage a section of the *MacTest* diskette.

There are two copy routines included on the *MacTest* diskette. Be sure to follow the instructions included in this section under "Backup Procedure."

Loopback Information

2. Identify the machine as a Macintosh or a Macintosh Plus. Connect the correct loopbacks for the machine you are testing (see "Materials Required" for more information).
3. Whenever a dialog box appears indicating that an item is not connected or installed (**keyboard** or **loopbacks**, for example), click in the **OK** box. **The test sequence will be aborted and an error code will be displayed.** Connect the item and/or deselect the test from the **Select Test** menu, reboot, and run the diagnostic again.
4. If the loopback cable and/or the SCSI loopback test card are not connected, be sure to deselect **Serial Loopback** and/or **SCSI Loopback [Mac+]** under the **Select Test** menu, and save the new configuration.

If you do not deselect the tests, a dialog box will appear asking if the loopback cables are installed. Click in the **OK** box. **The test sequence will automatically abort.**

5. If the loopback cable and/or the SCSI loopback test card are installed, be sure to select **Serial Loopback** and/or **SCSI Loopback [Mac+]** under the **Select Test** menu, and save the new configuration. If you do not select the tests, the ports will not be tested.
6. If you are using the SCSI loopback test card it must be correctly installed or the Macintosh Plus will be "recognized" as a 512K Macintosh.

Powering Off

7. To eject the *MacTest* diskette, pull down the **Options** menu and select **Shutdown**.

Saving Configurations

8. Under **Options** is an item called **Save Configuration**. This option allows you to save a favorite configuration on the diskette. The name of the file **must** be **Options.OPTN** to run.

DeskTop Appears

9. If the *MacTest* window does not appear but a screen with desktop and file icons does appear, you will need to:

- a) Open the *MacTest* diskette icon, and highlight the **MacTest** file icon.
- b) Pull down the **Special** menu and select **Set Startup**.

The internal disk drive will whirl for a few seconds and stop.

- c) Reboot the *MacTest* diskette.

Stopping Continuous Test

10. To stop the continuous test, do the following (the mouse will respond slowly):

- a) Pull down the **Options** menu and select **Auto Run Not Selected**.
- b) Pull down the **Options** menu and select **Save Configuration**.

The new configuration will be saved. The continuous test will stop after the next reboot cycle.

Desk Accessories

11. All Desk Accessories must be closed before running *MacTest*.

External Drives

12. *MacTest* cannot test an external drive that is connected through a Hard Disk 20.

□ BACKUP PROCEDURE

Two copy programs are included on the *MacTest* diskette for your convenience. Both routines require two disk drives.

400K Drive Copy

The destination diskette for the *400K Drive Copy* must be a double-sided diskette, but it must be inserted into a 400K external disk drive.

800K Drive Copy

The *800K Drive Copy* program must be run on the Macintosh Plus with 1024K of memory. The program will allow you to format and copy to either double- or single-sided diskettes.

Procedure

1. Write protect the *MacTest* diskette.
2. Insert the *MacTest* diskette, and power on the system.

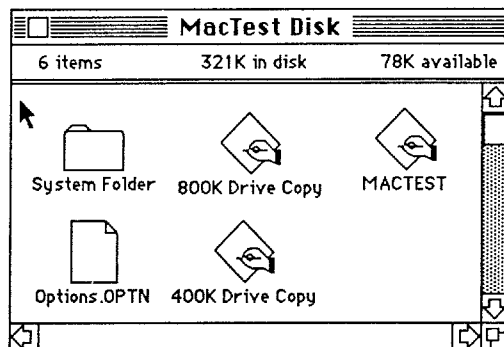
The **Service MacTest** window will appear.

3. Pull down the **Options** menu and select **Quit to Finder**.

The drive will whirl, and the desktop will appear with the *MacTest* diskette displayed in the upper right-hand corner.

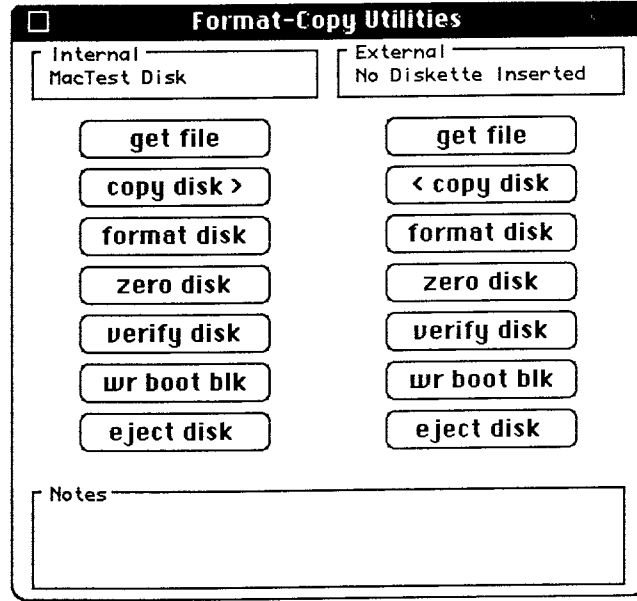
4. Open the *MacTest* diskette icon.

The following file icons should be displayed.



5. Open either the **400K Drive Copy** or the **800K Drive Copy** icon. Follow the appropriate instructions on the next few pages.

1. The following window will appear.



The message under **Internal Disk** should be "MacTest."

Dialog Box Appears

2. Insert a blank or a diskette you wish to copy over (double-sided) into the external drive. If a dialog box appears asking "Do you want to initialize it?":
 - a) Click in the box labeled **Initialize**.
 - b) A dialog box will appear asking you to name the diskette. Enter a name and then click in the box labeled **OK**.
 - c) The copy window will again be displayed. The name of the diskette in the external drive will appear in the block labeled **External Drive**.
 - d) Continue to step 3.

...Continued on next page

No Dialog Box Appears

If the dialog box does not appear:

- a) The name of the diskette will appear in the block labeled **External Drive**.
 - b) Under the box labeled **External** is a column of boxes with various commands. Click in the box labeled **Format**. The external drive will whirl and the message "Disk Format In Progress" will appear in the box labeled **Notes**. On completion the message "Disk Format Was Successful" will appear in the box labeled **Notes**.
 - c) Continue to step 3.
3. Under the box labeled **Internal** is a column of boxes with various commands. Click on the box labeled **<Copy Disk>**.

The message "Disk Copy In Progress" will appear in the box labeled **Notes**. The drives will whirl for a few minutes. The external drive will eject the diskette on completion of the copy. The message "Disk Successfully Copied" will appear under the box labeled **Notes**.

4. You now have two choices:

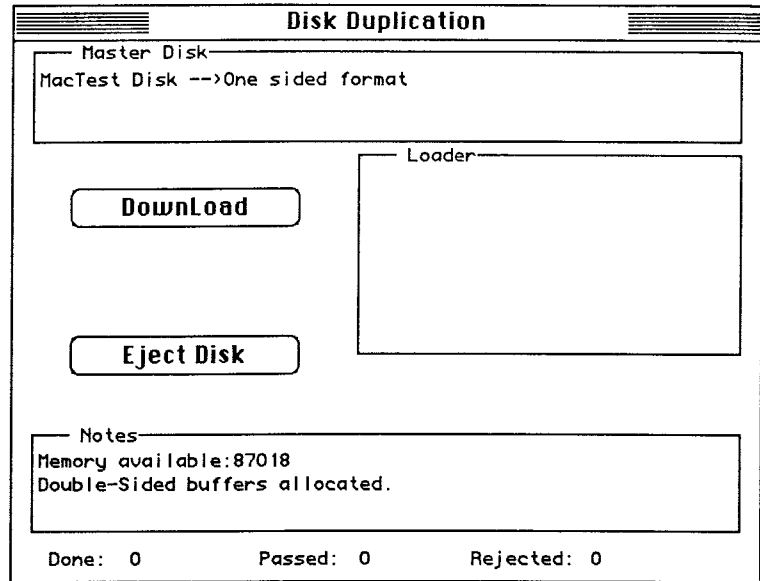
If you wish to make additional copies:

- a) Insert a blank or a diskette you wish to copy over into the external drive.
- b) Repeat steps 2 and 3.
- c) Repeat steps 4a and b until you have the number of copies you desire.

If you wish to quit making copies, pull down the **Utility** menu and select **Quit**. The desktop will appear.

You now have one or more copies of the *MacTest* diskette. Place the original in a safe place.

1. The following window will appear.



Wait till the **Watch** icon disappears.

2. Click in the box labeled **DownLoad**.

The message "Disk Download in progress...." will appear in the box labeled **Notes**. The drive will whirl for approximately one minute, and then it will eject the *MacTest* diskette. The message "Disk Successfully Downloaded" will appear in the box labeled **Notes**.

3. Insert a blank or a diskette you wish to copy over (double-sided) into the external disk drive.
4. Click in the box labeled **Start**.

The message "Format/Copy in progress" will appear in the box labeled **Notes**. The drive will whirl, and the message will change to "Verify in progress." The message will change to "Disk Copy is successful" and the copy will be ejected from the external disk drive.

5. You now have two choices.

a) If you wish to make additional copies:

- 1) Insert a blank or a diskette you wish to copy over into the external drive.

The program will make another copy without any commands being entered.

- 2) Repeat this until you have the number of copies you desire.

b) If you wish to quit making copies.

- 1) Click in the box labeled **Stop**.
- 2) Pull down the **Options** menu and select **Quit**.
- 3) Insert the *MacTest* diskette, as instructed in the dialog box.

The desktop will return.

You now have a copy of the *MacTest* diskette. Place the original in a safe place.

❑ RUNNING *MACTEST*

Materials Required

Identify which Macintosh you have by examining the connectors on the rear of the machine (see Section 1, Basics). Locate the following equipment for the Macintosh **or** for the Macintosh Plus.

Note: The loopback equipment does not need to be installed to run the diagnostic. However, to test the machine completely the loopbacks should be used. Refer to "Things to Remember" at the beginning of this section.

Macintosh

MacTest diagnostic diskette
DB 9 Serial Port Plug (Set of 2)
Blank 400K formatted diskette for External Drive Test

The DB 9 loopback connectors should be installed on the two serial ports on the rear of the machine.

Macintosh Plus

MacTest diagnostic diskette
DIN-8 to DIN-8 Serial Port Cable (loopback connector)
SCSI Loopback Test Card
Blank formatted 400K diskette for External Drive Test

The loopback cable with DIN-8 connectors should be installed between the two serial ports on the rear of the machine.

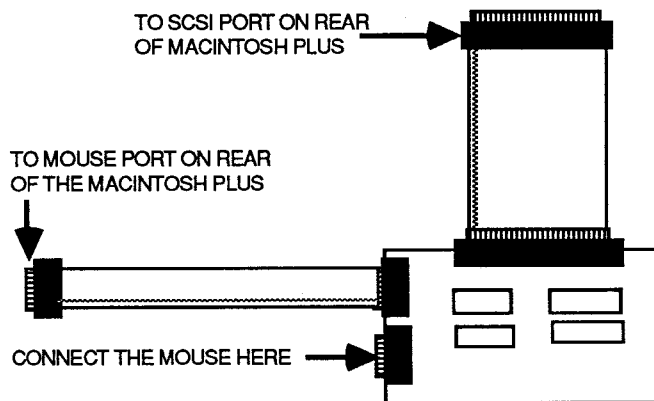


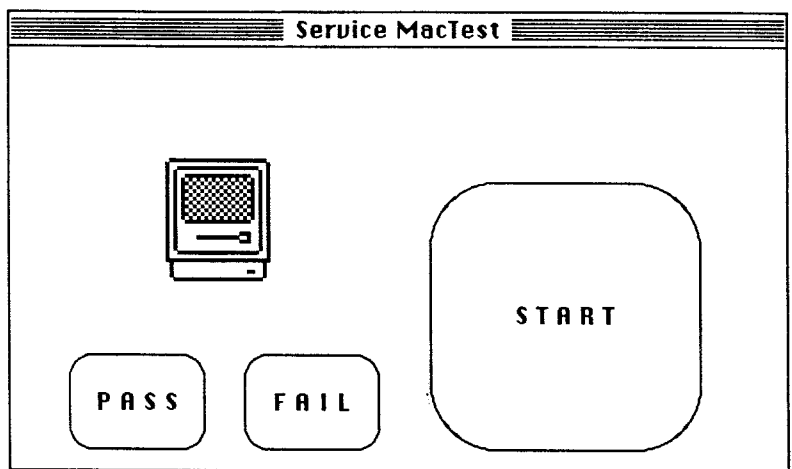
FIGURE 1

The SCSI Loopback Test Card should be connected to the Macintosh Plus (Figure 1). The cable connected to the SCSI port will need to be folded over in order to reach the port on the Macintosh Plus.

