

Macintosh SE

Technical Procedures

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Macintosh SE

Section 1 – Basics

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□ PRODUCT DESCRIPTION

Features

The Macintosh™ SE is an enhanced Macintosh Plus that supports internal and external customized expansion options. This new Macintosh contains an internal connector for expansion of the CPU bus. The system comes with 1 megabyte of RAM installed, with upgrades to 2.5 and 4 megabytes available. The customer has a choice of two drive configurations:

- Two internal 800K floppy disk drives
- One internal 800K floppy disk drive and one internal SCSI hard disk drive

The Macintosh SE supports the same peripherals as the Macintosh Plus, except the Macintosh keyboards and mouse. The Macintosh SE will accept any keyboard and mouse that connect to the new Apple DeskTop Bus™.

Internal Features

New or improved internal features include:

- 1 megabyte of RAM on repositioned slanted Single Inline Memory Modules (SIMMs)
- New 256K-byte ROM with modifications for support of the Apple DeskTop Bus and improved support of the Small Computer System Interface (SCSI) and AppleTalk
- Choice of internal SCSI hard disk or second 800K floppy disk drive
- Higher capacity 80-watt, wide-input-range power supply
- Internal fan for cooling
- Improved hardware handshaking on the SCSI port
- Internal 96-pin Euro-DIN bus connector for internal expansion board or other I/O device (mounting holes provided)

- Swing-away logic board mounting to allow easy removal when an internal expansion board is installed
- Seven-year lithium battery for clock and ram cache

External Features

New external features include:

- Two Apple DeskTop Bus connectors that support the detached keyboard and mouse
- Snap-out door at the rear to support optional external I/O device

Connector Identification

Back Panel Connectors

The back panel of the Macintosh SE has seven installed ports, and a slot for the installation of an additional expansion port. The number beside the port name below corresponds to the numbered arrow in Figure 1.

- #1 Apple DeskTop Bus (mini DIN-4)
- #2 Apple DeskTop Bus (mini DIN-4)
- #3 External drive port (DB-19)
- #4 SCSI port (DB-25)
- #5 Printer port (mini DIN-8)
- #6 Modem port (mini DIN-8)
- #7 Sound port (RCA phono jack)
- #8 Slot for optional expansion port

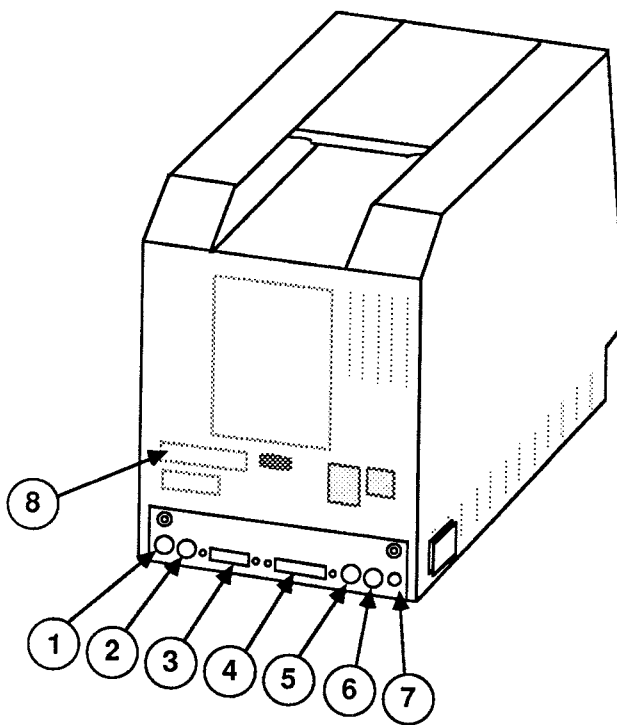


FIGURE 1

*Main Logic
Board
Connectors*

There are six connectors on the Macintosh SE logic board. In the list below, the number beside the connector name corresponds to the numbered arrow in Figure 2.

- #1 Power connector
- #2 Connector for lower internal 800K drive
- #3 Connector for upper internal 800K drive
- #4 Internal hard disk SCSI 50-pin ribbon cable connector
- #5 Speaker connector
- #6 96-pin Euro-DIN expansion connector

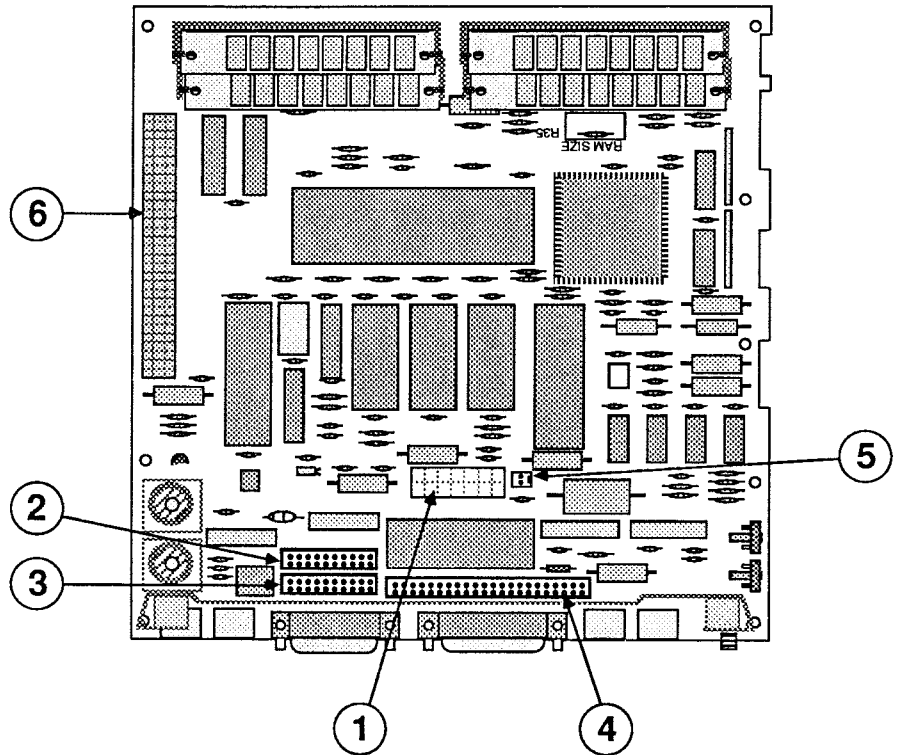


FIGURE 2

...Continued on next page

Internal Expansion Connector

The 96-pin connector on the logic board may be used in either of two ways:

- To attach a third-party co-processor board directly to the logic board via a right-angle connector. The co-processor board (measuring about 4 X 8 inches) would lie above and parallel to the logic board, supported by standoffs which may be installed in the logic board holes provided for that purpose.
- To attach a cable which is then routed to an external I/O device. From the connector on the logic board, the cable is routed up through the forward hole in the bottom of the metal chassis, through the mounting bracket on the rear of the chassis, and out through the snap-out accessory door on the rear of the case. (Remove the rear accessory door from inside the case.)

□ THEORY OF OPERATION

Introduction

The Macintosh SE has eight basic functional units:

- Main logic board
- Power supply
- Analog board
- Internal 800 disk drive(s)
- Internal hard disk (optional)
- Video board
- Video display (CRT)
- Apple DeskTop Bus keyboard and mouse

"Module-swapping," or repair by replacement of faulty modules, is much faster if you have a basic understanding of the function of each module in the unit. If you know what each module does when it is functioning normally, you can more easily decide which module of a unit is at fault when a particular function is missing or degraded. This is called "logical troubleshooting." The following section describes the Macintosh SE modules and the functions they perform.

Main Logic Board

The Macintosh SE main logic board, the heart of the system, contains the components described below:

CPU

The Central Processing Unit (CPU), a 68000 micro-processor, gets instructions from memory, translates them, and carries them out. It communicates with all components on the logic board.

SIMMs

The Macintosh SE dynamic RAM (Random Access Memory) is installed on 150-nanosecond Single Inline Memory Modules (SIMMs). Each SIMM is a small printed circuit card with eight surface-mounted ICs. The logic board has four sockets for SIMMs. The Macintosh SE comes with four 256K SIMMs installed.

ROM

The two ROM (Read Only Memory) chips contain the operating code for the 68000. The Macintosh SE ROM supports the Apple DeskTop Bus and gives improved support of SCSI and AppleTalk. The ROM chips, located at positions D6 and D7 on the logic board, are socketed and may be replaced by the technician.

*IWM
Disk
Controller*

The Macintosh SE uses 3.5-inch micro-floppy disk drives that operate under the Group Code Recording (GCR) disk format. The IWM chip, a self-contained disk controller on one IC, supports both the internal and external disk drives. The IWM simplifies the micro-processor's task of reading from and writing to the disk drives. The IWM, located at position D8 on the logic board, is socketed and may be replaced by the technician.

*Serial
Communications
Controller*

The Serial Communications Controller (SCC) handles information sent to and received from the serial ports on the back of the machine.

*Versatile
Interface
Adaptor*

The Versatile Interface Adaptor (VIA) converts serial data (from input devices) to parallel data, so that the logic board can interpret the information correctly.

Gate Array

The Macintosh SE incorporates gate array implementation of PAL (Programmable Array Logic) and other discrete logic devices. The Gate Array handles control and synchronizing functions for the main logic board.

Oscillator

The Oscillator, or timing device, generates the master clock pulse, which is broken down into the various timing signals needed by the ICs on the logic board.

Battery

The single long-life lithium battery provides power to the clock and calendar.

Sound Chip

The sound chip supports the internal speaker connector and the external sound jack.

SCSI Bus

The Apple SCSI manager supports up to seven daisy-chained SCSI devices.

*Apple
DeskTop
Bus*

The Apple DeskTop Bus is a method and protocol for connecting computers with human input devices. The Macintosh SE controls the flow of data to connected devices by issuing commands through the Apple DeskTop Bus.

**Power
Supply**

The power supply is attached to the bottom half of the analog board. This is where AC voltage is converted to DC voltage for use by the entire system. The power supply operates on standard line voltage and outputs various DC voltages, which are used by the logic board, the video display, and by some peripheral devices.

Analog Board

The analog board contains circuits for both horizontal and vertical signals that are fed to the CRT. The flyback transformer on the analog board delivers high voltage directly to the CRT through the anode connector.

**CRT and
Video Board**

The Cathode Ray Tube (CRT) provides the high resolution video display. The anode of the CRT receives high voltage from the flyback transformer on the analog board. The analog board also supplies the voltages and signals to the neck and yoke of the CRT that enable the CRT to create the video display. There is a separate video board on the neck of the CRT that provides video amplification and overvoltage protection.

**800K
Disk Drive(s)**

The internal 800K disk drive (or drives) connects to the main logic board through two internally installed connectors. An external 800K drive may be connected to the disk drive port on the back of the logic board. The flow of data between the logic board and the disk drives is channeled through the IWM disk controller, which controls reading and writing operations.

**SCSI
Hard Disk**

The optional hard disk connects to the logic board through the internal SCSI connector. Other SCSI devices may be daisy-chained to the Macintosh SE through the external SCSI port. The SCSI bus on the logic board will support a total of seven SCSI devices.

**Apple DeskTop
Bus Keyboard
and Mouse**

The keyboard connects to the Apple DeskTop Bus (ADB) port on the Macintosh SE. The mouse connects to the keyboard or to the other ADB port on the Macintosh SE. All devices made for the Apple DeskTop Bus have a microprocessor that makes them intelligent devices. All Apple DeskTop Bus devices communicate with the logic board via a mini DIN-4 connector. All except the mouse have ports for daisy-chaining other ADB devices. The mouse must be the last device in the chain because it has no port.

□ CARE AND HANDLING

The Macintosh SE is small enough to be somewhat portable. However, it does contain a CRT (picture tube) and may also contain a hard disk. The CRT may implode if cracked. The optional hard disk is a mechanical device with moving parts. Rough handling such as jarring or bumping, especially while the hard disk is running, can result in a mechanical failure or damage to the information stored on the hard disk. **Careless handling accounts for more drive failures than all other factors combined.**

With these facts in mind, always be sure to:

- Leave the Macintosh SE and the CRT and hard disk drive modules in the shipping containers until use.
- Use the shipping containers and packing materials when transporting the Macintosh SE or modules.
- Place the Macintosh SE on a protective padded surface before beginning any repair procedure.
- Never move the Macintosh SE during power-down. After the power is turned off, the hard disk will slow down and the heads will land within 15 seconds. Any jolts to the drive during power-down may cause the heads to crash into the media surfaces.
- Never drop a Macintosh SE. Even a drop of one inch to a hard surface could cause implosion of the CRT and/or a hard disk drive failure.

□ SAFETY PRECAUTIONS

The Macintosh SE, with its built-in video monitor, 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 live adjustments of the monitor are required.

Safe Electrical Setup

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

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.**

In case of an accident, it could save your life to have someone else nearby. Apple recommends that your staff be trained in Cardio-Pulmonary Resuscitation (CPR).