The new-style mouse with the small connector **must** be used. Gently jiggle the mouse connector onto the board at the location indicated below.

Pull-Down Menus and Icons

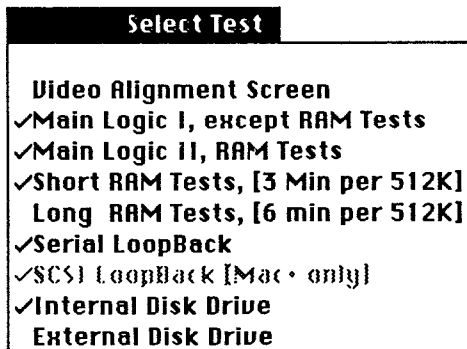
The following window should appear (on a 512K Macintosh).



The following pages will explain how to use and what to expect from each of the features listed under the four pull-down menus.

This pull-down menu indicates the amount of memory in the Macintosh or Macintosh Plus you are working on. For a 128K machine, **128K** would be displayed. For the Macintosh Plus, **1024K Mac+** would be displayed.

Select Test



The **Select Test** menu lists the various tests available to you.

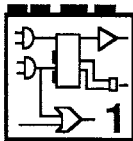
To select a test, pull down the menu and highlight the test you want, then release the mouse button. Pull down the menu again and notice the check mark that has appeared.

To deselect a test, pull down the menu and highlight the test you want, then release the mouse button. If you pull down the menu again, you will notice that the check mark is gone. The tests are described below.

Video Alignment Screen

The **Video Alignment Screen** is a white screen, with twelve grayscale squares for focus. The screen may be used to properly align and focus the video display.

Main Logic I, except RAM Tests



When selected, the **Main Logic I** verifies the working condition of various hardware items on the board.

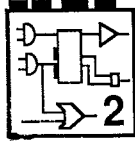
The loopbacks do not have to be installed to run this test. However, if they are not installed, the **Serial Loopback** and **SCSI Loopback [Mac+]** tests should be deselected.

If the loopback tests are selected but the loopbacks are not installed, a dialog box will appear asking if the loopback connectors are installed: click in the **OK** box. **The test sequences will automatically abort when you click in the OK box.** Then you can either deselect the tests for the ports, save the configuration, and rerun *MacTest*, or install the loopbacks and rerun *MacTest*.

If the loopback cables are installed and you want the ports tested, you will need to select one or both of the loopback tests and save the configuration.

The icon shown above is displayed in the **Service MacTest** window when this test is being performed.

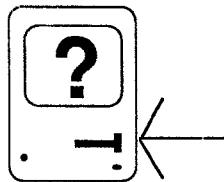
Main Logic II, RAM Tests



When selected, the **Main Logic II, RAM Tests** option verifies the RAM installed on the logic board. In order to test the RAM completely, you also need to select either the **Short RAM Tests [3 MIN per 512K]** or the **Long RAM Tests [6 Min per 512K]**. These selections will determine how long the RAM will be tested. When the RAM test is running, the menu bar at the top of the screen will flash slowly.

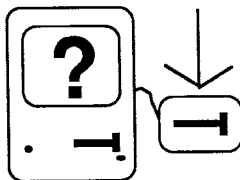
The icon above is displayed in the **Service MacTest** window when this test is being performed.

Internal Disk Drive



When selected, the **Internal Disk Drive** test verifies the functionality of the internal disk drive. The icon above is displayed in the **Service MacTest** window when this test is being performed.

External Disk Drive



When selected, the **External Disk Drive** test verifies the functionality of the external drive. Insert a blank formatted diskette into the external drive before testing. The icon above is displayed in the **Service MacTest** window when this test is being performed.

Options

Options
Show GoNoGo Window
Auto Run Selected
✓Auto Run Not Selected
Save Configuration
Quit to Finder
Shut Down

This **Options** menu lists the various features available when using the *MacTest* diskette. Check marks indicate options that are currently selected.

Auto Run Selected

Auto Run allows you to run the Logic I, Logic II (which must be selected) and Internal Disk Drive tests in a continuous loop. Appropriate loopback connectors must be installed to use the Automatic Run feature effectively. The External Disk Drive test may be selected, but it will run only once. Under Auto-Run *MacTest* will run automatically until a failure occurs. To stop the automatic test sequence, refer to Things to Remember.

Auto Run Not Selected

If **Auto Run Not Selected** is displayed, *MacTest* will run each selected test once and will then reboot and display the results with an icon.

Save Configuration

IMPORTANT: The diskette must be unlocked before you try to save a configuration. The program does not warn you when the disk is locked.

Save Configuration allows you to customize your *MacTest* diskette. Select the tests you want to run and select this feature. A window will appear with a file named **Options.OPTN** displayed. Click in the **Save** box.

The file you save must be named "Options.OPTN" to run.

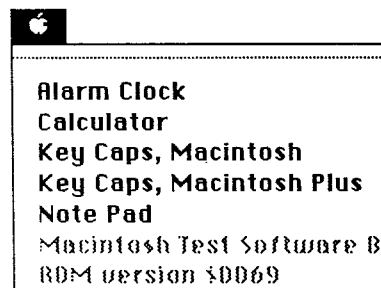
Quit to Finder

Quit to Finder returns you to the desktop with the disk and file icons displayed.

Shut Down

Shutdown ejects the diskette and reboots the system.

Apple



The Apple (🍏) menu allows you to test the keyboard, keypad, and speaker for the machine you are testing. Perform the logic board test before performing any of these tests.

IMPORTANT: All desk accessories must be closed before running *MacTest*.

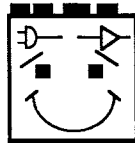
Calculator

When selected, **Calculator** displays a window with a calculator. Press each key on the keypad and verify that it is highlighted in the window. If a key is not highlighted, the keyswitch is bad and the numeric keypad (Macintosh) or the keyboard (Macintosh Plus) should be replaced.

Key Caps

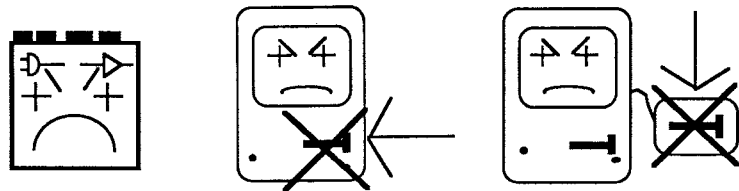
There are two **Key Caps** tests, one for the Macintosh and one for the Macintosh Plus. Choose the appropriate test. When selected, this feature displays a window with a keyboard. Press each key on the keyboard and verify that the display block for that key is highlighted. If the key is not highlighted, the keyswitch is bad and the keyswitch should be replaced. If numerous keys are not highlighted, exchange the keyboard.

Miscellaneous Icons



Pass

If all tests pass, the Macintosh/Macintosh Plus will reboot after a few minutes, momentarily highlight the **PASS** icon box, and display a "happy face" icon, similar to the one above.



Fail

If a test fails, a bad module will be indicated by a "sad face" icon of the specific module. If any test fails, the tests will stop running and the **FAIL** icon box will be highlighted. The icons are (above from left to right): the logic board, the internal disk drive, and the external disk drive.

Running the Diagnostic

The following are abbreviated procedures for running a standard test, a customized test, or a continuous test. The amount of time you need to run the diagnostic will range from two minutes to twenty minutes, depending on your machine and the tests you select.

If you need additional information, refer to "Things to Remember" and "Pull-Down Menus and Icons."

Standard

The *MacTest* diskette is shipped configured to run the Logic I test, the Logic II test, and the the Internal Drive tests.

1. Install the appropriate connectors for the machine you are testing.

2. Turn on the machine.

An icon of a diskette with a flashing question mark should appear.

3. Insert the *MacTest* diskette into the internal drive.

The **Service MacTest** window should appear. The amount of memory will be displayed in the menu bar.

4. Click in the **Start** icon box.

MacTest will run the tests selected under the menu **Select Test**.

If the tests pass, the machine will reboot and the "happy face" icon will appear.

If a test fails, a "sad face" icon of the bad module will appear.

5. Pull down the **Apple** menu and perform the **Key Caps**, **Control Panel** (speaker), and **Calculator** tests, if applicable.

Customized

This test allows you to select the modules you want to test, be it one module or any combination of modules.

1. If the logic board is to be tested, install the appropriate loopback connectors for the machine you are testing.
2. Turn on the machine.

An icon of a diskette with a flashing question mark should appear.

3. Insert the *MacTest* diskette into the internal drive.

The **Service MacTest** window should appear. The amount of memory will be displayed in the menu bar.

4. Select the test(s) you want to run from the **Select Test** pull-down menu.

5. On completion, pull down the **Options** menu and select **Save Configuration**.

A dialog box will appear with the message "Save Test Data as: Options.OPTN."

Click in the **Save** box.

A dialog box will appear asking, "Replace existing Options.OPTN?"

Click in the **Yes** box.

The disk will whirl for a few seconds and the **Service MacTest** window will be displayed.

6. Click in the **Start** icon box.

MacTest will run the tests selected under the menu **Select Test**.

If the tests pass, the machine will reboot and the "happy face" icon will appear.

If a test fails, a "sad face" icon of the bad module will appear.

Continuous

This test allows you to run the Logic I test, the Logic II test, and the Internal Disk Drive test continuously or overnight to check for intermittent problems.

1. The appropriate loopbacks must be installed to use the continuous test feature effectively.
2. Turn on the machine.

An icon of a diskette with a flashing question mark should appear.

3. Insert the *MacTest* diskette into the internal drive.

The **Service MacTest** window should appear. The amount of memory will be displayed in the menu bar.

4. Verify that the tests listed above are selected in the **Select Test** pull-down menu.

If they are not selected, select them now.

5. On completion, pull down the **Options** menu and select **Auto Run Selected**.

6. Then pull down the **Options** menu and select **Save Configuration**.

A dialog box will appear with the message "Save Test Data as: Options.OPTN".

Click in the **Save** box.

A dialog box will appear asking "Replace existing Options.OPTN?"

Click in the **Yes** box.

The disk will whirl for a few seconds and the **Service MacTest** window will be displayed.

7. Click in the **Start** icon box.

MacTest will run the tests selected under the menu **Select Test**.

If the tests pass, the machine will reboot and the "happy face" icon will appear. The cycle will be repeated continuously until stopped.

If a test fails, a "sad face" icon of the bad module will appear and the testing will stop.

8. To stop the continuous test do the following:

- a) Pull down the **Options** menu and select **Auto Test Not Selected**.

- b) Pull down the **Options** menu and select **Save Configuration**.

The new configuration will be saved and the continuous test will stop after the next reboot cycle.

Error Codes

Error codes may appear when you run the *MacTest* diskette. The following chart lists the various error codes that may be displayed (the X's in the error code can be ignored) and the things you should check to correct the problems.

Before using the chart, verify that you are using a **known-good MacTest** diskette.

If an error code is displayed, find it in the list below and check the items listed to the right. After each step, run *MacTest* to see if the error code is still displayed.

Error Code

Things to Check

100XX.XXXX

1. Keyboard connected correctly?
2. Exchange keyboard cable.
3. Exchange keyboard.
4. Exchange logic board.

200XX.XXXX

1. Appropriate loopback connectors installed?
2. Dialog box appeared asking if cables were connected?
3. Loopback connectors work OK on another machine?
4. Exchange logic board.

300XX.XXXX

1. Check items listed for 200XX.
2. Exchange logic board.

400XX.XXXX

1. *MacTest* diskette unlocked?
2. Exchange internal disk drive.

500XX.XXXX

1. Blank formatted 400K diskette installed in external disk drive before running test?
2. Formatted diskette unlocked?
3. Exchange external disk drive.

600XX.XXXX

- Exchange Logic Board.

Macintosh Plus Error ONLY

800XX.XXXX

1. SCSI Loopback Test Card connected?
2. Dialog box appeared asking if cables were connected?
3. SCSI Loopback Test Card works OK on another machine?
4. Exchange logic board.

Macintosh and Macintosh Plus

Section 4 – Troubleshooting

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4.2	Introduction
4.2	General Information
4.2	Before You Start
4.2	How to Use the Symptom Chart
4.2	Exchanging the Logic Board
4.2	Exchanging the Power/Sweep Board
4.3	Things to Remember
4.4	Symptom Chart
4.4	Video Problems
4.5	Drive Problems
4.6	Peripheral Problems
4.7	Miscellaneous Problems
4.8	Special Problems

□ INTRODUCTION

General Information

Use this troubleshooting section if the diagnostics are unable to detect a module failure or if the diagnostic disk cannot be booted. After you repair the system, run the diagnostic test to verify system operation.