- **Remove rings, wristwatches, bracelets, hanging necklaces, and other jewelry before performing repairs on a monitor.**

Metal jewelry is an excellent conductor of electricity. Removing jewelry will reduce 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.

- **Disconnect the AC power cord before working on a monitor.**

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

- **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 Macintosh SE.**

The Macintosh SE has a bleeder resistor on the anode that drains off the charge when the power is turned off. **However, ensure your safety in the event that the resistor has failed and the anode is still fully charged, you must perform the discharge procedure before working inside the Macintosh SE.**

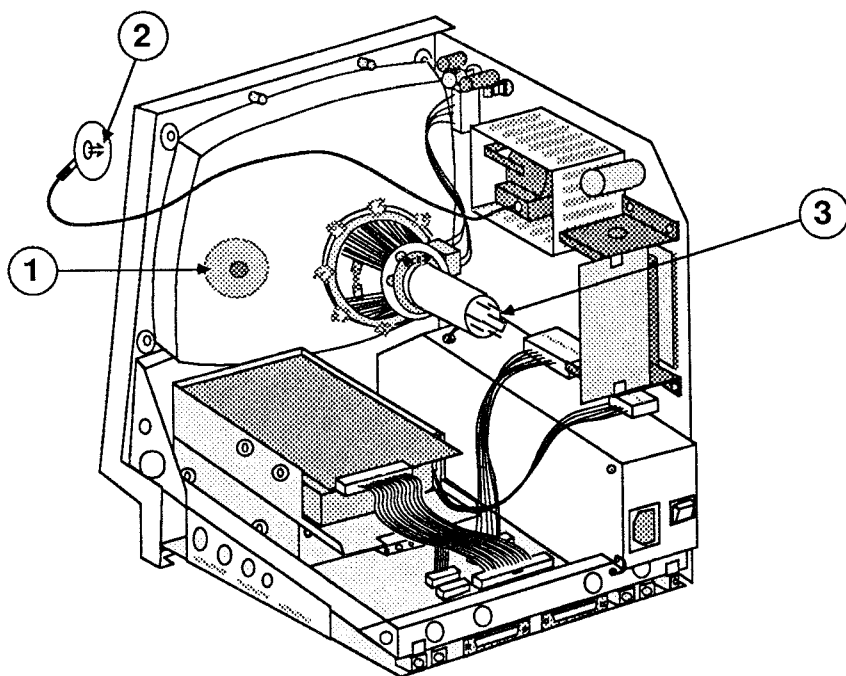


FIGURE 3

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

Normally the anode aperture (Figure 3, #1) has a connector plugged into it (Figure 3, #2). When a CRT is replaced, the anode connector is removed, exposing the anode. If the bleeder resistor fails, 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, especially at the neck (Figure 3, #3), where the tube is the thinnest. The neck is the part most likely to be sucked into the tube and expelled again should the tube implode.

Live Adjustment Rules

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

- The yoke wires (Figure 4, #1)
- The anode connector (Figure 4, #2)
- The anode wire (Figure 4, #3)
- The flyback transformer (Figure 4, #4)

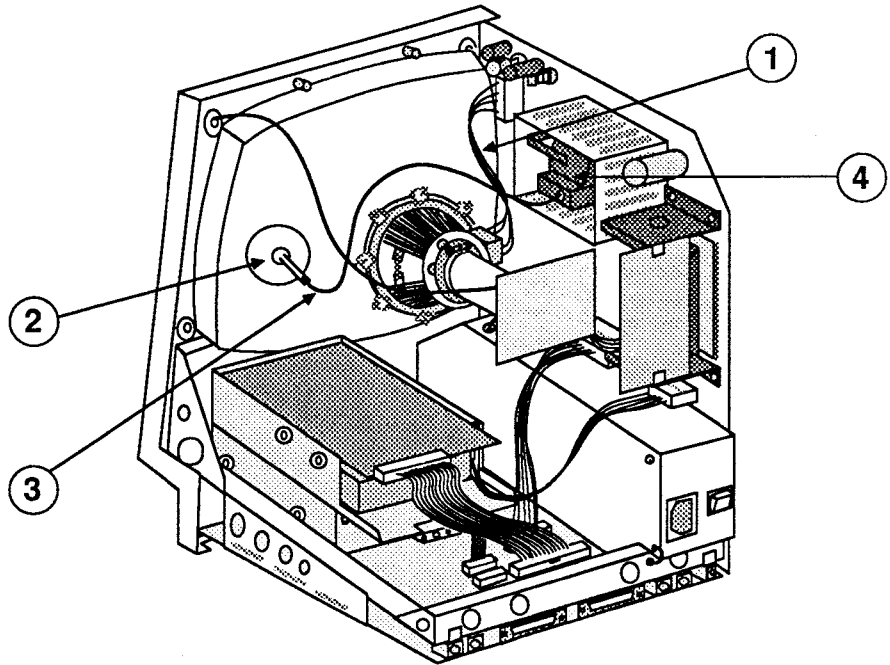


FIGURE 4

WARNING: *Serious injury could result if you touch any of these components with the power on.*

❑ DISPOSING OF THE MACINTOSH SE CRT

Remember that a CRT can implode unless 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" x 12" piece of cloth or heavy paper

Devacuuming the CRT

1. Put on safety goggles.
2. Cut or drill a hole in the side of the box about six inches from the bottom, just large enough to insert the very tip of the CRT neck through.
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 5).

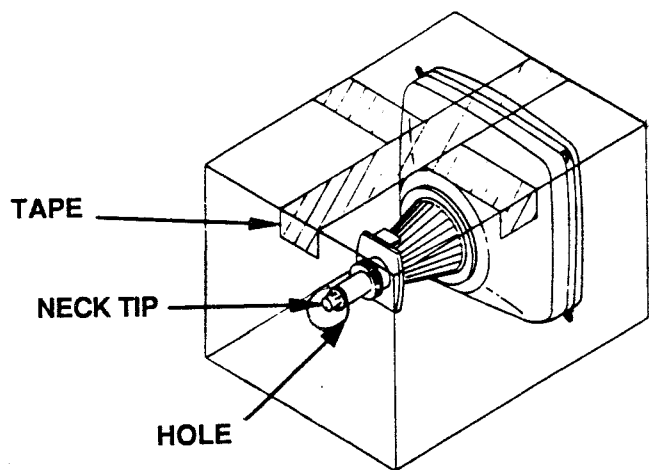


FIGURE 5

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. 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 6, #1) so that it forms a veil over the opening (Figure 6, #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.

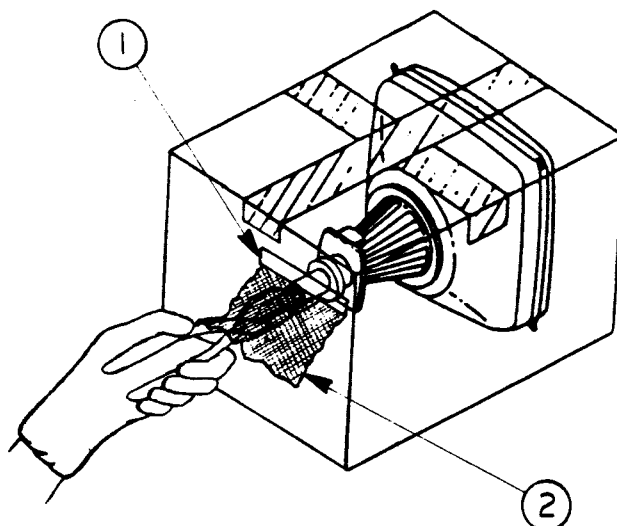


FIGURE 6

7. Make sure no one is standing nearby. Place the pliers under the veil and stand to one side and look away while you use the pliers to snip off the exposed tip of the CRT (see Figure 6).

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

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 inner space of the CRT is clearly visible through the opening created by the removed tip.

Macintosh SE

Section 2 – Take-Apart

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- 2.32 Lower 800K Disk Drive
- 2.34 Speaker and Front Bezel
- 2.36 Battery
- 2.39 Keyboard

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

□ COVER

Materials Required

Foam pad
Small flatblade screwdriver
15-inch Torx screwdriver
Pull-apart tool

CAUTION: *Electrostatic Discharge (ESD) can cause severe damage to sensitive microcircuits. The Macintosh SE logic board contains C-MOS components, among the most sensitive chips in use today. Printed circuit assemblies and ICs (integrated circuits, or "chips") in the Macintosh SE, especially those that are removable, must also be handled with extreme care. The Macintosh SE has two removable ROMs and four removable printed circuit assemblies (SIMMs), which contain the RAM memory. The C-MOS chips, ROMs, and SIMMs are very susceptible to ESD damage. To prevent ESD damage to the Macintosh SE components, follow the precautions outlined for ESD prevention in **You Oughta Know**.*

Remove

Remove the cover of the Macintosh SE as follows:

1. Place the Macintosh SE on the foam pad in an area where you will have ample room to remove the cover. Don't put it under shelves containing objects that could fall on the CRT and break it.

Note: Be especially careful when handling a Macintosh SE with an internal hard disk. Read "Care and Handling" in the Basics section before continuing.

2. Turn off the power and disconnect the power cord.
3. Disconnect the keyboard and mouse cables and all other peripheral cables from the back of the Macintosh SE.

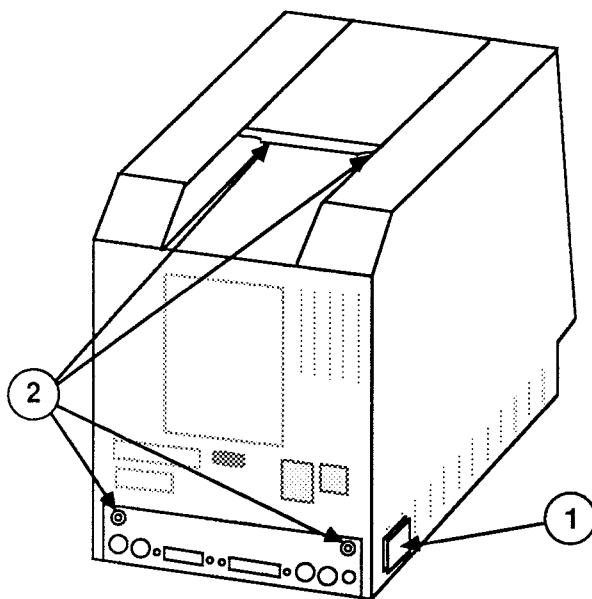


FIGURE 1

4. If a reset/interrupt switch (Figure 1, #1) is present, pry it off with a small flatblade screwdriver.
5. Place the Macintosh SE face down on the pad.
6. Use the Torx screwdriver to remove the four case screws (Figure 1, #2).
7. Carefully lift up the cover and set it out of the way. If the cover is difficult to remove, use the pull-apart tool. (To prevent cosmetic damage to the cover and bezel, do not use a screwdriver to pry off the cover.)
8. Remove the insulating paper shroud from the bottom of the Macintosh SE.

Replace

Replace the cover as follows:

1. Place the Macintosh SE face down on the foam pad.
2. Replace the insulating paper shroud over the bottom of the Macintosh SE.
3. Slide the cover over the chassis and fit it into the front bezel, making sure the video ground cable (Figure 2, #1) is out of the way of the case screw holder (Figure 2, #2).

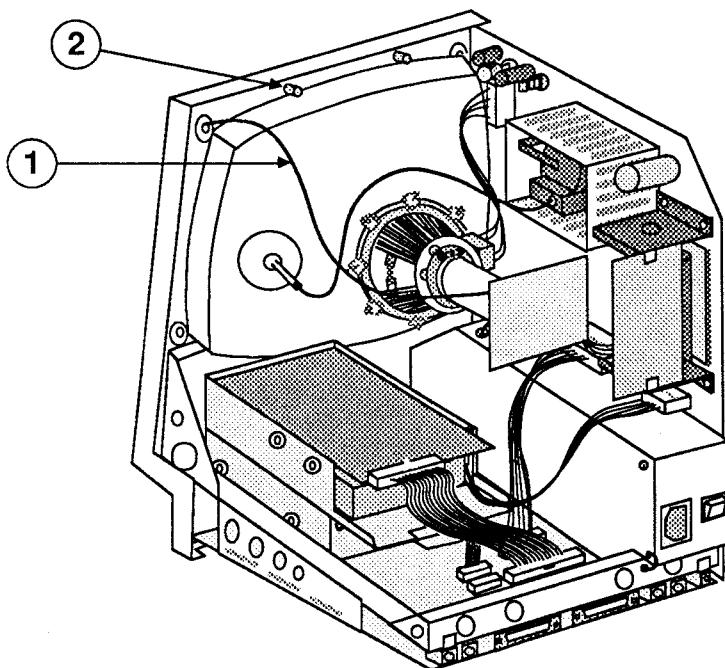


FIGURE 2

4. Reinstall the four case screws (Figure 1, #2).
5. Reinstall the reset/interrupt switch (Figure 1, #1).

❑ DISCHARGING THE CATHODE RAY TUBE (CRT)

Materials Required

Safety goggles
Foam pad (ungrounded)
CRT discharge tool
Needlenose pliers
Alligator lead

Discharge Procedure

The Macintosh SE CRT is equipped with a bleeder resistor that automatically drains the charge from the CRT when the power is shut off. **Nevertheless, you must follow the discharge procedure below to ensure your safety in the event that the resistor has failed and the anode is still fully charged.**

To discharge the Macintosh SE CRT:

1. **If you have not already done so, read the safety precautions in the Basics section before you proceed!**

WARNING: To prevent serious injury, do not touch the yoke wires (Figure 3, #1), the anode wire (Figure 3, #2), the anode connector (Figure 3, #3), or the flyback transformer (Figure 3, #4).