Before You Start

Read the section entitled "Things to Remember" before you begin troubleshooting. There are a number of things you should know about the Macintosh or Macintosh Plus to troubleshoot them effectively.

How to Use the Symptom Chart

Use the left-hand column to find the symptom that most nearly describes the problem of the defective unit. For that symptom, perform the corrective action(s) in the order listed. If a corrective action does not fix the problem, proceed to the next step. If a board is replaced but does not fix the problem, the original board should be reinstalled before you perform the next step.

Exchanging the Logic Board

If a customer requires a replacement Macintosh Plus logic board, compare the part numbers of the ROMs on the customer's board with those on the replacement board. If the ROMs are different, swap the them so that the customer keeps the same ROMs he started with. This must be done so that the customer's board is not downgraded.

Boot ROMs for the Macintosh Plus and Macintosh 512K Enhanced systems exist in several versions, which cannot be mixed on the same logic board. For more information refer to Section 6, Additional Procedures.

On 512K logic boards, verify that the ROMs on the exchange board are the same as the ones on the customer's board. If the ROMs are different, swap them so that the customer keeps the same ROMs.

Exchanging the Power/Sweep Board

When sending Apple a defective power/sweep board from a Macintosh or Macintosh Plus, be sure to include the power/sweep-to-logic-board cable. Make sure the contrast control knob and battery have been removed from the defective board and reinstalled onto the exchange board.

□ THINGS TO REMEMBER

1. Follow the basic ESD precautions when troubleshooting. (Refer to Section 2, Take-Apart, for more information.)
2. Be sure you read all the safety precautions before removing or installing any modules (refer to Section 1, Basics).
3. Be sure you discharge the CRT before removing or installing any modules. (Refer to Section 2, Take-Apart, for specific information.)
4. Be sure the software you use is known-good. Bad software can produce symptoms that appear to be hardware problems.
5. When exchanging the logic board or the power/sweep board, you must adjust the voltage. (Refer to Section 5, Adjustments, for complete instructions.)

□ SYMPTOM CHART

Video Problems

Solutions

- | | |
|--|---|
| <ul style="list-style-type: none">• <i>No video, but audio tone is present and drive operates</i> | <ol style="list-style-type: none">1. Turn contrast control fully counterclockwise.2. Check video cable connections.3. Replace neck cable.4. Replace power/sweep board.5. Replace logic board. |
| <ul style="list-style-type: none">• <i>Screen is bright and audio is present, but no video information is present</i> | <ol style="list-style-type: none">1. Replace power/sweep board.2. Replace logic board. |
| <ul style="list-style-type: none">• <i>Audio tone sounds at power on, video is present, but drive does not operate</i> | <ol style="list-style-type: none">1. Replace disk drive cable.2. Replace disk drive.3. Replace main logic board. |

Drive Problems

Solutions

IMPORTANT: When exchanging an 800K drive, either internal or external, refer to Section 6, Additional Procedures, for exchange module compatibility information.

- | | |
|--|---|
| <ul style="list-style-type: none">• <i>Disk ejects, display shows disk icon with blinking "X"</i>
• <i>Unable to insert diskette all the way</i>
• <i>Drive will not eject diskette</i>
• <i>Will not read diskettes on internal drive</i>
• <i>Will not read diskettes on external drive</i>
• <i>Disk drive runs continuously</i> | <ol style="list-style-type: none">1. Replace bad diskette.2. Replace disk drive.3. Replace logic board.
<ol style="list-style-type: none">1. Insert a paper clip into the small hole beside the drive slot, or power off the system and hold the mouse button down while powering on to ensure the eject cycle has been completed. Then insert the diskette with the metal slot forward and the write protect tab on the bottom.2. Replace the disk drive.
<p>– Refer to Section 6, Additional Procedures.</p>
<ol style="list-style-type: none">1. Replace bad diskette.2. Replace Mylar RFI shield.3. Replace internal drive.4. Verify ROMs on the logic board (refer to Section 6, Additional Procedures).5. Replace logic board.
<ol style="list-style-type: none">1. Replace bad diskette.2. Replace Mylar RFI shield.3. Replace external drive.4. Replace logic board.
<ol style="list-style-type: none">1. Replace bad diskette.2. Replace drive cable.3. Replace disk drive.4. Replace logic board. |
|--|---|

Peripheral Problems

Solutions

- *Cursor does not move*
 1. Connect mouse.
 2. Replace mouse.
 3. Replace logic board.
- *Cursor moves but clicking mouse produces no response*
 1. Replace mouse.
 2. Replace logic board.
- *No response to any key on keyboard*
 1. Replace keyboard cable.
 2. Replace keyboard.
 3. Replace logic board.
- *No response from a particular key*
 1. Replace keyswitch.
 2. Replace keyboard.
 3. Replace logic board.
- *Known-good ImageWriter or ImageWriter II will not print*
 1. Replace software with known-good.
 2. Make sure that the Chooser and the Control Panel are set correctly.
 3. Replace interface cable.
 4. Replace logic board.
- *Known-good LaserWriter will not print*
 1. Replace software with known-good.
 2. Make sure that the Chooser and the Control Panel are set correctly.
 3. Refer to *Apple Service Technical Procedures: Networks*.

Miscellaneous Problems

Solutions

- *When turned on, the Macintosh Plus continuously beeps and tries to power up*
 - Replace power/supply board, main logic board, and internal drive; then turn on the Macintosh Plus.
Replacing only the power/sweep board may damage the new power/sweep board.
- *Clicking or chirping sound*
 - 1. Connect logic board cable.
 - 2. Perform the voltage adjustment (refer to Section 5, Adjustments).
 - 3. Replace power/sweep board.
 - 4. Replace logic board.
- *Smoke/odor issues from the Macintosh*
 - Replace power/sweep board
- *No video, no audio tone, and no drive operation*
 - 1. Connect power cord.
 - 2. Turn power on.
 - 3. Replace power cord.
 - 4. Check fuse.
 - 5. Replace power/sweep board.
 - 6. Replace logic board.
- *MacTest displays 128K/512K when a 1 Megabyte Macintosh Plus is tested*
 - Replace Macintosh Plus logic board.
- *When the developer's switch is installed, the Macintosh Plus sometimes will reset intermittently*
 - Remove switch and file it down about 1/16 of an inch.

Special Problems

Solutions

- *Macintosh Plus hangs on startup*
 - If the logic board has the ROMs 342-0341-A or B (ROM HI) and 342-0342-A (ROM LO) and a peripheral device is connected to the SCSI port, the peripheral device must be turned on before powering on the Macintosh Plus. For additional information on ROM versions refer to Section 6, Additional Procedures.
- *Macintosh 512K Enhanced has two RFI Shrouds*
 - Some of these machines have two RFI shrouds installed. The two RFI shrouds can be replaced by one RFI shroud, which is orderable as a service part.
- *Stripped or lost Macintosh chassis screws*
 - Refer to Section 6, Additional Procedures.

Macintosh and Macintosh Plus

Section 5 – Adjustments

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5.2	Power/Sweep Voltage Adjustment
5.2	Introduction
5.2	Materials Required
5.3	Voltage Adjustment
5.4	Yoke Adjustments
5.4	Introduction
5.5	Materials Required
5.5	Adjustment Procedures
5.6	Video Adjustments
5.6	Introduction
5.6	Materials Required
5.7	Adjustment Procedures

□ POWER/SWEEP VOLTAGE ADJUSTMENT

Introduction

The voltages must be verified whenever the logic board or the power/sweep board is exchanged. If the voltages are outside of the specified tolerances, the adjustments must be performed.

The adjustments are done with the power on, and all voltage measurements are taken on the disk drive port with no peripheral devices attached. The internal disk drive should not be running when the measurements are being taken.

WARNING: *Read and follow all the safety precautions in Section 1, Basics, before performing any adjustments. Failure to follow the safety rules could result in serious injury.*

Materials Required

Macintosh voltage test cable
Plastic alignment tool
Digital voltmeter (accurate to within 0.01 volts)

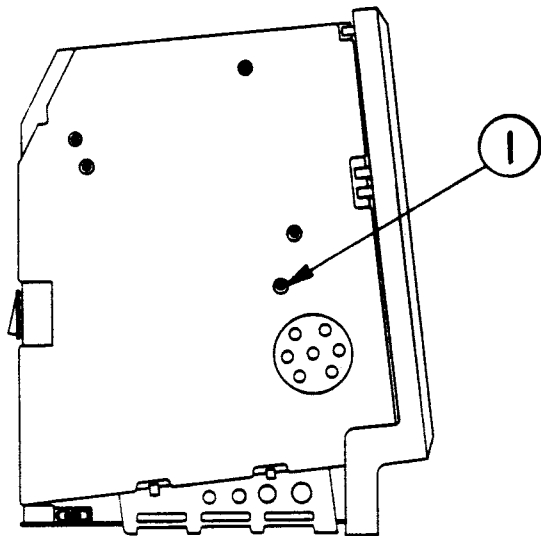


FIGURE 1

Voltage Adjustment

WARNING: *If the banana plugs on the test cable short to one another, the Macintosh will be damaged. Make sure that the banana plugs are insulated by their rubber hoods when not in use.*

1. The power should be off and the back cover removed. Connect the black test lead to the ground, set the proper range on the voltmeter, and plug the connector into the disk drive port on the rear of the Macintosh.
2. Connect the orange test lead (12 volts) to the input on the voltmeter. Power on the Macintosh.

The voltage reading must be between 11.90 and 12.3 volts. If the voltage is not within these tolerances, use the alignment tool to adjust the voltage regulator (Figure 1, #1) on the power/sweep board to 12.3 volts.

3. Power off the Macintosh. Disconnect the orange test lead and replace its insulating hood.
4. Connect the red test lead (5 volts) to the input on the voltmeter. Power on the Macintosh.

The voltage reading must be between 4.85 and 5.15 volts. If the voltage is not within these tolerances, use the alignment tool to adjust the voltage regulator (Figure 1, #1) on the power/sweep board to the specified limits.

6. Power off the Macintosh. Disconnect the red test lead and replace its insulating hood.
7. Repeat steps 2 through 6 to verify that both voltages are within the specified tolerance ranges.

If the power/sweep board cannot be adjusted so that both voltages fall within the tolerances indicated above, it should be exchanged.

□ YOKE ADJUSTMENTS

Introduction

If you replace the CRT, you will probably need to adjust the yoke. To determine if yoke adjustments are required, turn the power on and observe the CRT screen. If the picture is tilted, perform the tilt adjustment. If the picture is off center, perform the centering rings adjustment.

Yoke adjustments are made from the rear of the computer. You will need to position a mirror so that you can view the front of the computer. **Do not try to adjust by reaching around the computer;** you can't see what your hands are going to touch.

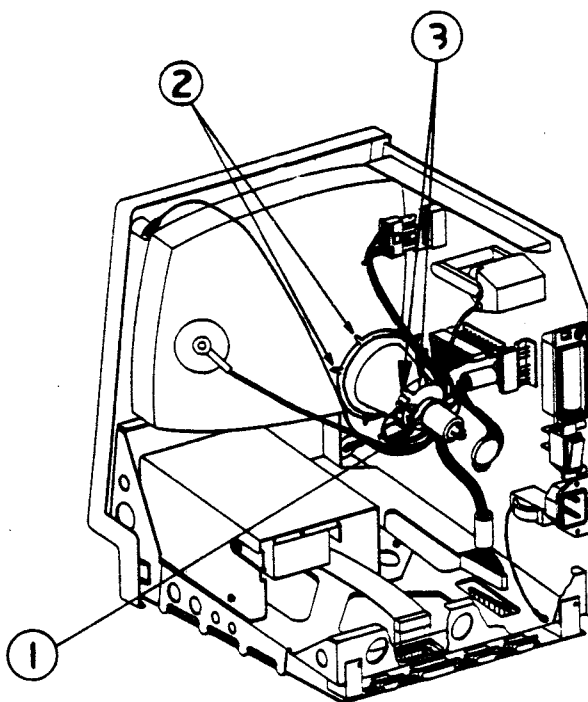


FIGURE 2

WARNING: Read and follow all the safety precautions in Section 1, Basics, before performing adjustments. Failure to follow the safety rules could result in serious injury.

Materials Required

Small flatblade screwdriver
CRT discharge tool
Soft cloth or foam pad
Mirror

Adjustment Procedures

1. Remove the cover and discharge the CRT to the ground lug (refer to Section 2, Take-Apart).
2. Turn the computer with its back facing you and position the mirror so that the CRT screen is visible in the mirror.

Tilt

3. Loosen the yoke clamp screw (Figure 2, #1) two or three turns.
4. Connect the power cord to the Macintosh, and then connect the other end to an electrical outlet. Turn the power on.
5. Put one hand behind your back and with your other hand grasp only the plastic spokes of the yoke collar (Figure 2, #2). Rotate the yoke and observe the effects on the picture. Rotate the yoke until the top and bottom edges of the picture appear parallel with the top and bottom edges of the bezel.
6. Turn the power off and unplug the computer. discharge the CRT to the ground lug. Hold the plastic collar in position and **carefully** tighten the yoke clamp screw just enough to so it does not slip. Do not overtighten.

Yoke Centering Ring

7. Connect the power cord and turn the power on. Locate the two centering rings on the yoke assembly (Figure 2, #3). The adjustment of these rings determines whether the picture is centered or offset to one side.
8. Rotate each ring about half a turn and observe the effect on the screen.
9. Now center the picture by first holding the front ring steady and moving the rear ring, then holding the rear ring steady and moving the front ring.

□ VIDEO ADJUSTMENTS

Introduction

Video adjustments are performed whenever the CRT or power supply/sweep board is replaced.

Materials Required

Alignment tool
Mirror
Ruler

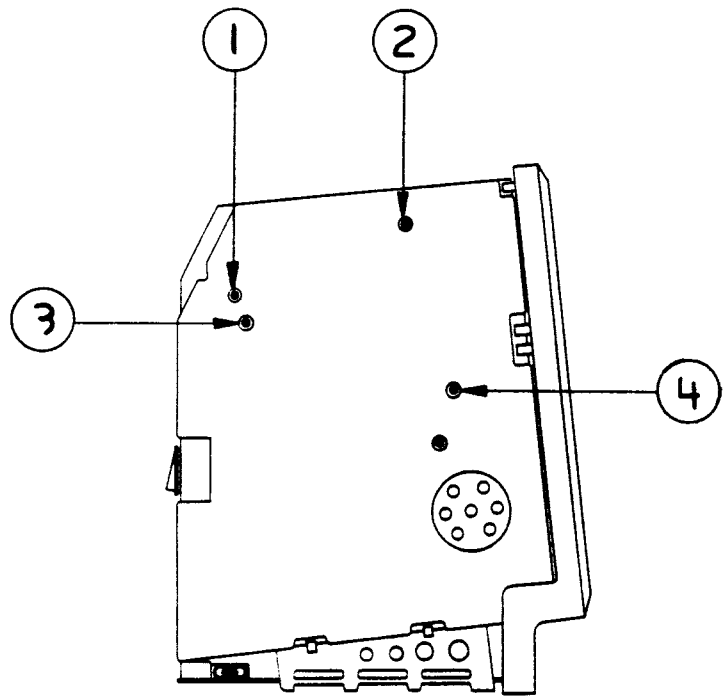


FIGURE 3

Adjustment Procedures

Brightness and Contrast

1. Put on safety goggles and remove all jewelry, including rings and necklaces.
2. Turn the contrast control fully clockwise. (The contrast control is on the front of the Macintosh, on the left hand side, under the Apple logo.)
3. Adjust the brightness control (Figure 3, #1) with the alignment tool: turn it fully counterclockwise so that white lines are visible on the screen. Then turn it back in the opposite direction until the white lines just disappear.
4. Turn the contrast control on the front panel a little bit counterclockwise. This is the ideal adjustment.

Size Adjustments

5. Use the alignment tool to adjust the width (Figure 3, #2) until the picture is approximately 7 inches wide.
6. Use the alignment tool to adjust the height (Figure 3, #3) until the picture is approximately 4.7 inches high.

Focus Adjustment

7. Turn the focus adjustment (Figure 3, #4) all the way clockwise until it doesn't turn anymore. Now turn it back in the opposite direction (counterclockwise) one-eighth of a turn. This setting gives the best overall sharpness at all points on the screen.

Macintosh and Macintosh Plus

Section 6 – Additional Procedures

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6.2	Macintosh Plus Kits
6.2	Things to Remember
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6.5	Macintosh Plus Disk Drive Kit
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6.9	800K Drive Exchange Compatibility
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6.13	Logic Board ROM Upgrade and 400K Drives
6.15	Alternate Chassis Screw Sizes
6.16	Removing the CRT Overspray
6.19	ROM Version Compatibility

□ MACINTOSH PLUS KITS

WARNING: *There is high voltage and a high-vacuum picture tube inside the Macintosh computer. To prevent serious injury and property damage, make sure you read and follow the safety information and procedures found in Section 1, Basics.*

Things to Remember

When installing the Macintosh Plus Disk Drive Kit or the Macintosh Plus Logic Kit, pay special attention to the following:

1. Discharge the CRT as specified in Section 1, Take-Apart. Failure to do so can result in damage to the logic and power/sweep boards.
2. Follow the ESD prevention rules explained in Section 2, Take-Apart.
3. You may use 400K diskettes in the 800K drive, but be aware that the 800K drive may emit a squealing sound. This does not indicate a problem and will not cause damage to either the diskette or the 800K drive.
4. The shipping instructions must be followed **exactly** as stated on the sheet included with the kit.
5. The 800K disk drive is shipped with a packing diskette installed. This packing diskette should be given to the customer. Whenever the machine is transported, the packing diskette should be inserted to prevent damage to the drive.
6. Remind your customers that all their diskettes have to be updated with the most recent system files. The files are included in the kit and should be given to customers. Instructions for performing the system file upgrades are given in the manuals that accompany the kits.
7. When the Drive Kit is installed, the customer should be given the *Macintosh Plus Internal Drive Manual*.

8. When the Drive Kit and the Logic Board Kit are installed, the customer should be given the Peripheral Adapter Cable, the *Macintosh Plus Owner's Guide*, the *Macintosh Plus Internal Drive Manual* and the *Macintosh Plus Information Sheet*.
9. The Macintosh Plus will display a gray screen for 5 to 10 seconds before booting from any diskette. (The Macintosh Plus is running a self-check.)
10. The Macintosh Plus Disk Drive Kit is not recommended for the 128K Macintosh.
11. Insert the yellow packing diskette into the new 800K disk drive to prevent damage during transport.

Disk Drive and Logic Board Kits

If you are installing the Macintosh Plus Disk Drive and Logic Board Kit at the same time, follow these steps:

1. Turn to "Macintosh Plus Disk Drive Kit" and follow steps 1-4, 7, and 8.
2. Turn to "Macintosh Plus Logic Board Kit" and follow steps 5-9.
3. Insert the yellow packing diskette into the new 800K disk drive.
4. Return the **old** ROMs, the 400K drive, and the **old** 128K/512K logic board to Apple as instructed in the kits.

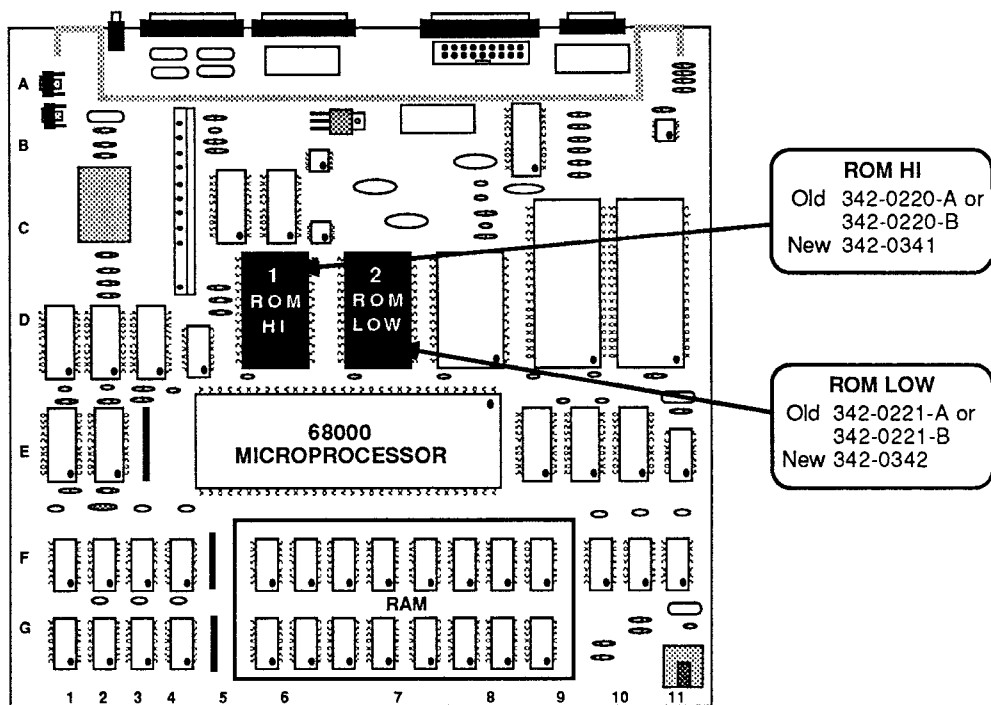


FIGURE 1

Macintosh Plus Disk Drive Kit

Read "Things to Remember" before beginning.

The Macintosh Plus Disk Drive Kit contains an 800K internal disk drive and two new boot ROMs. When installing it, you will replace the 400K internal disk drive and two socketed boot ROMs on the 512K Macintosh logic board. The new ROMs will support both the 400K and 800K external disk drives.

Return Information

The shipping instructions must be followed **exactly** as stated on the sheet included with the Macintosh Plus Drive Kit.

Procedures

1. Power off the Macintosh and remove the power cable from the machine.
2. Remove the rear housing and RFI shroud.
3. Discharge the CRT as specified in Section 2, Take-Apart.

WARNING: Discharge the anode to the metal part of the ground lug. Failure to do so will damage the logic and power/sweep boards and will expose you to electrical shock hazards.

4. Remove the Macintosh logic board. Using an IC extractor, remove the old ROMs installed at locations D5 and D8. (Refer to Figure 1, Macintosh 128K/512K Logic Board.)
5. Install the two new ROMs in the appropriate locations: ROM HI (P/N 342-0341) at location D5, ROM LOW (P/N 342-0342) at location D8. (Refer to Figure 1, Macintosh 128K/512K Logic Board.) There is a notch at one end of each ROM. This notch should face the front of the machine on installation.
6. Remove the internal disk drive (refer to Section 1, Take-Apart).
7. Reinstall the Macintosh logic board and install the new 800K internal disk drive.
8. Replace the RFI shroud and rear housing.
9. Run *MacTest* to verify that the machine is still working correctly.
10. Return the old ROMs and 400K disk drive to Apple (refer to instructions included in the kit).