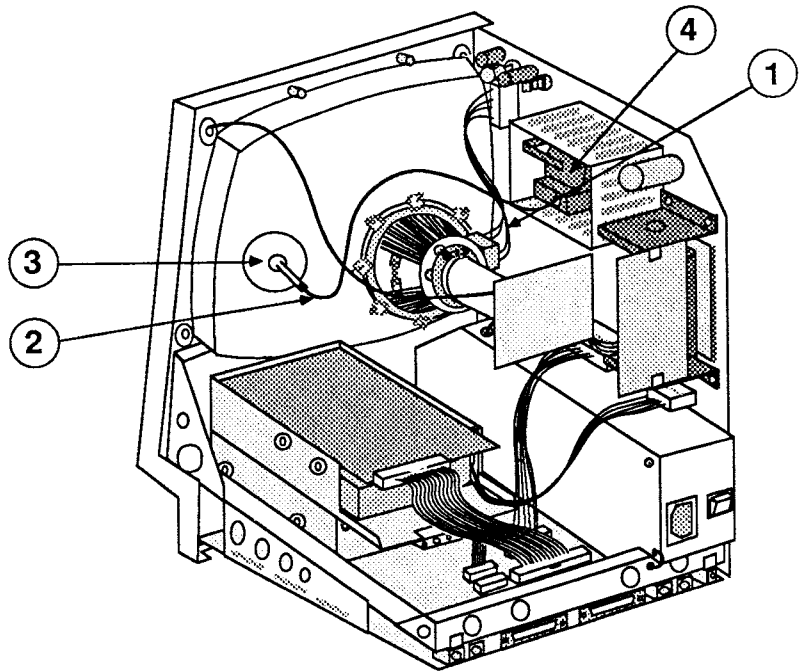


FIGURE 3

2. Remove any metal jewelry. If you are wearing a grounding wriststrap, remove it. Put on the safety goggles.
3. Remove the cover.
4. Set the monitor upright on the ungrounded foam pad, with the back facing you.

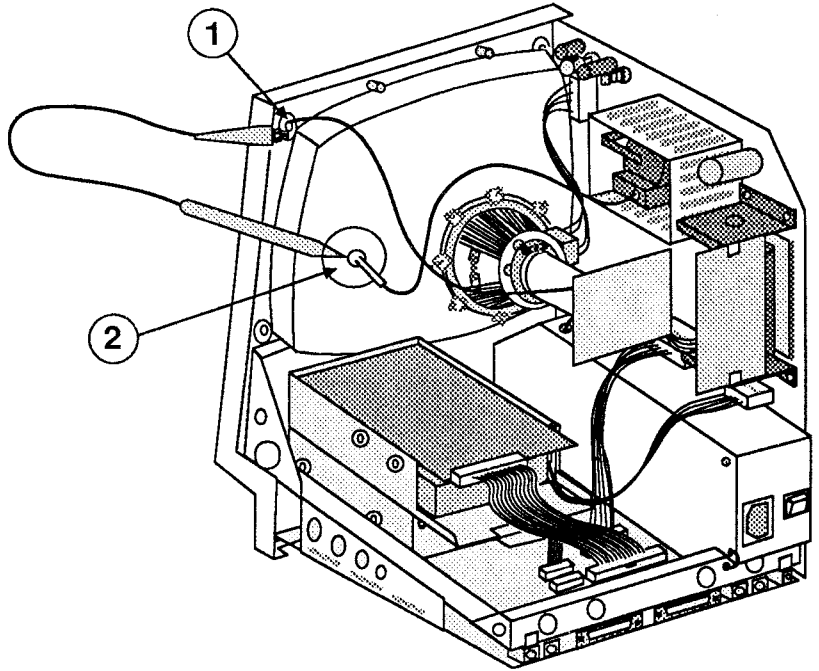


FIGURE 4

5. Attach the alligator clip on the CRT discharge tool to the metal part of the ground lug (Figure 4, #1).

CAUTION: Discharge the anode to the metal part of the ground lug displayed in Figure 4, #1. Failure to do so will damage the main logic board and/or the analog board.

6. Put one hand behind your back and grasp the handle of the discharge tool with your other hand.

WARNING: Use only one hand when discharging the CRT. This is to prevent you from becoming a path for current should your hand slip and touch the metal part of the discharge tool. While discharging the CRT, grasp only the insulated handle of the discharge tool.

7. Hold the CRT discharge tool to the tube surface, and insert it under the anode cap (Figure 4, #2) until it touches the anode ring.

8. Remove the CRT discharge tool from under the anode cap. To be sure the CRT is discharged, repeat step 7.
9. Remove the alligator clip from the ground lug. Set the tool aside where it will be out of the way.
10. For some of the following procedures, you may have to remove the anode cap. To do so, peel back the anode cap until you can see the anode ring at the center. Look at the metal connector in the center of the cap and notice how it is clipped into the CRT. Use the needlenose pliers to compress the two prongs on the clip to free it from the CRT, and lift it off the tube.

Note: A secondary charge can build up over a period of time, even after you have discharged the CRT. If repairs are not finished within 30 minutes, the anode should be discharged again. Or, to ensure that any residual charge is dissipated during the service procedure, establish a path for anode current to ground by fastening one end of an alligator lead to the metal ground lug and connecting the other end to the anode aperture.

❑ ANALOG BOARD AND POWER SUPPLY

Materials Required

Grounded workbench pad and wriststrap
Small Phillips screwdriver

Remove

To remove the analog board and power supply:

1. Remove the cover and discharge the CRT.
2. Remove the anode cap (Figure 5, #1).

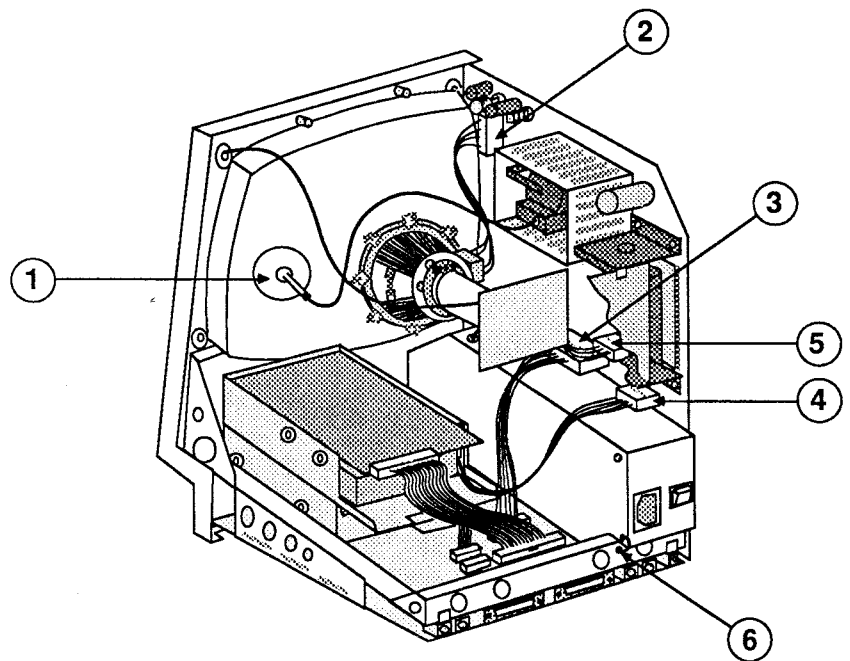


FIGURE 5

3. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
4. Remove the following cables from the analog board:
 - Yoke cable (Figure 5, #2). (First depress the tab.)
 - Main logic board cable (Figure 5, #3)
 - Hard disk power cable, if present (Figure 5, #4)
 - Video board cable (Figure 5, #5)
5. Remove the screw holding the power supply ground wire to the chassis (Figure 5, #6).

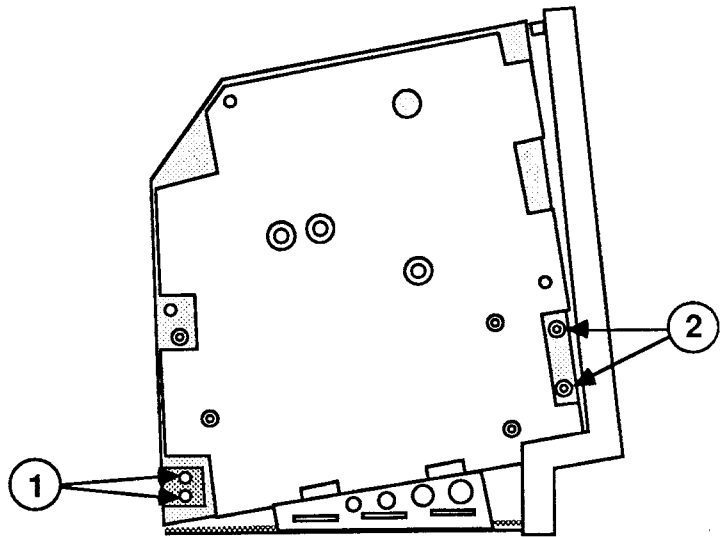


FIGURE 6

6. Using the small Phillips screwdriver, remove the two lower left analog board screws and the metal clip (Figure 6, #1).
7. Remove the two lower right analog board screws (Figure 6, #2).
8. Place the Macintosh SE face down on the grounded workbench pad.

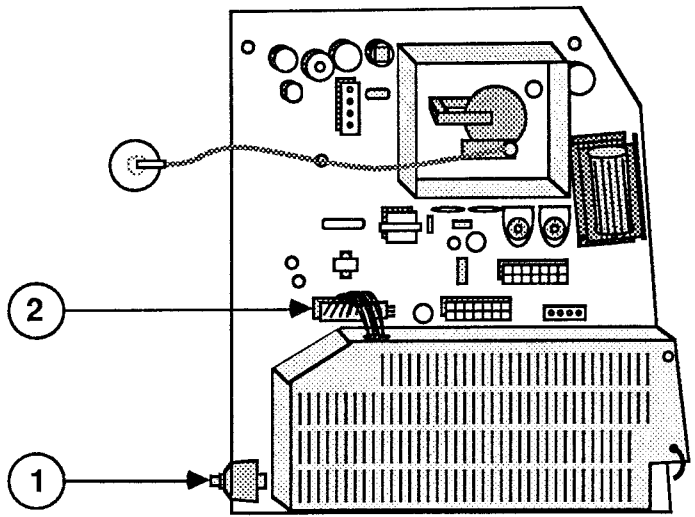


FIGURE 7

9. Carefully move the analog board (with power supply attached) up and away from the chassis, taking care not to bump the CRT or the brightness control knob (Figure 7, #1) at the lower front of the analog board.

WARNING: Do not grasp the analog board by the fan. Hold the analog board by the edges, using your fingertips.

10. Disconnect the power supply cable (Figure 7, #2) from the analog board.

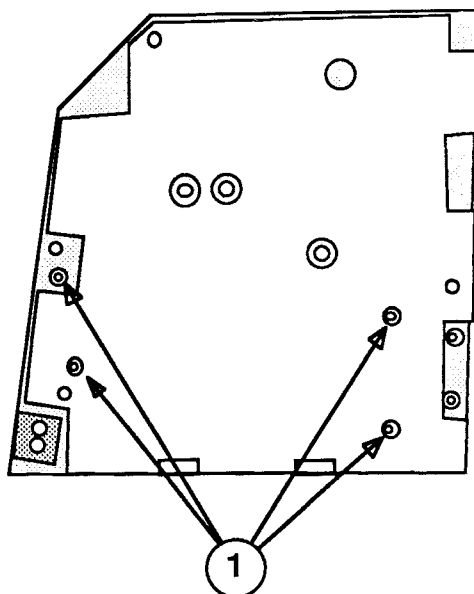


FIGURE 8

11. Place the board on the grounded workbench pad with the power supply down, and remove the four power supply screws (Figure 8, #1). Lift the board free.

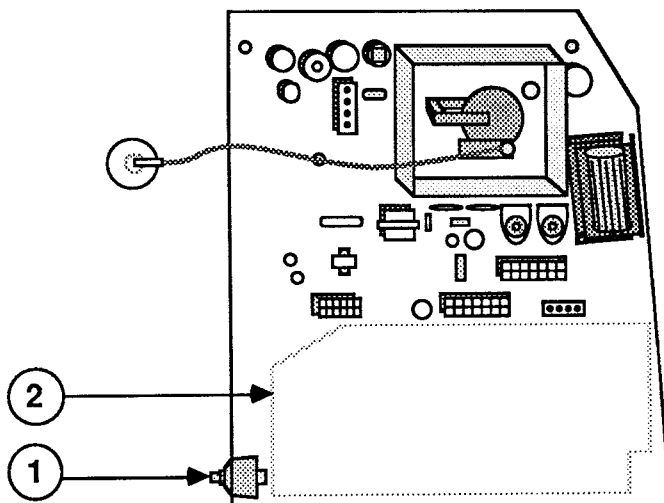


FIGURE 9

12. If you are returning the analog board to Apple, first remove the brightness knob (Figure 9, #1) and put the knob on the replacement analog board.

Replace

Replace the power supply and analog board as follows:

1. Place the power supply on the inside of the analog board, using the painted outline on the board as a guide (Figure 9, #2).
2. Holding the power supply in position, flip the analog board and power supply to a face-down position with the power supply underneath. **Do not grasp the analog board by the fan.**
3. Replace the four power supply screws (Figure 8, #1).

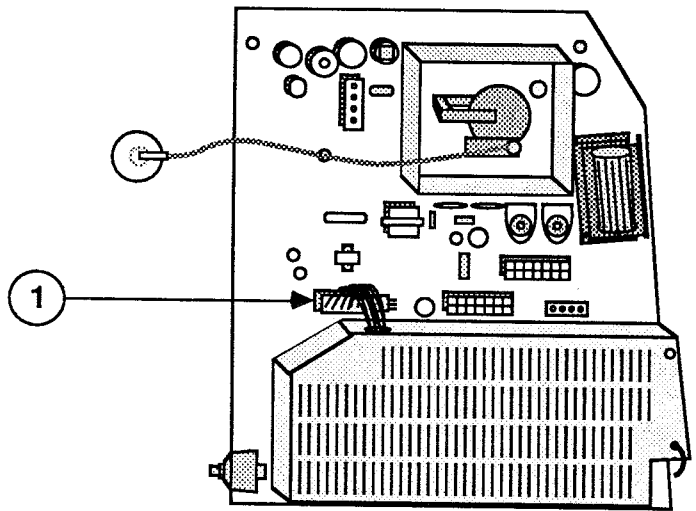


FIGURE 10

4. Reconnect the power supply cable (Figure 10, #1).

5. With the Macintosh SE face down on the grounded workbench pad, carefully place the analog board/power supply unit into the chassis, taking care not to bump the CRT or the brightness knob at the lower front of the analog board. It is easiest if you slide the corner with the brightness knob in first, then maneuver the power supply cage past the metal bracket at the back of the chassis. **Again, do not grasp the analog board by the fan.**

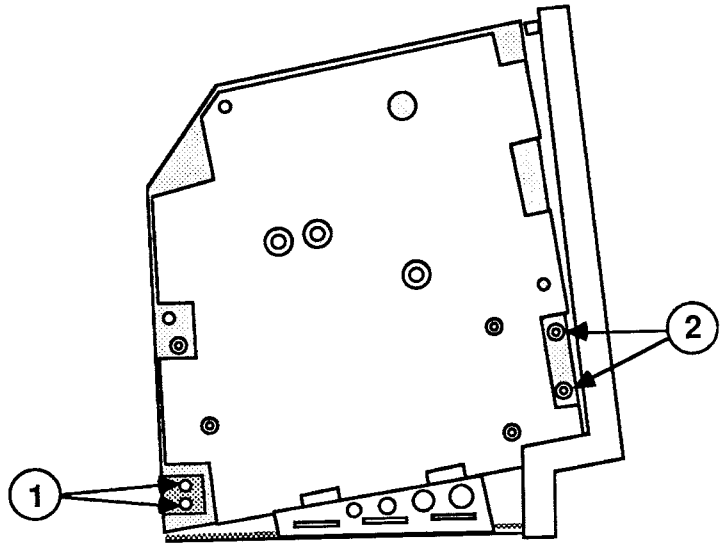


FIGURE 11

6. Replace the metal clip and the two lower left analog board screws (Figure 11, #1).
7. Replace the two lower right analog board screws (Figure 11, #2).

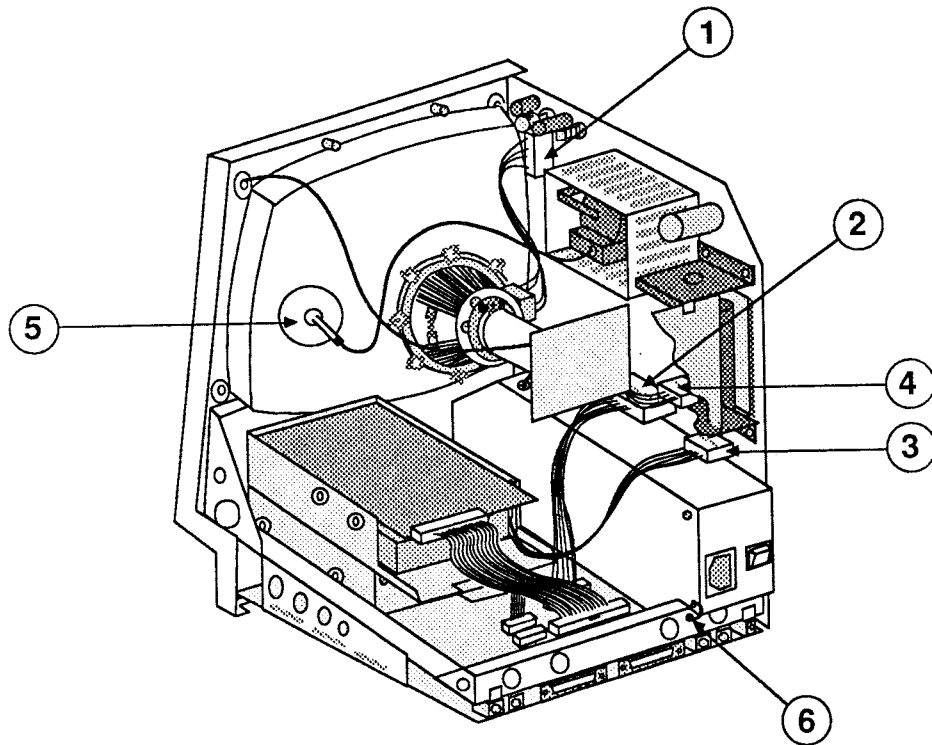


FIGURE 12

8. Reconnect the following cables to the analog board:

- Yoke cable (Figure 12, #1)
- Main logic cable (Figure 12, #2)
- Hard disk drive power cable (Figure 12, #3), if present
- Video board cable (Figure 12, #4)

9. Replace the anode cap (Figure 12, #5).

10. Replace the screw that secures the power supply ground wire to the chassis (Figure 12, #6).

11. Replace the cover.

□ MAIN LOGIC BOARD

Materials Required

Grounded workbench pad and wriststrap
Small Phillips screwdriver

Remove

Follow these steps to remove the main logic board:

1. Remove the cover.
2. Discharge the CRT.
3. Place the Macintosh SE face down on the grounded workbench pad and put on your grounding wrist-strap. (Never do this until after the CRT has been discharged.)

CAUTION: In the following step, pull only on the pulltabs or on the connectors themselves, **not** on the cables.

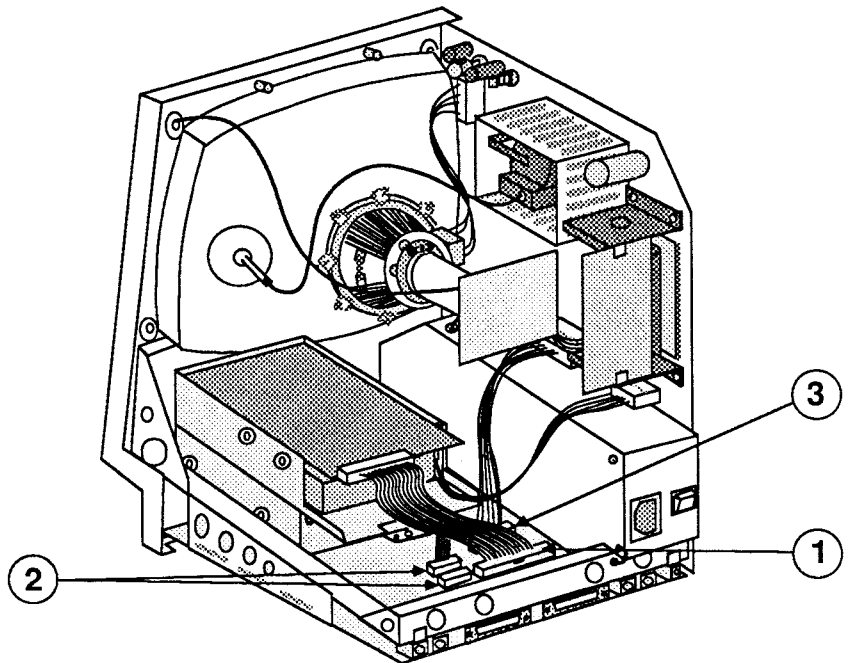


FIGURE 13

4. Remove these connectors from the main logic board:
 - Hard disk drive cable, if present (Figure 13, #1)
 - 800K disk drive cable(s) (Figure 13, #2)
 - Power supply cable (Figure 13, #3). (You must depress the holding clip on this connector before you can pull it out.)
5. Turn the Macintosh SE so that you are looking at the bottom of the main logic board. You will see that the right edge of the board is notched and the left edge is smooth.

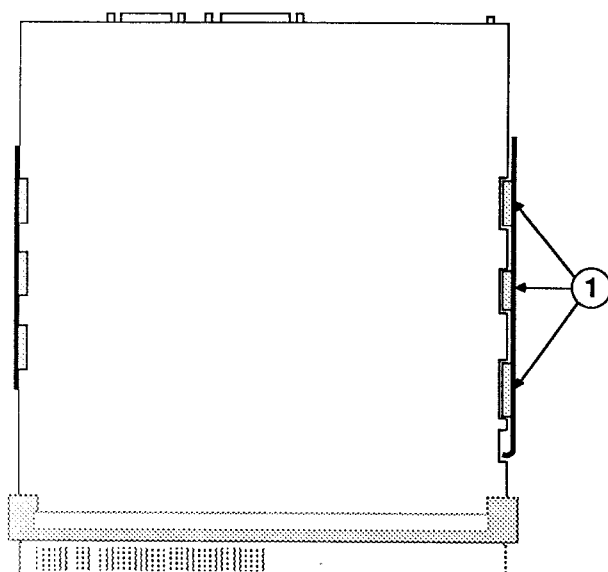


FIGURE 14

6. Holding the board by the edges, slide it up until the tabs on the right edge of the board exactly match the notches in the right metal bracket (Figure 14, #1).
7. Swing the right edge of the board free of the metal bracket and lift the board out of the metal chassis.

...Continued on next page

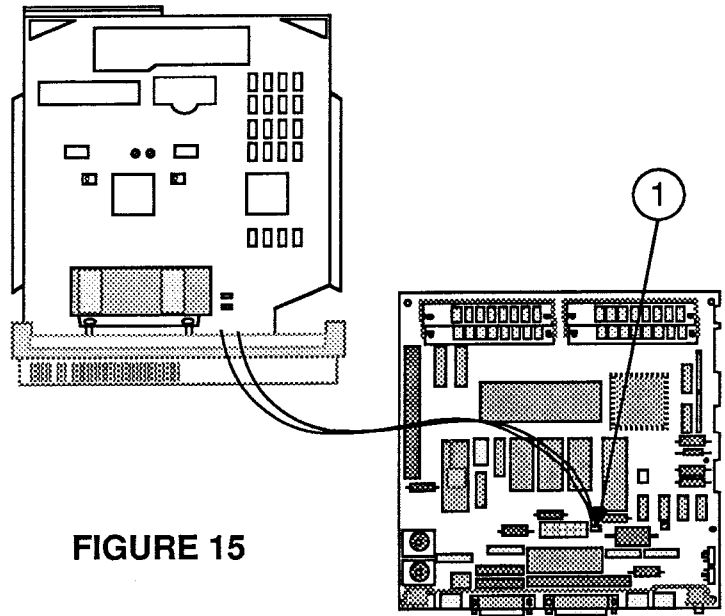


FIGURE 15

8. Set the main logic board down on the grounded workbench pad and disconnect the speaker cable from the board (Figure 15, #1).