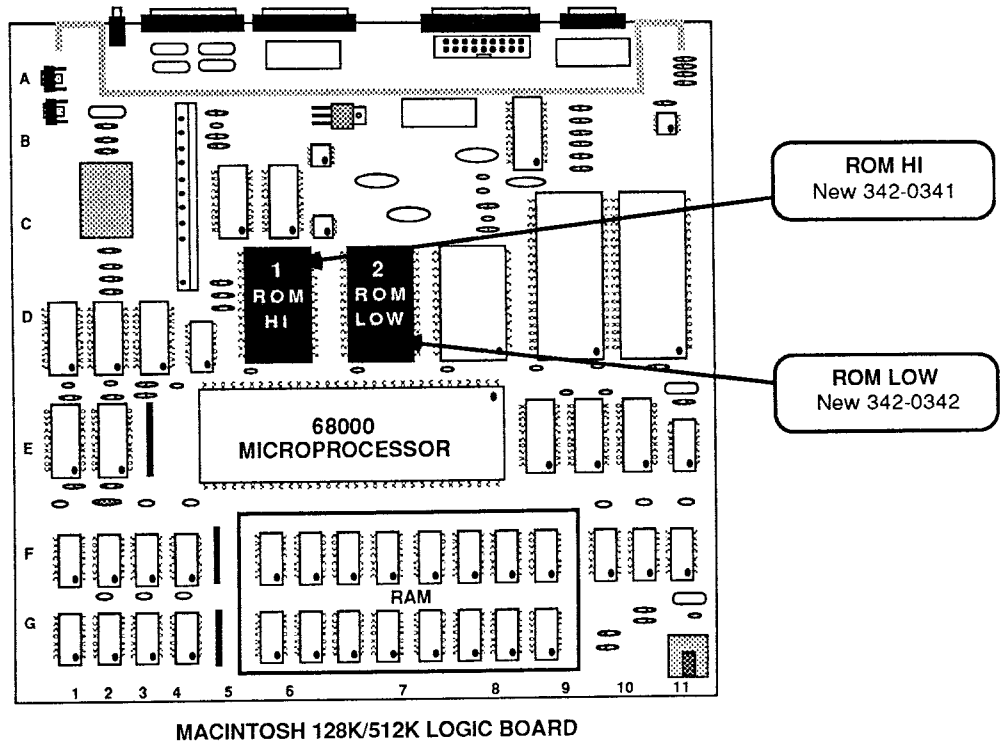


FIGURE 2

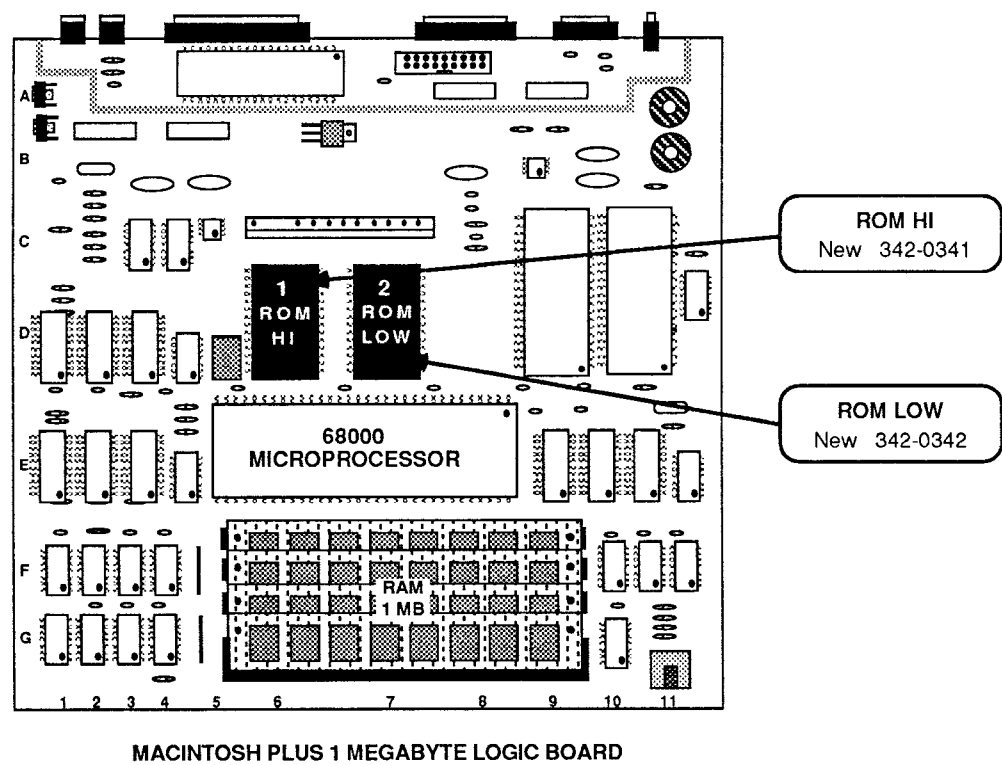


FIGURE 3

Macintosh Plus Logic Board Kit

Read "Things to Remember" before beginning.

The Macintosh Plus Logic Board Kit cannot be installed unless the Disk Drive Kit has been installed. You will need the new ROMs which were installed for the Disk Drive Kit. The Logic Board Kit includes a Macintosh Plus logic board with 1 megabyte of memory, an RFI shroud, and a new rear housing.

Return Information

The shipping instructions must be followed **exactly** as stated on the sheet included with the Macintosh Plus Logic Board Kit.

Procedures

1. Power off the Macintosh and remove the power cable from the machine.
2. Remove the old rear housing and RFI shroud.
3. Discharge the CRT as specified in Section 1, Take-Apart.

WARNING: *Discharge the anode to the metal part of the ground lug. Failure to do so will damage the logic and power/sweep boards and will expose you to electrical shock hazards.*

4. Remove the 128K/512K Macintosh logic board. Using an IC extractor, remove the two Revision D ROMs. ROM HI is at location D5, and ROM LOW is at location D8. (Refer to Figure 2, Macintosh 128K/512K Logic Board.)
5. Install the two ROMs in the appropriate locations on the **new** logic board: ROM HI (P/N 342-0341) at location D5, ROM LOW (P/N 342-0342) at location D8. (Refer to Figure 3, Macintosh Plus 1 Megabyte Logic Board.) There is a notch at one end of each ROM. This notch should face the front of the machine on installation.
6. Install the **new** Macintosh Logic Board with the ROMs. Install the **new** RFI shroud and the **new** rear housing.
7. Run *MacTest* to verify that the machine is still working correctly.
8. Return the old logic board (with no ROMs), the old RFI shroud and the old rear housing to Apple.

❑ SPECIAL PROBLEMS

800K Drive Exchange Compatibility

There are three series of 800K drive mechanisms. All three mechanisms can be used as an internal drive, but only with the cable specified below. If you do not use the correct cable, the drive will not work correctly.

<i>Series Number</i>	<i>Cable Needed</i>
MFD-51W-03 (Red on Silver Label)	Yellow
MFD-51W (Black on Silver Label)	Red
51W-10 (Black on Silver Label)	Red

For additional information refer to the *Disk Drive* tab.

800K Diskette Ejection Problems

Whenever a diskette from an internal or external 800K drive does not fully eject, the user must push the diskette back in and attempt to eject it electronically.

CAUTION: *If the diskette becomes "frozen" and does not fully eject, the user must not force the diskette by pulling it out from the drive. Using force may result in damage to the mechanism.*

The following three ways of ejecting the diskette should be tried.

1. Hold down the <Shift> and <Command> keys and press 1 (for the internal drive) or 2 (for the external drive).
2. Pull down the **File** menu and select **Eject**. Attempt this two or three times.
3. As a last resort, the user can insert a paper clip in the pin hole located beneath and to the right of the slot where the diskette is inserted.

The following factors can also affect the insertion and ejection of a diskette.

- A diskette should be inserted by pressing the diskette gently into the drive. Avoid grasping and pushing the diskette, as this may cause the diskette to go in only part way and stop. If this happens, the user should attempt to eject the diskette as described above.
- Diskettes with three or more labels may not slide easily into and out of the diskette slot in the Macintosh case. If a third label is required, either remove the other labels first or discard the diskette.

Technicians should also be careful when removing or installing a disk drive mechanism. If the diskette opening in the disk drive mechanism is not properly centered, binding or friction may cause ejection problems. If the internal mounting bracket is warped or bent, the drive will not align properly with the bezel and the mounting bracket will need to be exchanged. Refer to Section 2, Take-Apart, for the proper installation procedure.

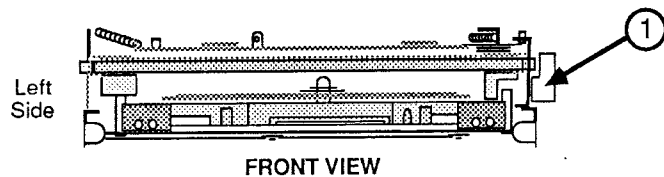


FIGURE 4

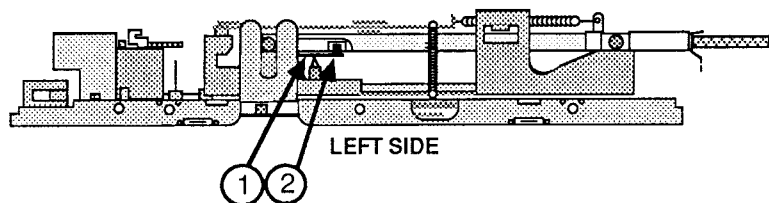


FIGURE 5

*Removing
Diskettes That
Will Not Eject*

If a diskette becomes "jammed" in a customer's disk drive, use the following procedure to remove it before you return the disk drive.

1. Remove the disk drive (refer to Section 2, Take-Apart).
2. Place the disk drive and RFI shield assembly upside down on a flat surface.
3. Remove the four screws securing the disk drive mechanism to the RFI shield.
4. Remove the disk drive mechanism from the RFI shield.
5. Place the disk drive mechanism on a flat surface, with the printed circuit board facing down and the diskette opening facing you (Figure 4).

If the diskette is not already fully inserted into the disk drive, push it in until it is properly seated.

6. Press the eject lever at the right side of the disk drive (Figure 4, #1).

Turn the disk drive so that the left side is facing you.

7. Locate the small arm with a cylindrical cog at its end. This arm is located near the left-to-right center of the drive mechanism (Figure 5, #1). The cog will be caught in the half-moon depression of the diskette case.
8. Insert a small screwdriver at the position shown in Figure 5, #2, and gently move the arm away from the diskette until the diskette pops forward slightly. Remove the diskette from the disk drive.
9. Return the defective disk drive to Apple and follow the instructions in Section 2, Take-Apart, to align the new disk drive with the front bezel.

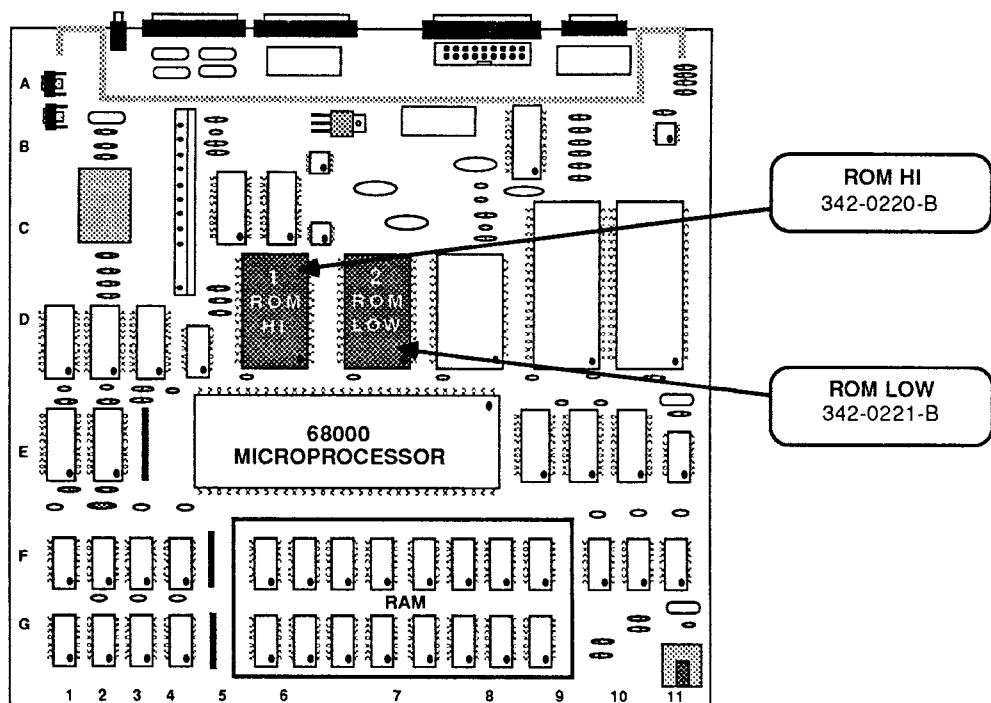


FIGURE 6

Logic Board ROM Upgrade and 400K Drives

Current 400K disk drives contain a new stepper motor, which may require the replacement of the two boot ROMs on older Macintosh logic boards (both 128K and 512K). Both of these ROMs are socketed. The new ROMs are compatible with both the new and old stepper motors.

The 128K/512K Macintosh should have ROM HI 342-0220-B at location D5, and ROM LOW 342-0221-B at location D8. If these ROMs are not installed, you will need to upgrade the logic board by replacing the boot ROMs.

Installation Procedures

1. Power off the Macintosh and remove the power cable from the machine.
2. Remove the cover and discharge the CRT (refer to Section 2, Take-Apart).

WARNING: Discharge the anode to the metal part of the ground lug. Failure to do so will damage the logic and power/sweep boards and will expose you to electrical shock hazards.

3. Remove the Macintosh logic board. Referring to Figure 6, locate the two ROMs and verify that the old ROMs are installed.
4. Using an IC extractor, remove the ROMs and place them on a piece of antistatic foam.
5. Install the new ROMs in the appropriate location [ROM HI (P/N 342-0220-B) at location D5, ROM LOW (P/N 342-0221-B) at location D8]. There is a notch at one end of each ROM. This notch should face the front of the machine on installation.
6. Reinstall the Macintosh logic board.
7. Replace the back cover.
8. Run *MacTest* to verify that the machine is still working correctly.

Alternate Chassis Screw Sizes

Some Macintosh systems have been shipped with non-standard chassis screws. The standard Macintosh uses three 2.9 x 10mm screws to attach the power/sweep board to the chassis, and one 2.9 x 6mm screw to attach the ground lug to the chassis. The non-standard systems use one of the following types of screw for both the board and the ground lug:

#6 x 3/8" Type A sheet metal screw, Phillips pan head, with external tooth start washer attached, steel, with zinc or cad plating.