Replace

Follow the steps below to replace the main logic board:

1. Reconnect the speaker cable (Figure 15, #1) to the main logic board.

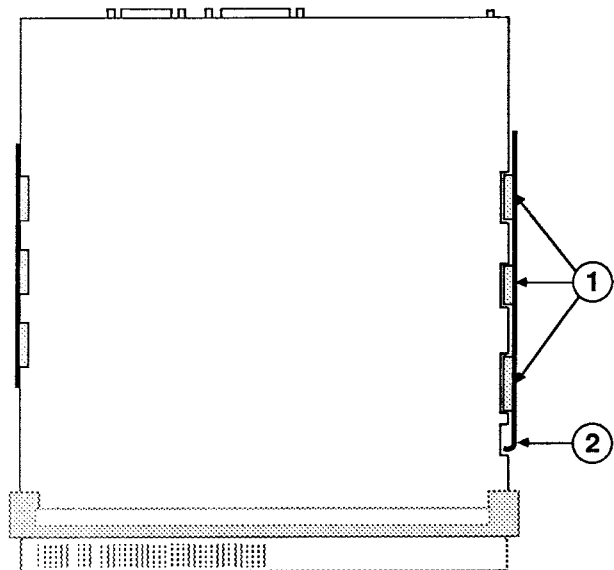


FIGURE 16

2. Fit the smooth left edge of the main logic board into the metal frame.
3. Exactly align the tabs on the right edge of the board with the notches on the right metal bracket (Figure 16, #1).
4. Settle the right edge of the board into the right metal bracket, then slide the board down until you hear it click into place. The lower right tab of the board should be flush against the curved "barrier" on the lower right edge of the metal bracket (Figure 16, #2).
5. Turn the Macintosh SE so that you can see the inside of the chassis.

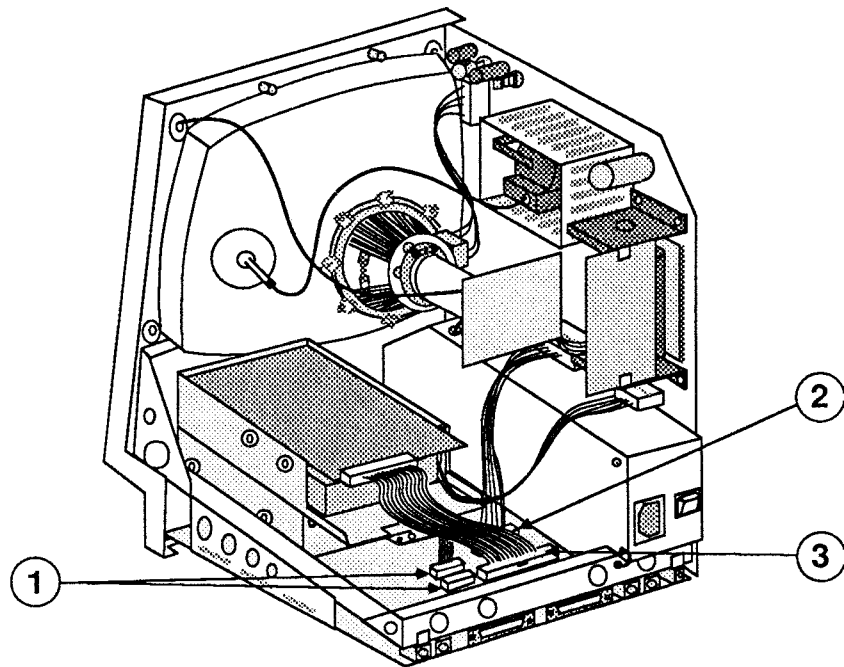


FIGURE 17

6. Reconnect the following to the main logic board:
 - 800K disk drive cable(s) (Figure 17, #1)
 - Power supply cable (Figure 17, #2)
 - Hard disk drive cable, if present (Figure 17, #3)
7. Replace the cover.

□ SIMMs

The Macintosh SE comes with one megabyte of RAM installed on four 256K 150-nanosecond Single Inline Memory Modules (SIMMs). The replacement SIMMs are 120-nanosecond. (The 120-nanosecond and 150-nanosecond SIMMs are interchangeable in the Macintosh SE.)

Materials Required

Grounded workbench pad and wriststrap

Remove

Follow the steps below to remove a SIMM from the main logic board:

1. Remove the cover and discharge the CRT.
2. Put on your grounding wriststrap and place the Macintosh SE on the grounded workbench pad.
(Never do this until after the CRT is discharged.)
3. Remove the main logic board.

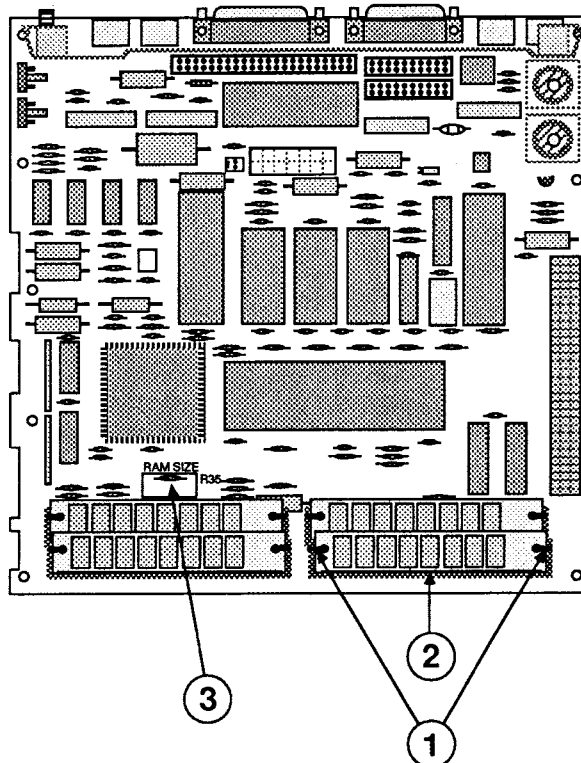


FIGURE 18

4. To remove a SIMM, push outward on the plastic holders (Figure 18, #1) at the ends of the module until you hear a click. Then lift out the module.

CAUTION: *SIMMs are very susceptible to ESD and skin acid damage. Handle only by the edges.*

Replace

Follow the steps below to replace a SIMM:

1. With the contacts (Figure 18, #2) on the SIMM pointing down, set the module into the connector at an angle (bottom forward).
2. Push back on the top corners of the module. You will hear a click when the module snaps into place.
3. Replace the main logic board.
4. Replace the cover.

❑ SIMM UPGRADES

The Macintosh SE RAM may be expanded to 2.5 or 4 megabytes by removing either two or four 256K SIMMs, cutting out a resistor (R35), and installing two or four 1-megabyte SIMMs.

Locate the R35 resistor (Figure 18, #3) in the area labeled RAM SIZE. Using small diagonal cutters, clip the resistor off the board and discard it. (You do not need to desolder the leads from the board.)

For 2.5 megabytes: Install two 1-megabyte SIMMs in positions 1 and 2, leaving 256K SIMMs in positions 3 and 4.

For 4 megabytes: Install four 1-megabyte SIMMs.

□ VIDEO BOARD

Materials Required

Grounded workbench pad and wriststrap
Torx screwdriver

Remove

Follow the steps below to remove the video board:

1. Remove the cover.
2. Discharge the CRT.

WARNING: Leave your safety goggles on for the remainder of this procedure.

3. Put on your grounding wriststrap and place the Macintosh SE on the grounded workbench pad. (Never do this until after the CRT has been discharged.)

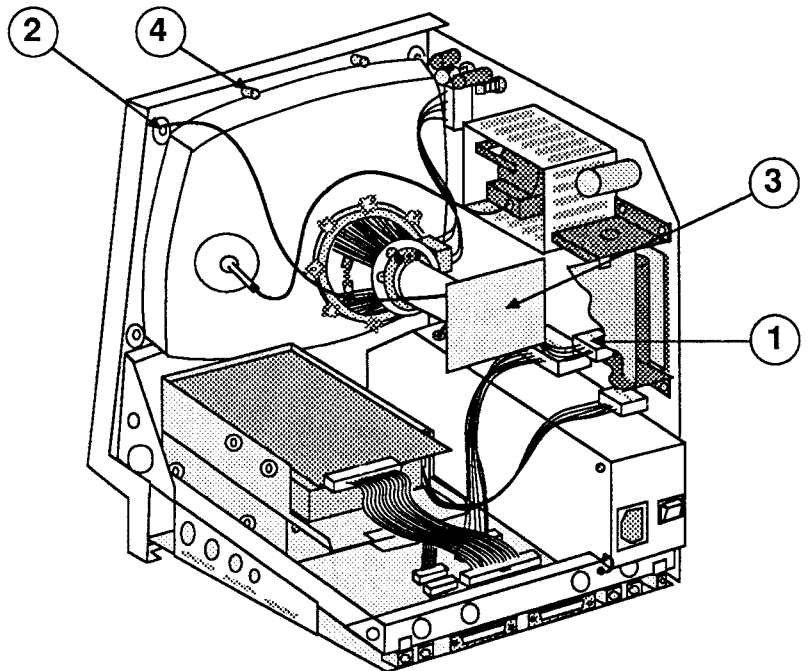


FIGURE 19

4. Disconnect the video board connector (Figure 19, #1) from the analog board.
5. Remove the Torx screw holding the video ground wire to the upper left CRT mounting bracket (Figure 19, #2).
6. Carefully pull the video board (Figure 19, #3) off the neck of the CRT.

Replace

Follow the steps below to replace the video board:

1. Reconnect the video board (Figure 19, #3) to the neck of the CRT. It fits only one way.
2. Place the video ground wire tab over the upper left CRT mounting bracket and replace the Torx screw (Figure 19, #2). Be sure the ground wire is routed away from the case screw holder (Figure 19, #4).
3. Reconnect the video board cable to the analog board (Figure 19, #1).
4. Replace the cover.

□ CATHODE RAY TUBE (CRT)

Materials Required

Grounded workbench pad and wriststrap
Torx screwdriver

Remove

Follow the steps below to remove the CRT:

1. Remove the cover and discharge the CRT.

WARNING: *Leave your safety goggles on for the remainder of this procedure.*

2. Remove the anode cap.
3. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
4. Remove the analog board. (Do not remove the power supply from the analog board.)
5. Remove the video board.

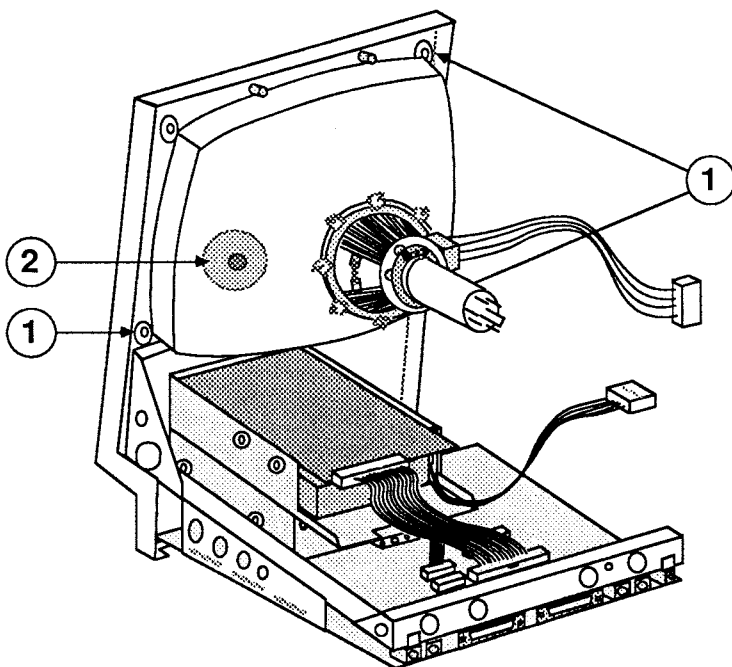


FIGURE 20

6. Using the Torx screwdriver, remove the three remaining mounting screws from the corners of the CRT (Figure 20, #1).
7. Lift the CRT free from the bezel.

Replace

Follow the steps below to replace the CRT:

1. Place the CRT face down in the bezel, with the anode aperture (Figure 20, #2) on the left, as shown.
2. Replace the three CRT mounting screws shown in Figure 20, #1.

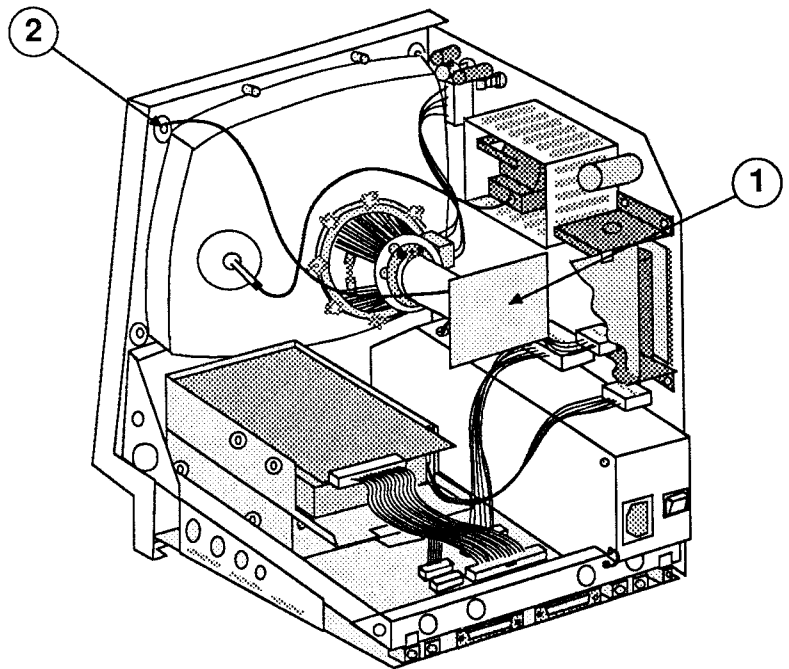


FIGURE 21

3. Replace the video board (Figure 21, #1).

Note: Directions for replacing the fourth CRT mounting screw (Figure 21, #2) are included in the video board procedure.