#4-40 x 3/8" machine screw

To determine which screw is needed, compare the screw holes with the figures below. Systems with pem nuts or nutserts (Figure 7 and 8) use the machine screw. Systems without them (Figure 9) use the sheet metal screw.

These screws are available at any hardware store.

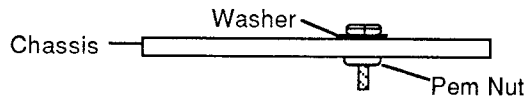


FIGURE 7

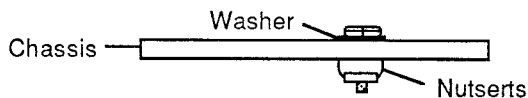


FIGURE 8

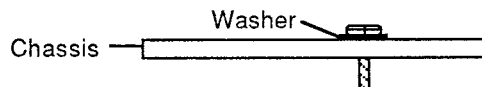


FIGURE 9

□ REMOVING THE CRT OVERSPRAY

Introduction

Macintosh CRTs have a conductive coating (Figure 10, #1), which is sprayed on. Certain CRTs have been sprayed with too much of this coating, especially near the ears of the CRT (Figure 10, #2). This overspray will occasionally cause them to produce an electrical discharge (arc) to the bezel near the "ears" on the CRT, causing electrical interference to the CPU. This may result in a "Serious System Error" message or "garbage" displayed on the screen. You may also hear "screaming" or "squealing" noises when this occurs. Turning power off and then back on will usually restore normal operation.

The following procedure will correct this problem. The procedure consists of cutting away some tape with a knife, scrubbing away some spray coating on the CRT, and installing four mylar washers between the CRT "ears" and the bezel.

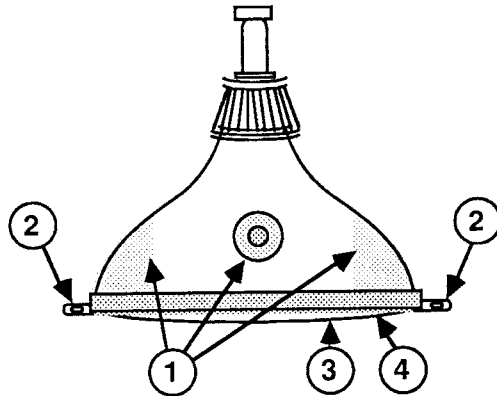


FIGURE 10

Materials Required

Rubbing Alcohol
X-acto knife
Mylar washers (4)
Rags or paper towels for cleaning up
Small stiff brush (a very stiff toothbrush or a cut-off acid brush works best)

WARNING: *There is high voltage and a high-vacuum picture tube inside the Macintosh computer. To prevent personal injury and property damage, make sure you have read the safety information in Section 1, Basics, before you perform this procedure.*

Procedure

1. Put on safety goggles and remove the CRT (refer to Section 2, Take-Apart). **Make sure the CRT has been discharged and the anode wire removed before going on to step 2.**
2. Place the CRT face down on a workbench so that you are viewing the area shown in Figure 10.
3. Inspect the area around the bottom of the metal band that goes around the CRT. If the CRT has any adhesive tape extending out from under the band (Figure 10, #1), hold the CRT steady with one hand (be careful not to touch the anode) and use an X-acto knife to cut the tape back to the edge of the band. Cut away the tape on all sides of the CRT. If there is no tape extending out, go on to the next step.
4. Check along the bottom edge of the band for any overspray of the conductive spray (Figure 10, #2). Scrub the glass along the edge of the band with a brush that has been dipped in rubbing alcohol.
5. Now check your work: the area below the edge of the band should be shiny like the glass on the screen of the CRT. Any dull or dark-looking areas should be scrubbed again.

...Continued on next page

6. With the bezel face down, apply a mylar washer to each of the four CRT mounting holes on the bezel (Figure 11, #1). Each washer should be centered with its center hole matching the screw hole in the bezel.
7. Make sure that the face of the CRT is clean, and then carefully seat the CRT on the bezel and install the CRT mounting screws.
8. Connect the anode wire to the CRT and replace the cover.

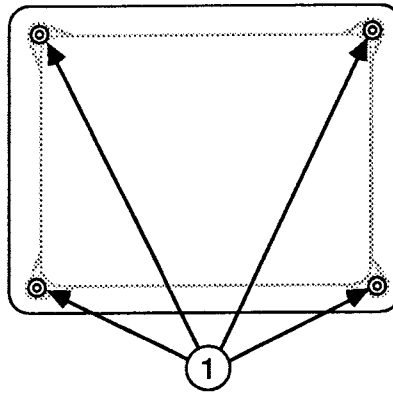


FIGURE 11

❑ ROM VERSION COMPATIBILITY

Starting in March, 1987, the Macintosh Plus, the Macintosh 512K Enhanced, and the 800K disk drive upgrade kit will be shipped with a new set of ROMs. These ROMs correct the SCSI device problems that were being experienced with older ROMs. The new ROMs are fully compatible with 512K systems. The only rule—**do not mix old and new ROMs**.

The following list gives the part number and the version letter of the old and new ROMs.

	Old ROMs	New ROMs
High:	342-0341-B	342-0341-C
Low:	342-0342-A	342-0342-B

Macintosh and Macintosh Plus

Section 7 – Illustrated Parts List

□ CONTENTS

- 7.3 Macintosh External Housing (Figure 1)
- 7.5 Macintosh/Macintosh Plus Chassis & Power Supply (Figure 2)
- 7.7 Macintosh Exploded Assembly (Figure 3)
- 7.9 Macintosh Keyboard Assembly (Figure 4)
- 7.11 Macintosh Numeric Keypad Assembly (Figure 5)
- 7.13 Macintosh Plus Rear Housing (Figure 6)
- 7.15 Macintosh Plus Exploded Assembly (Figure 7)
- 7.17 Macintosh Plus Keyboard Assembly (Figure 8)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Macintosh, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

Note: Only those items which are unique to the Macintosh Plus are called out on Figures 6, 7 and 8.

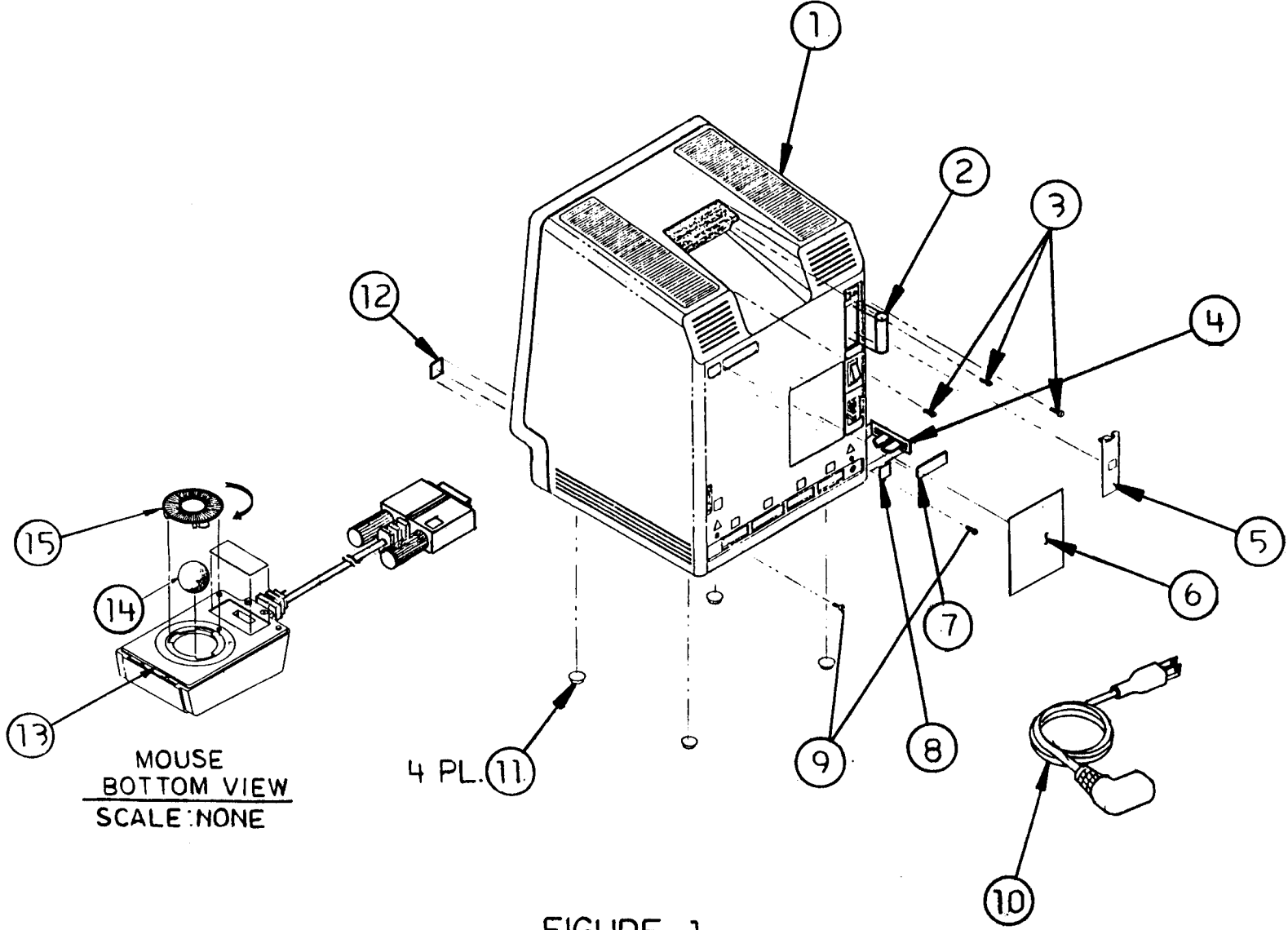


FIGURE 1

□ MACINTOSH – EXTERNAL HOUSING (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5139	Rear Housing with Label
2	742-0003	Battery, Alka, 4.5V
3	435-5002	Screw, Tap 8-32 x .625 Fill, Torx, Zinc Oxide (Main Case)
4	815-0737	Development System Pushbutton, Beige (Reset Button)
	815-0763	Development System Pushbutton, Smoke (Reset Button)
5	815-0938	Macintosh Battery Door, Beige
	815-0971	Macintosh Plus Battery Door, Platinum
6	825-4018	Agency Approval Label
	825-1014	Agency Approval Label, 512K enhanced
7	825-0742	Macintosh Label
	825-1065	Macintosh Signature 512K Label
8	825-0613	Logo Label (Housing)
9	422-1007	Screw, Tap, 4.21 x 1.41 x 16 (Main Case)
10	590-0138	Power Cable, Beige
	590-0131	Power Cable, Smoke
11	865-0051	Macintosh Foot
12	825-0547	Logo Label (Bezel)
13	661-96155	Macintosh Mouse
	661-0400	Apple Mouse, Platinum
14	699-8001	Rubber-Coated Mouseball
15	815-0409	Mouseball Retainer