4. Replace the analog board/power supply.
5. Replace the cover.

□ INTERNAL SCSI HARD DISK DRIVE

Materials Required

Grounded workbench pad and wriststrap
Medium Phillips screwdriver

Remove

Follow the steps below to remove the optional internal SCSI hard disk drive.

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)

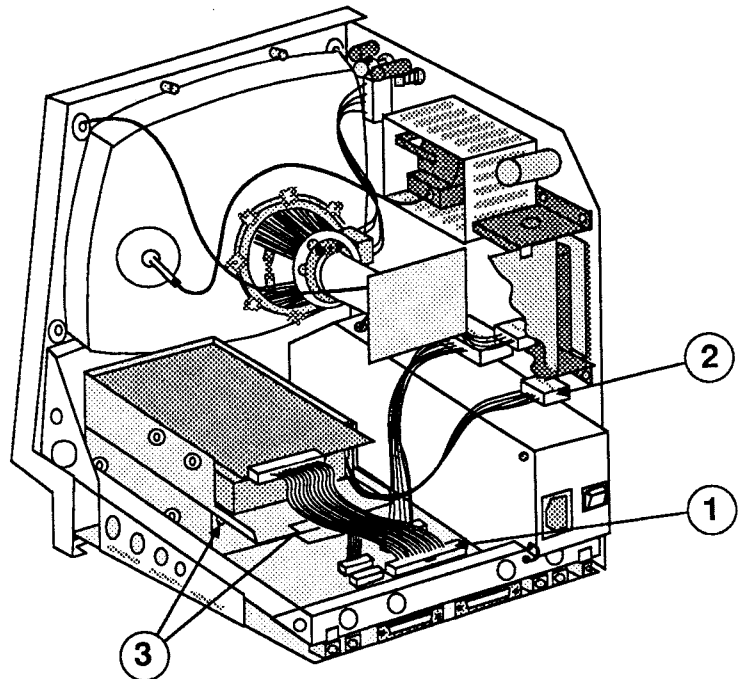


FIGURE 22

3. Disconnect the hard disk drive cable from the main logic board (Figure 22, #1).
4. Disconnect the hard disk drive power cable from the analog board (Figure 22, #2).

5. Remove the two Phillips screws that secure the hard disk drive housing to the lower drive housing (Figure 22, #3), and lift out the hard disk assembly.
6. Before returning the hard disk assembly to Apple, remove the 50-pin SCSI connector cable.

Replace

To replace the optional internal SCSI hard disk drive:

1. Replace the 50-pin SCSI connector cable on the hard disk assembly.
2. Slide the hard disk assembly over the lower drive so that the tabs on bottom of the hard drive housing mesh with the top holes on the lower drive housing.

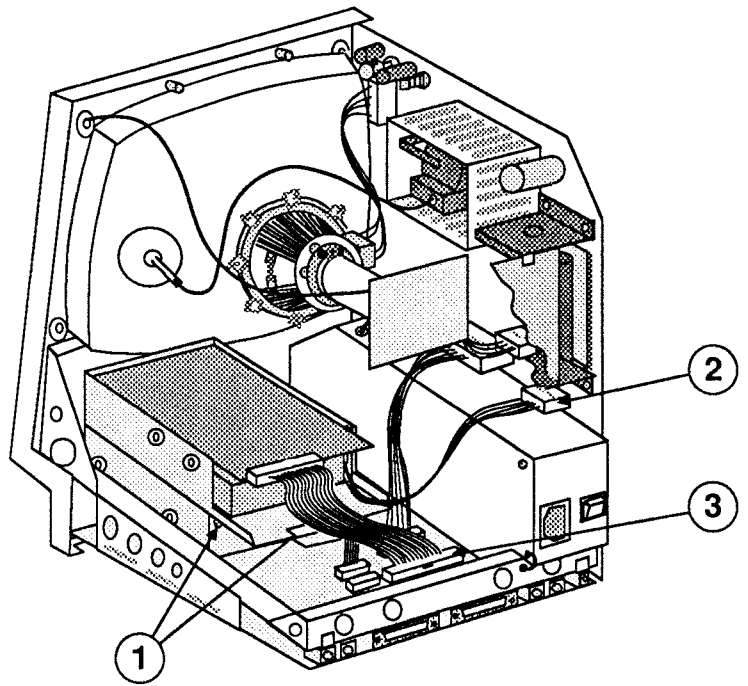


FIGURE 23

3. Replace the two screws that secure the hard disk housing to the lower drive housing (Figure 23, #1).
4. Reconnect the hard disk drive power supply cable to the analog board (Figure 23, #2).
5. Reconnect the drive cable to the main logic board (Figure 23, #3).
6. Replace the cover.

□ UPPER 800K DISK DRIVE

Materials Required

Grounded workbench pad and wriststrap
Medium Phillips screwdriver

Remove

To remove the optional upper 800K drive:

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)

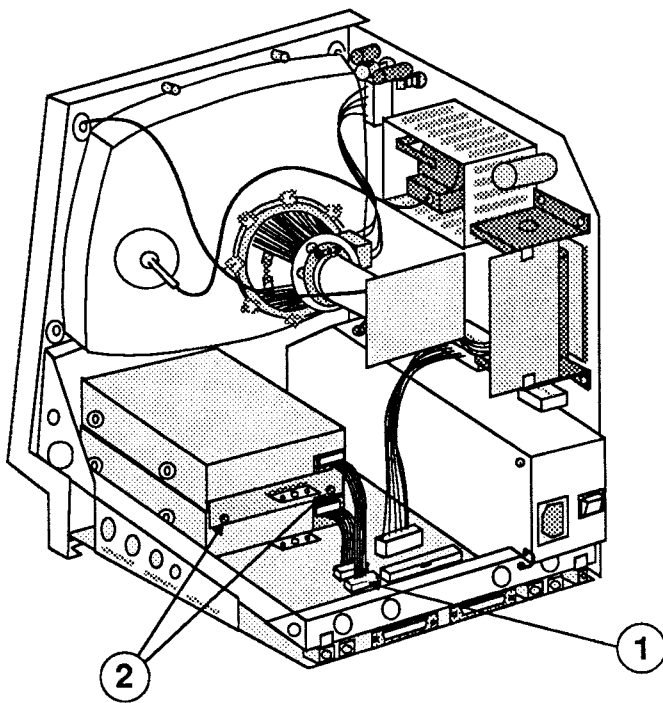


FIGURE 24

3. Disconnect the upper 800K disk drive cable from connector J7 on the main logic board (Figure 24, #1).
4. Remove the two screws (Figure 24, #2) from the metal bracket that holds the two drive housings together. Lift off the metal bracket.

5. Slide the upper 800K drive forward and lift it out.
6. Remove the four screws, two on each side of the metal drive housing, and remove the drive mechanism from the housing.

Note: If you are sending the drive mechanism back to Apple, place it in the shipping fixture that the replacement drive mechanism came in, and install a dummy packing diskette into the drive.

Replace

1. Remove the shipping fixture and the dummy packing diskette from the replacement 800K drive mechanism.
2. Place the drive mechanism into the metal housing and replace the four Phillips screws, two on each side (Figure 25, #1).

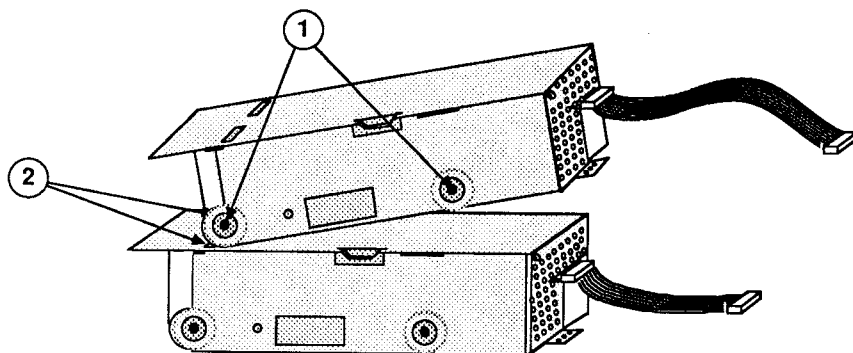


FIGURE 25

3. To place the upper drive into the chassis over the installed lower drive, slide the upper 800K drive forward then back over the lower 800K drive so that the tabs on the top of the lower drive housing mesh with the holes on the bottom of the upper drive housing (Figure 25, #2).

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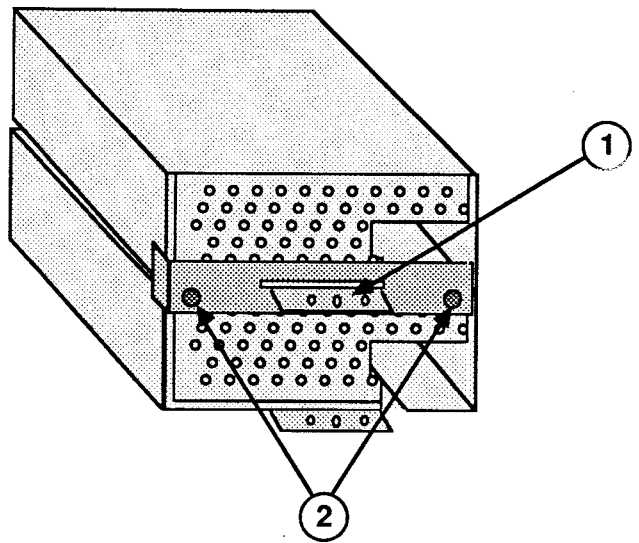


FIGURE 26

4. Place the metal bracket over the two drive housings so that the slot in the bracket (Figure 26, #1) fits over the tab on the upper housing.
5. Replace the two Phillips screws (Figure 26, #2) that secure the metal bracket to the lower 800K drive housing.

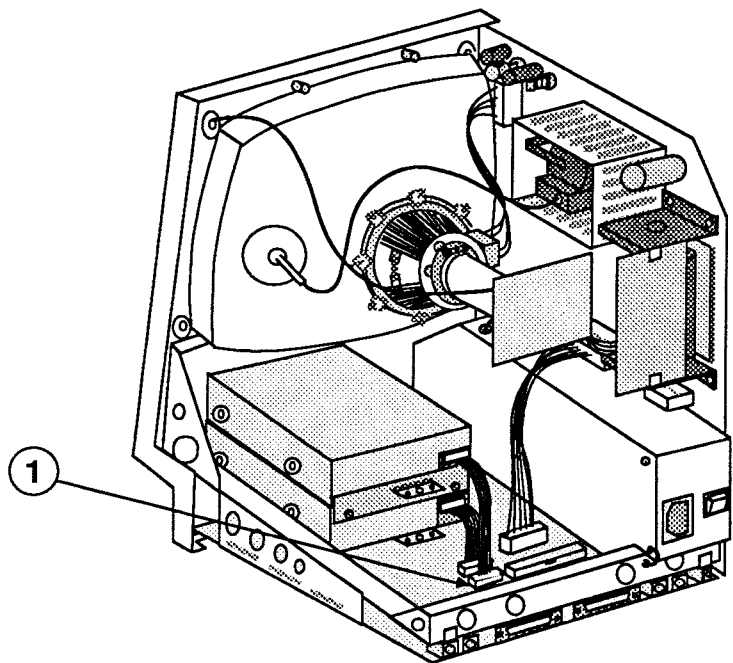


FIGURE 27

6. Reconnect the upper 800K disk drive cable to connector J7 on the main logic board (Figure 27, #1).

Note: You must use the longer of the two available **yellow-coded** 800K disk drive cables for the upper drive. The shorter cable will not reach to the main logic board. (The two cables are identical except for length.)

7. Replace the cover.

❑ LOWER 800K DISK DRIVE

Materials Required

Grounded workbench pad and wriststrap
Medium Phillips screwdriver

Remove

To remove the lower 800K disk drive:

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
3. Remove the hard disk drive or upper 800K drive, whichever is present.
4. Remove the main logic board.

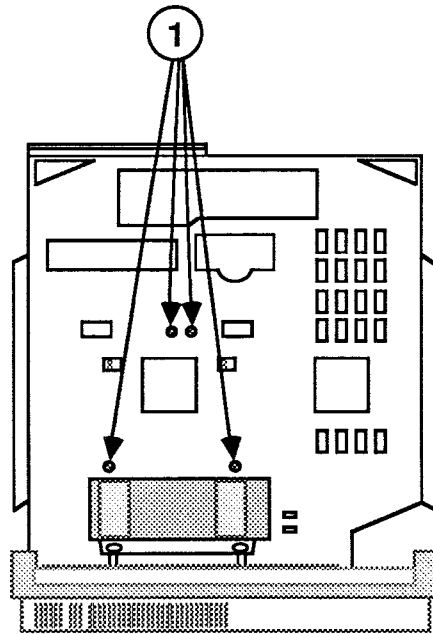


FIGURE 28

5. With the bottom of the Macintosh SE chassis facing you, remove the four Phillips screws (Figure 28, #1) that secure the lower 800K drive to the bottom of the metal chassis. Lift the drive free.

6. Remove the four screws, two on each side of the metal drive housing, and remove the drive mechanism from the housing.

Note: If you are sending the drive mechanism back to Apple, place it in the shipping fixture that the replacement drive mechanism came in, and install a dummy packing diskette into the drive.

Replace

1. Remove the shipping fixture and the dummy packing diskette from the replacement 800K drive mechanism.
2. Place the drive mechanism into the metal housing and replace the four Phillips screws, two on each side.

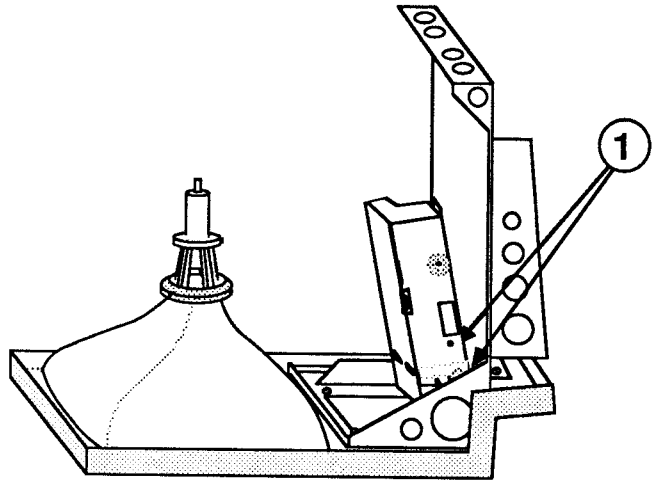


FIGURE 29

3. Place the drive into the chassis so that the tabs on the bottom of the metal drive housing fit into the holes provided in the chassis frame (Figure 29, #1).
4. Replace the four Phillips screws (Figure 28, #1) that secure the 800K drive to the bottom of the metal chassis.
5. Replace the main logic board.
6. Replace the hard disk or upper 800K drive.
7. Replace the cover.

□ SPEAKER AND FRONT BEZEL

Materials Required

Grounded workbench pad and wriststrap
Exacto knife
Soldering iron
Torx screwdriver

Remove

Follow the steps below to remove the speaker or bezel:

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
3. Remove the main logic board.
4. Remove the analog board. (Do not remove the power supply from the analog board.)

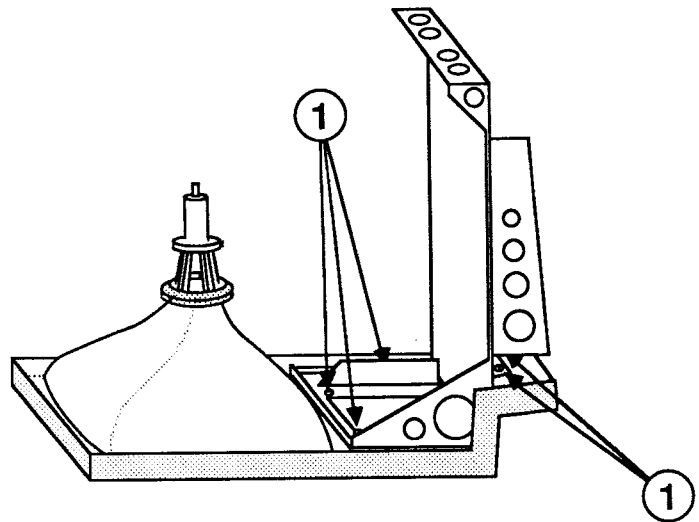


FIGURE 30

5. Remove the five Torx screws (Figure 30, #1) that secure the metal chassis to the bezel, and lift out the chassis, with disk drive(s) attached.

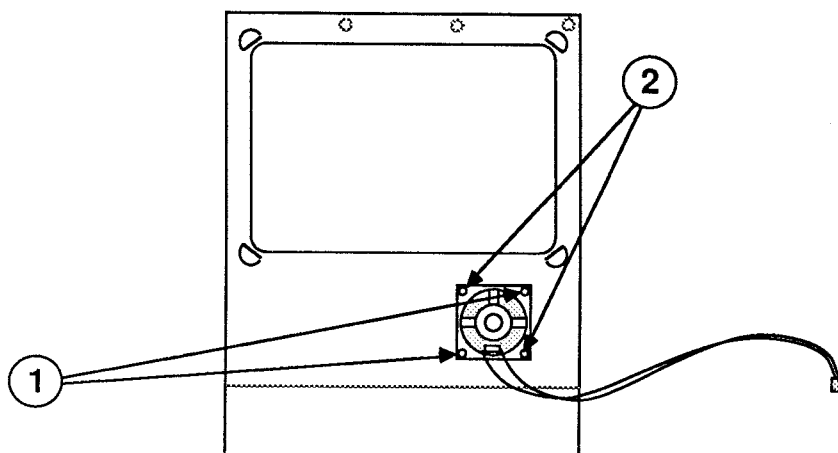


FIGURE 31

6. If you are replacing the speaker, use an exacto knife to cut away the melted plastic that secures two of the corners of the speaker to the front bezel (Figure 31, #1) and lift the speaker out.
7. If you are replacing the bezel, first remove the CRT.

Replace

Follow the steps below to replace the speaker or bezel:

1. Place the bezel face down on the grounded workbench pad.
2. Position the speaker in the bezel (see Figure 31).
3. Touch a heated soldering iron to the two previously unmelted plastic posts that now protrude through the corners of the speaker (Figure 31, #2). The plastic will spread as it melts, then harden, holding the speaker in place.
4. Replace the CRT, if you removed it.
5. Replace the metal chassis, with disk drive(s) attached, and fasten it to the bezel with the five Torx screws (Figure 30, #1).
6. Replace the analog board.
7. Replace the main logic board.
8. Replace the cover.

□ BATTERY

Introduction

Lithium thionyl chloride batteries, the type used in the Macintosh SE, have some potential for explosion if improperly handled. The following precautions should be taken when storing, handling, and disposing of lithium batteries.

- Lithium batteries should be stored in a designated, well-marked area with limited access.
- Apple's lithium batteries are sealed in individual zip-lock wrappers. Upon receipt, the batteries should be inspected for integrity of their wrappers, and should be stored in the same packaging in which they were received.
- Lithium batteries cannot be recharged and therefore will require disposal when "dead." In addition to its explosive potential, lithium is water-reactive **and must be disposed of as a hazardous waste**. Therefore, Apple recommends the following course of action:

After removing a "dead" battery from a board, clip off the lead wires and place the battery into the zip-lock wrapper and original packaging from which the replacement battery was taken. Mark the battery DEAD and return it to Apple, where it will be disposed of following EPA guidelines.

The Macintosh SE contains a single long-life lithium battery that should serve for the life of the product. However, if a battery does fail, replace it according to the following procedure.

Replacement Procedure

To replace the Macintosh SE battery:

1. Remove the cover and discharge the CRT.
2. Move the Macintosh SE onto a soft, grounded workbench pad and put on your grounding wriststrap. (Never do this until after the CRT is discharged.)
3. Remove the main logic board.
4. Place the main logic board on the grounded workbench pad.

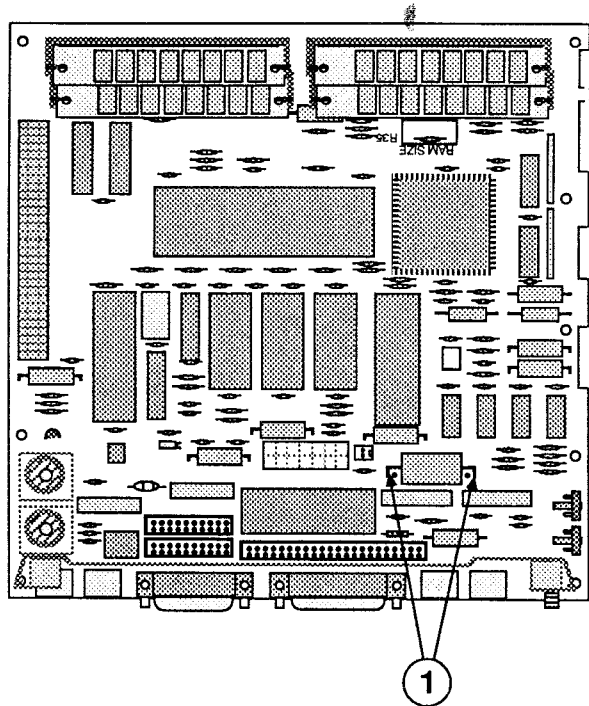


FIGURE 32

5. Using wire clippers, cut the leads (Figure 32, #1) at both ends of the battery to free it from the main logic board. Cut the leads as close to the logic board as you can without touching the board with the clippers.

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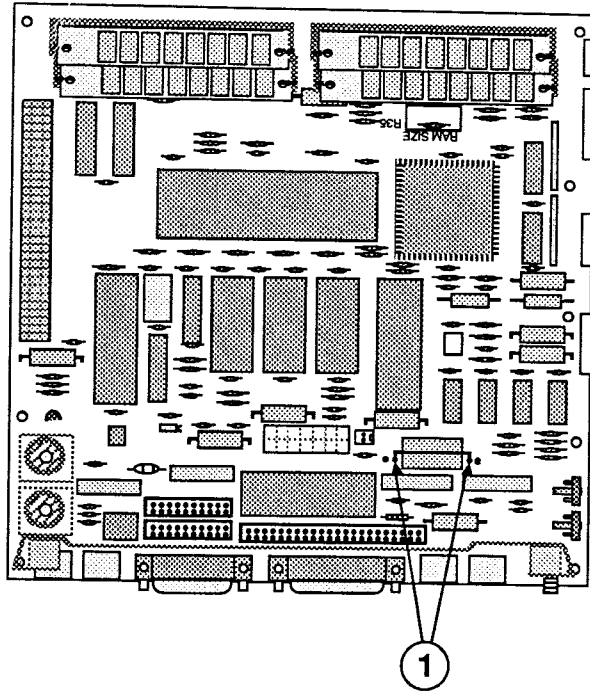


FIGURE 33

6. Orient the new battery so that the end marked "+" matches the "+" on the main logic board. Insert the battery leads into the extra set of mounting holes (Figure 33, #1) on the logic board (just inside the original mounting holes). Make sure the leads go all the way through the logic board to the other side.

7. Holding the battery in place, turn the logic board over and touch a heated soldering iron to the two new battery leads that are protruding through the inner mounting holes.

Note: It is not necessary to desolder the remains of the old leads from the outer mounting holes.

8. Replace the main logic board.
9. Replace the cover.
10. Trim off the leads of the old battery, package and label it as directed in the introduction to this procedure, and return it to Apple for proper disposal.

□ KEYBOARD

Exchanging the Keyboard

If you are exchanging the keyboard, **do not** remove the keyboard mechanism. Send in the entire unit for exchange (**without** the cable). Remove the keyboard mechanism **only** when you must replace a keyswitch.

Note: Various Apple DeskTop Bus keyboards may be used with the Macintosh SE. The procedures for opening other Apple DeskTop Bus keyboards are similar to the one below (for the Apple Keyboard).

Materials Required

Grounded workbench pad and wriststrap
Medium Phillips screwdriver

Removing the Keyboard Mechanism

To remove the keyboard mechanism:

1. Disconnect the keyboard from the Macintosh SE.
2. Remove the keyboard cable.
3. Place the keyboard on the grounded workbench pad and put on your grounding wriststrap.
4. Remove the three Phillips screws from the back of the keyboard and lift off the top plastic cover.

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5. Before you remove the mechanical assembly from the bottom case, notice how the small breakaway boards (with the Apple DeskTop Bus connectors) fit into the upper corners of the bottom case (Figure 34, #1).

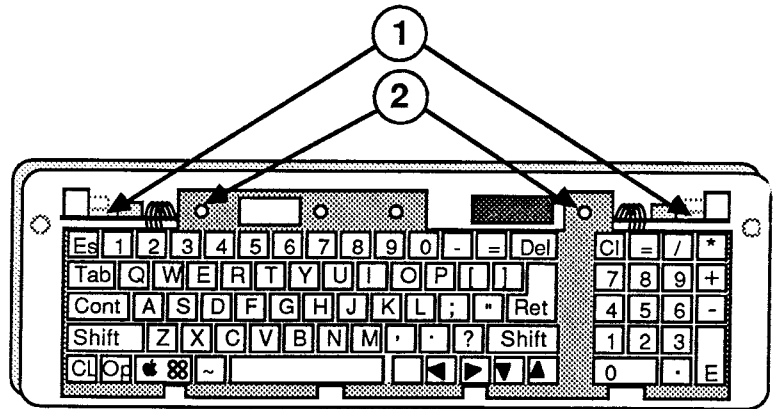


FIGURE 34

6. Lift the mechanical assembly out of the bottom case.
7. Use the replacement procedures for Apple DeskTop Bus keyboard keyswitches in *You Oughta Know*.