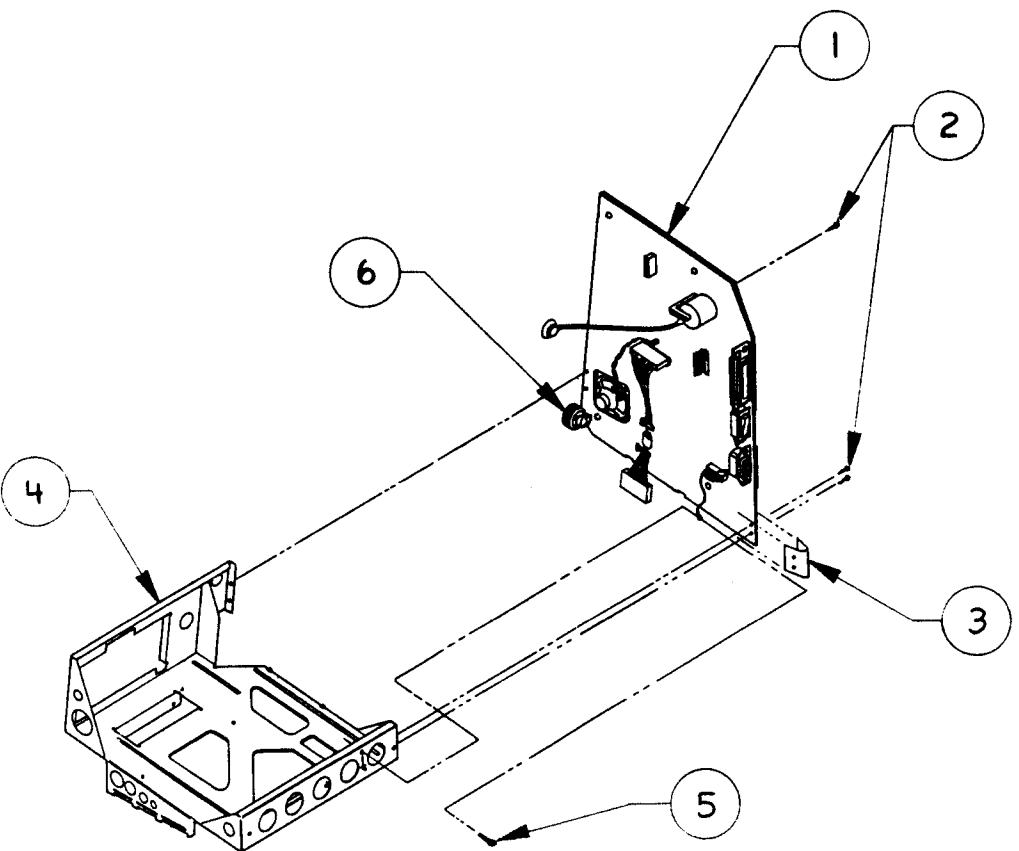


FIGURE 2

□ **MACINTOSH/MACINTOSH PLUS – CHASSIS AND POWER
SUPPLY (Figure 2)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-76153	Power Supply
2	470-2101	Screw, 2.9 x 10 mm
3	805-0576	Lower Ground Clip
4	805-0766	Macintosh Chassis
5	470-2100	Screw, 2.9 x 6 mm
6	865-0019	Brightness Knob, Beige
	865-0029	Brightness Knob, Smoke

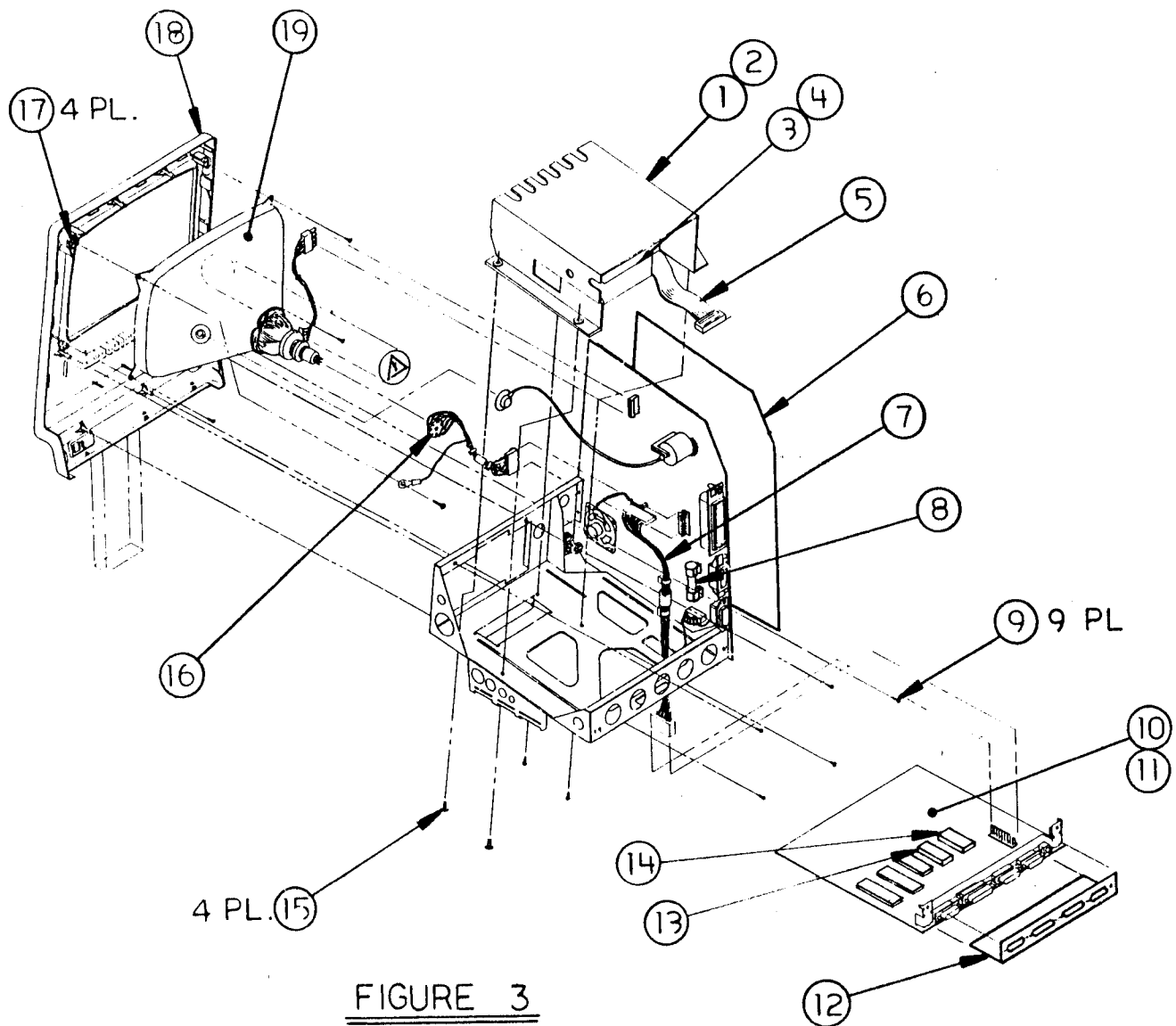


FIGURE 3

□ MACINTOSH – EXPLODED ASSEMBLY (Figure 3)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	805-0574	Shield for Internal Drive
2	805-0217	Shield for Internal 800K Drive (512K enhanced)
3	661-76156	Micro Disk Assembly, 400K
4	661-0345	800K Mechanism, Apple 3.5 Drive (512K enhanced)
5	590-0167	3-1/2" Drive Cable Internal (Red Striped)
	590-0437	3-1/2" Drive Cable Internal (Yellow Striped)
6	725-0011	Insulator Shield (Back of Power Supply)
7	590-0184	Power Supply to Logic Cable
8	740-0300	U.S. Power Supply Fuse, 2.5A 250VAC 740-0060 Int'l Power Supply Fuse, 1.6A 250V
9	422-1007	Screw, Tap 4.21 x 1.41 x 16 (Main Case)
10	661-96152	128K Main Logic Board*
11	661-96236	512K Logic Board*
12	805-0577	RFI Shroud
13	342-0221	IC, ROM Low**
14	342-0220	IC, ROM High**
15	462-3100	Screw, M3 x .5 x 6
16	590-0160	CRT Socket Cable
17	725-0018	Mylar Washer
18	810-0373	Front Bezel
19	076-0103	CRT and Yoke Assembly

* If the logic board fails, refer to Section 6, Additional Procedures, for instructions.

**These ROMS are used on 128K Logic Boards and on 512K Logic Boards that have not been upgraded with ROMS that support the 800K Disk Drive.

Part numbers 342-0220 and 342-0221 are listed on the Price Pages of the *Apple Service Programs* manual as "Other Parts."

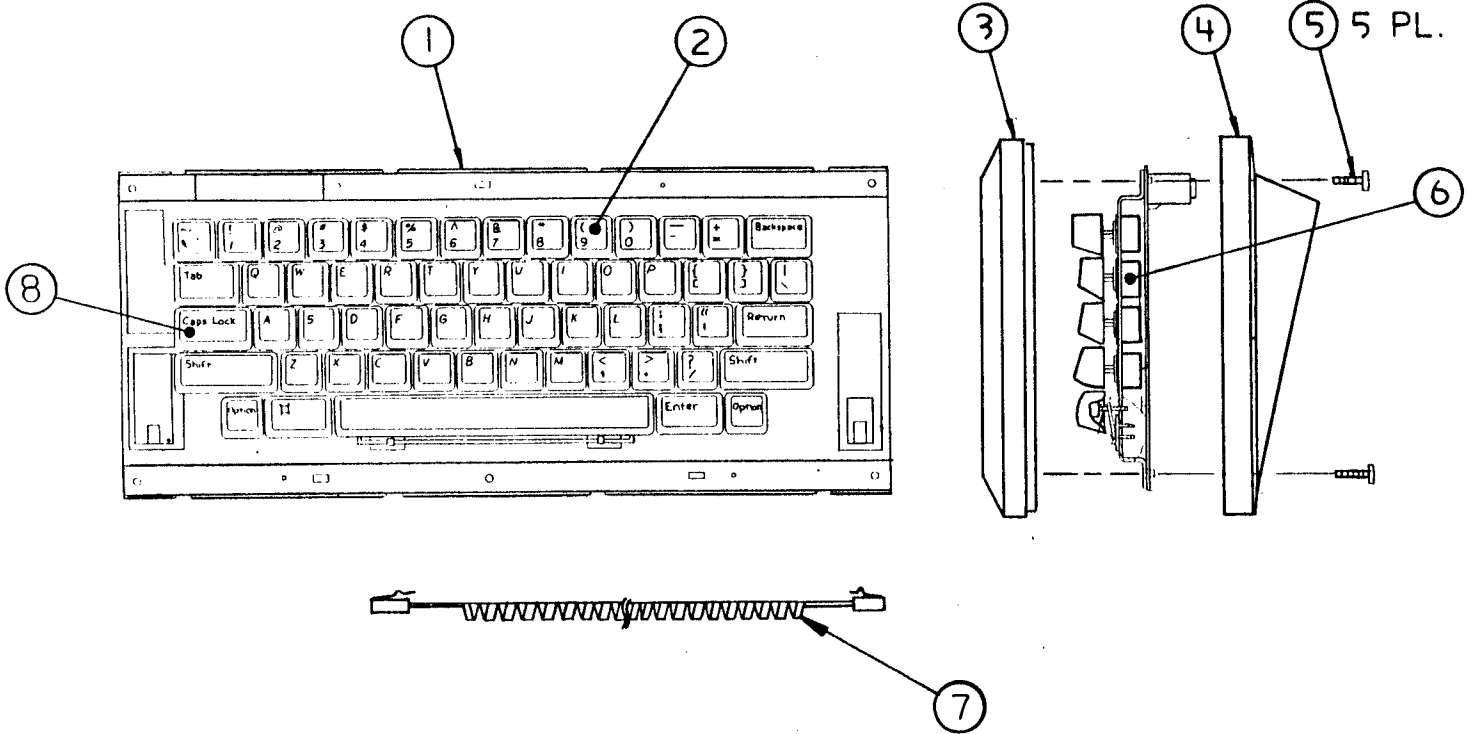


FIGURE 4

□ MACINTOSH – KEYBOARD ASSEMBLY (Figure 4)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-96154	Keyboard with Cable
2	658-7039	Keycap Set
3	815-0728	Cover, Top Keyboard
4	815-0754	Cover, Bottom Keyboard
5	430-1025	Screw, Tap 2.20 x 6.25 (Keyboard Case)
6	705-0070	Alps Long Stem Keyswitch, Macintosh/ Macintosh Plus*
7	590-0144	Keyboard/Keypad Cable, Beige
	590-0170	Keyboard/Keypad Cable, Smoke
8	705-0077	Alps Alpha Lock Keyswitch, Macintosh/ Macintosh Plus*

Note: Keycaps are not available for international keyboards. For Macintosh Plus keycap set, see Figure 8, "Macintosh Plus Keyboard Assembly."

*Refer to keyswitch identification in **Appendix** section.

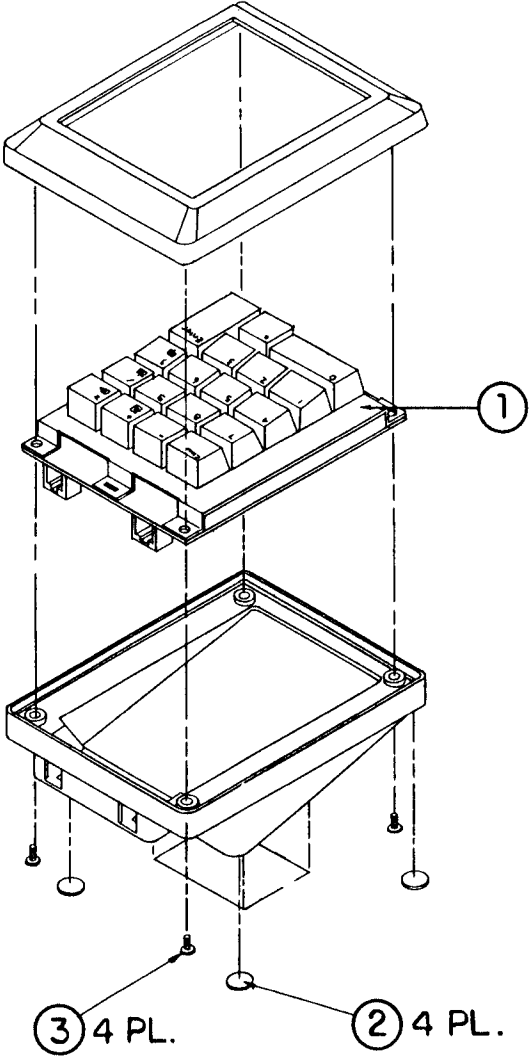


FIGURE 5

□ MACINTOSH – NUMERIC KEYPAD ASSEMBLY (Figure 5)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	658-4045	Keypad Assembly
2	865-0051	Macintosh Foot
3	430-1025	Screw, Tap, 2.2 x 6.25

Note: The keyswitch used on the Macintosh Numeric Keypad is the same as that on the Macintosh Keyboard: Alps Longstem Keyswitch (p/n 705-0070). See Appendix A for illustration.

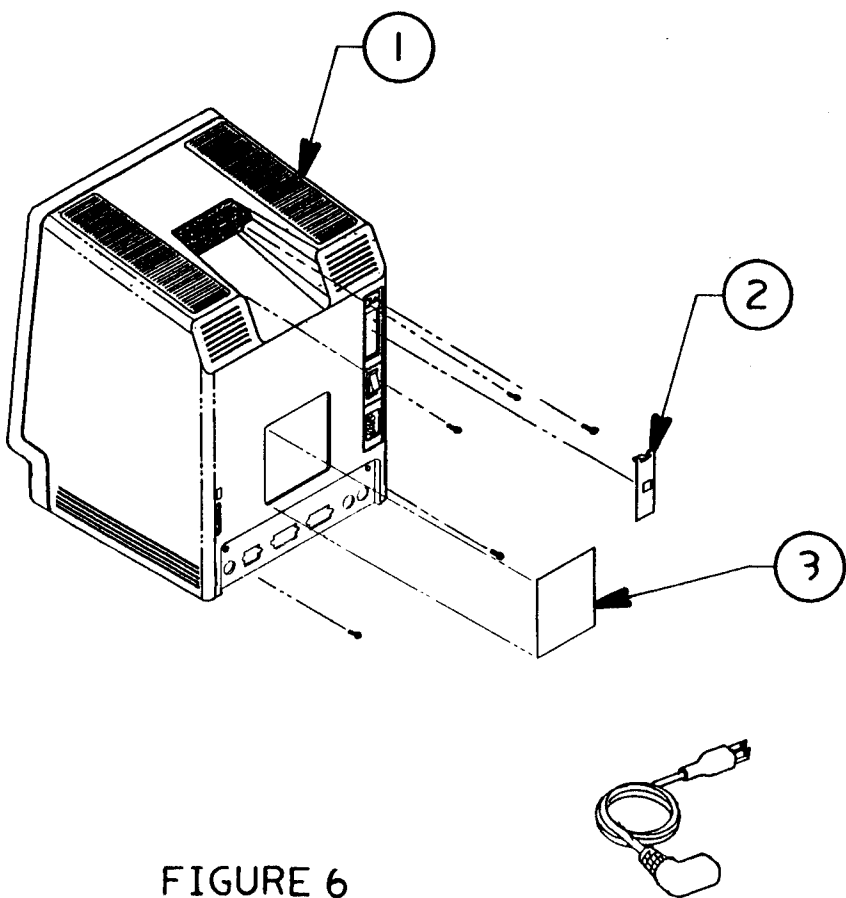


FIGURE 6

□ MACINTOSH PLUS – REAR HOUSING (Figure 6)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5211	Macintosh Plus Rear Housing with Labels, Beige
	630-5235	Macintosh Plus Rear Housing with Labels, Platinum
2	815-0938	Macintosh Plus Battery Door, Beige
	815-0971	Macintosh Plus Battery Door, Platinum
3	825-1254	Macintosh Plus Agency Approval Label, Beige
	825-1345	Macintosh Plus Agency Approval Label, Platinum

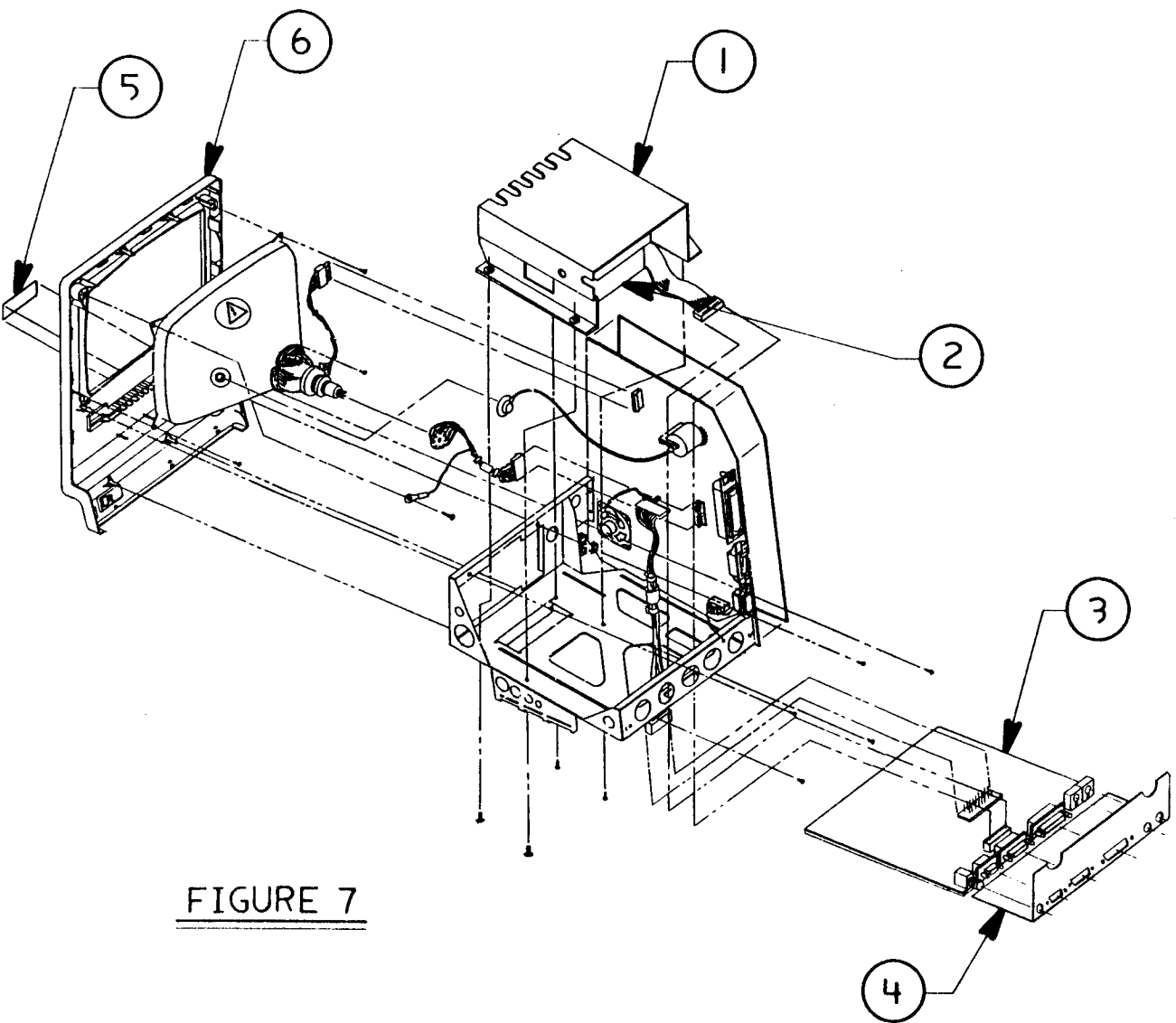


FIGURE 7

□ MACINTOSH PLUS – EXPLODED ASSEMBLY (Figure 7)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	805-0217	Shield for Internal Drive (Shipping Fixture)
2	661-0305	Drive Mechanism, 800K
3	661-0321	Macintosh Plus Logic Board
4	805-5047	Macintosh Plus RFI Shroud
5	825-1256	Macintosh Plus Logo Plate Label
6	810-0379	Macintosh Plus Front Bezel

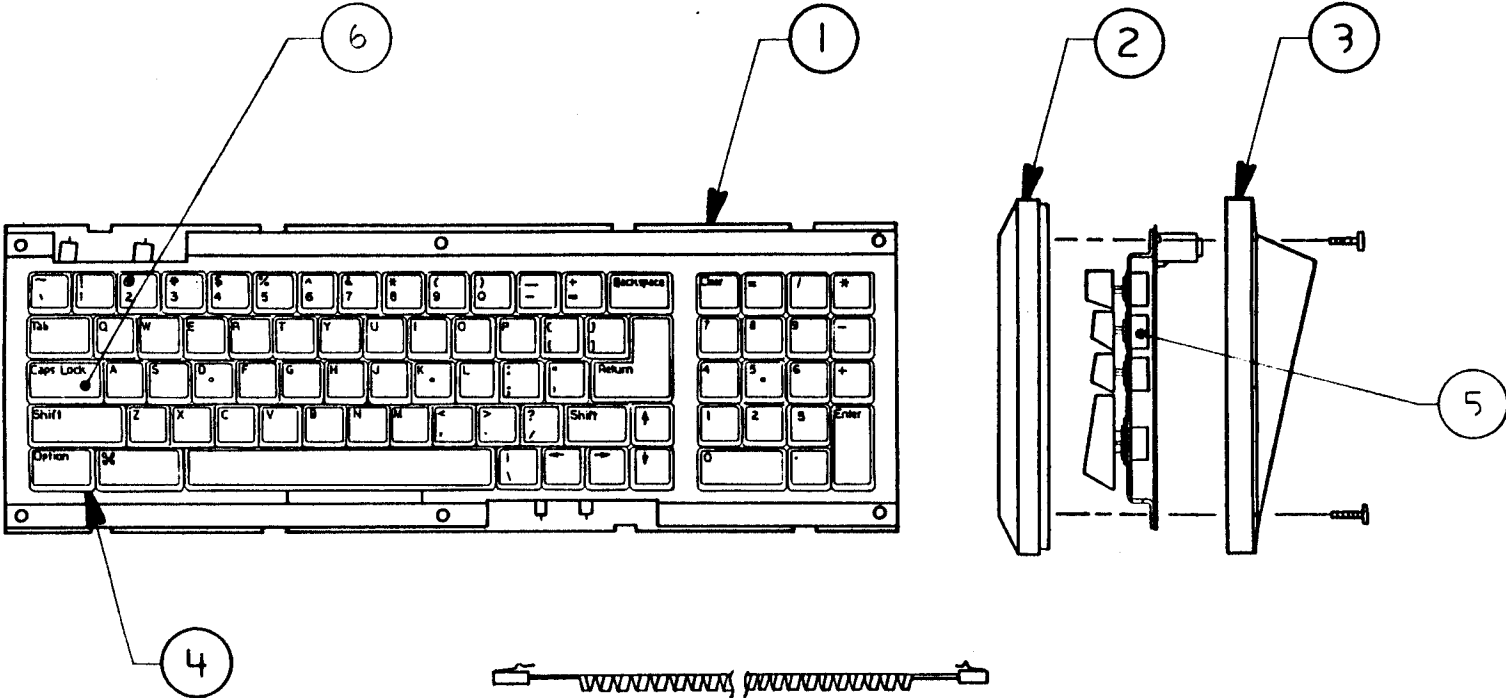


FIGURE 8

□ MACINTOSH PLUS – KEYBOARD ASSEMBLY (Figure 8)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0322	Macintosh Plus Keyboard, Beige (with cable)
	661-0416	Macintosh Plus Keyboard, Platinum (with cable)
2	815-0936	Top Cover, Macintosh Plus K/B, Beige
	815-0983	Top Cover, Macintosh Plus K/B, Platinum
3	815-0937	Bottom Cover, Macintosh Plus K/B, Beige
	815-0984	Bottom Cover, Macintosh Plus K/B, Platinum
4	658-5186	Macintosh Plus Keycap Set, Beige
	658-5190	Macintosh Plus Keycap Set, Smoke
5	705-0104	Mitsumi Keyswitch*
	705-0070	Alps Long-Stem Keyswitch, Macintosh/ Macintosh Plus*
6	705-0044	Mitsumi Locking Keyswitch*
	705-0077	Alps Alpha Lock Keyswitch, Macintosh/ Macintosh Plus*

*Refer to keyswitch identification in Appendix section.