Replacing the Keyboard Mechanism

To replace the keyboard mechanism:

1. Place the mechanical assembly in the bottom case and slip the small breakaway boards into place vertically (Figure 34, #1).
2. Engage the top cover's teeth onto the front edge of the bottom cover, and fit the top cover's guide posts into the holes on the bottom cover (Figure 34, #2).
3. Hold the cover in place, turn the keyboard over, and install the three case screws.

Macintosh SE

Section 3 – Adjustments

❏ CONTENTS

3.2	Yoke Adjustments
3.2	Introduction
3.2	Materials Required
3.3	Tilt Adjustment
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3.5	Adjustment Procedures

□ YOKE ADJUSTMENTS

Introduction

In infrequent cases, you may need to adjust the yoke of the Macintosh SE after you replace the CRT. To see if the yoke needs adjusting, turn the power on and look at the CRT screen. If the picture is tilted, correct it using the tilt adjustment. If the picture is off center, use the centering rings adjustment.

Yoke adjustments are made while standing behind the Macintosh SE, so you must position a mirror so that you can see the screen. **Because of the high voltage danger, do not try to make live adjustments by facing the screen and reaching around the computer; you can't see what your hands are going to touch.**

Materials Required

Small Phillips screwdriver
Safety goggles
CRT discharge tool
Soft cloth or foam pad
Mirror
Exacto knife

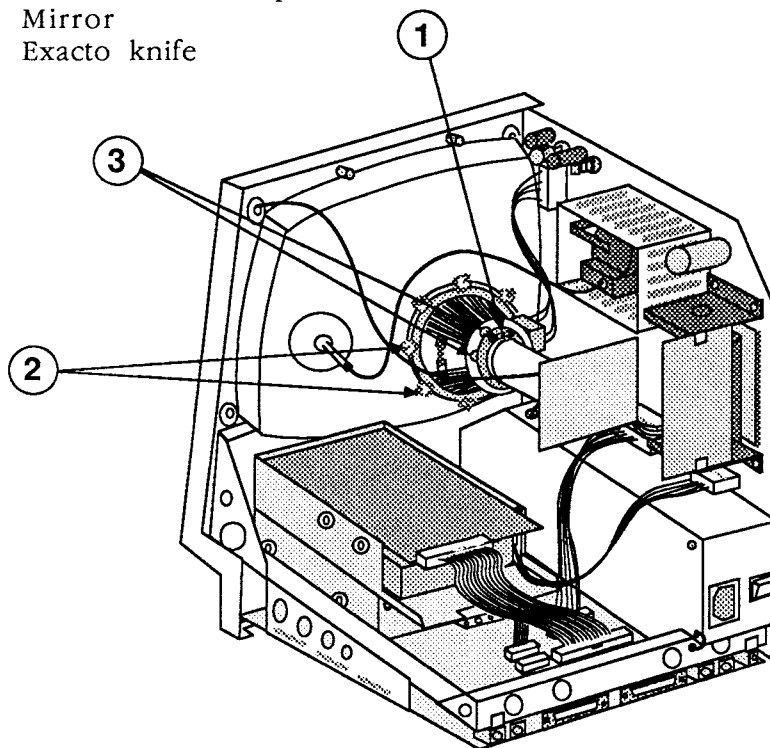


FIGURE 1

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

Tilt Adjustment

1. Put on safety goggles and remove all metal jewelry. If you are wearing a grounding wriststrap, remove it.
2. Remove the cover and discharge the CRT. (Refer to Section 2, Take-Apart.)
3. Turn the computer with its back facing you and position the mirror so that the CRT screen is visible in the mirror.
4. Loosen the yoke clamp screw (Figure 1, #1) at the top of the CRT neck two or three turns.
5. Connect the power cord and turn the power on.
6. Put one hand behind your back and with your other hand grasp only the plastic spokes of the yoke collar (Figure 1, #2). Rotate the yoke until the top and bottom edges of the picture appear parallel with the top and bottom edges of the bezel.
7. Turn the power off, unplug the computer, and discharge the CRT again.
8. Hold the yoke collar in the position you just determined in Step 5 and carefully tighten the yoke clamp screw just enough so that the yoke cannot slip. Do not overtighten.
9. Replace the cover.
10. Connect the power cord and turn the power on to make sure the tilt adjustment is still correct.

Centering Ring Adjustment

1. Put on safety goggles and remove all metal jewelry. If you are wearing a grounding wriststrap, remove it.
2. Remove the cover and discharge the CRT. (Refer to Section 2, Take-Apart.)
3. Turn the Macintosh SE so that its back is facing you, and position the mirror so that the CRT screen is visible in the mirror.
4. Locate the two centering rings on the yoke assembly (Figure 1, #3). The adjustment of these rings determines whether the picture is centered or offset to one side.

Note: If a bonding material is holding these rings in place, break it using an exacto knife.

5. Connect the power cord and turn the power on.
6. Center the picture by first holding the front centering ring steady and moving the rear ring, then holding the rear ring steady and moving the front ring.
7. When the picture is perfectly straight and centered, turn the power off, remove the power cord, and again discharge the CRT.
8. Replace the cover.
9. Plug in the power cord, turn on the Macintosh SE, and view the screen to ensure that the centering adjustment is still correct.

□ VIDEO ADJUSTMENTS

Introduction

Video adjustments **may** be necessary whenever the CRT, the analog board, or the power supply is replaced.

Materials Required

Safety goggles
Alignment tool
Mirror
Ruler

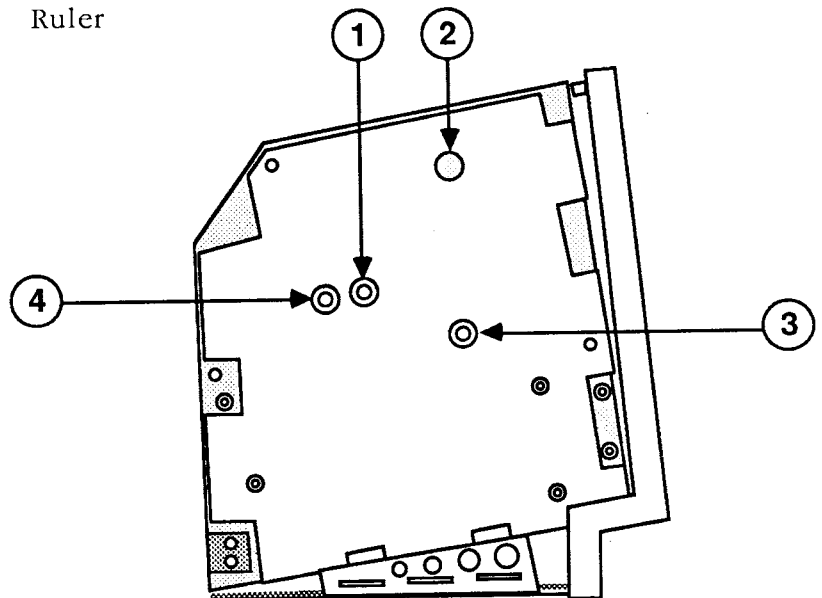


FIGURE 2

Adjustment Procedures

1. Put on safety goggles and remove all metal jewelry. If you are wearing a grounding wriststrap, remove it.
2. Remove the cover and discharge the CRT. (Refer to Section 2, Take-Apart.)
3. Turn the computer with the side of the analog board facing you, and position the mirror so that the CRT screen is visible in the mirror.

Brightness and Contrast

4. Turn the contrast control fully clockwise. (The contrast control is on the front of the Macintosh SE, on the left hand side, under the Apple logo.)
5. Adjust the brightness control (Figure 2, #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.
6. Turn the contrast control on the front panel slightly counterclockwise. This is the ideal adjustment.

Size Adjustments

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

Focus Adjustment

9. Turn the focus adjustment (Figure 2, #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 SE

Section 4 – Diagnostics

□ CONTENTS

- 4.2 Introduction
- 4.3 Things To Remember
- 4.3 Making a Backup Diskette
- 4.4 Using Your Backup Diskette
- 4.5 800K Drive Copy Program
- 4.7 Running *MacTest SE*
- 4.7 Materials Required
- 4.7 Installing the Loopbacks
- 4.8 Using the *MacTest SE* Menus
- 4.10 Running the Tests
- 4.11 SCSI Loopback Jumper Procedure
- 4.11 To Determine if a Jumper Is Needed
- 4.12 To Install the Jumper

□ INTRODUCTION

The *MacTest SE* diagnostic diskette is used to test the Macintosh SE main logic board, internal and external floppy disk drives, and SCSI bus. It also provides a grid display for use in adjusting the CRT.

MacTest SE does not test the internal SCSI hard disk.

To test the hard disk, use the *Macintosh Hard Disk Drive Diagnostic* diskette (see Section 3, Diagnostics, in the *Hard Disk 20SC Technical Procedures*.)

The internal 96-pin Euro-DIN expansion bus connector on the Macintosh SE logic board cannot be tested by *MacTest SE*. (Test the bus connector by verifying the functionality of a card installed in the slot.)

MacTest SE is a pass/fail confidence test. As the test progresses, messages on the screen indicate which area is under test. As soon as a failure is detected, the test stops and the screen indicates which module must be replaced before the test can be run to completion.

Note: If you cannot start up the diskette, check the power cable and internal cable connections. If the cables are OK, turn to Section 5, Troubleshooting, and replace the module(s) specified for the problem you have observed. Attempt to start up the diskette after each module swap to see if the problem has been solved.

□ THINGS TO REMEMBER

Making a Backup Diskette

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

The *MacTest SE* diskette cannot be copied using a Macintosh SE because the *800K Disk Copy* program, contained on the *MacTest SE* diskette, was originally designed to work on the Macintosh Plus. Therefore, to make a copy of the *MacTest SE* diskette, you must use:

- A Macintosh Plus
- An 800K external drive
- The *800K Drive Copy* program, contained on the *MacTest SE* diskette
- A blank 800K diskette

To make a valid copy of your *MacTest SE* diskette, follow the instructions in the next section, "800K Drive Copy Program." **Note the following precautions:**

- You cannot make a copy by simply dragging the disk icon onto a new diskette. (The reserved tracks used for disk drive testing will not be properly reserved on the new disk.)
- You cannot use a different backup program to copy the contents of the diskette. (The resulting copy of the *800K Drive Copy* program would be unusable.)
- You must use a Macintosh Plus to make the copy because the *800K Drive Copy* program does not work correctly on the Macintosh SE.
- The *800K Drive Copy* program will not work if you attempt to copy to an external drive that is connected (daisy-chained) through a non-SCSI Hard Disk 20.
- Do not turn on the memory cache when you are using the *800K Drive Copy* program. There may not be enough memory left in RAM to copy the contents of the diskette.
- When you have made a correct copy of *MacTest SE*, put your master diskette away for safekeeping. Never run the tests from the master diskette—use it for making copies only!

Using Your Backup Diskette

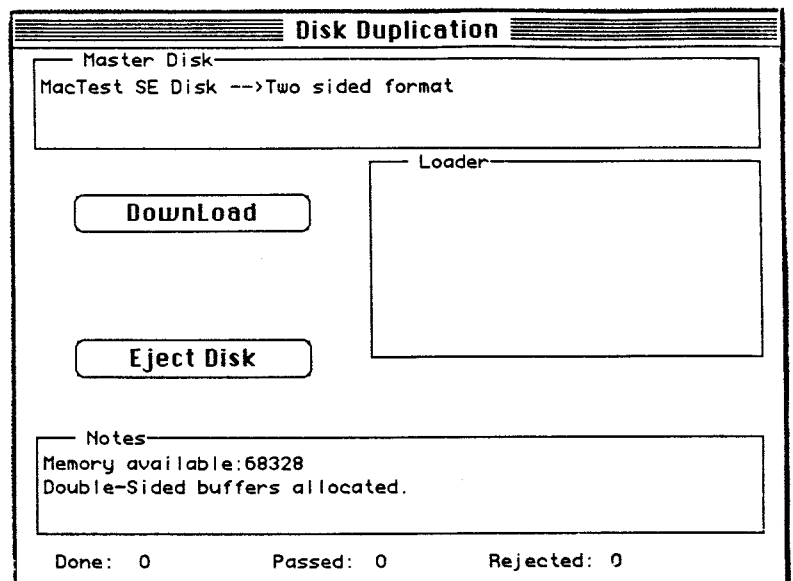
Note the following precautions when using your *MacTest SE* diskette copy:

- Do not write-protect your working copy of the *MacTest SE* diskette. (The program will not run correctly if you do.)
- Do not replace the system or finder provided on the *MacTest SE* diskette. The versions used on the diskette are Finder 5.4 and System 4.0. *MacTest SE* is not guaranteed to work with other versions.
- Do not change the name of the diagnostic program on the diskette. During logic board testing, the machine reboots and looks for and restarts the diagnostic named *MacTest SE*. If the name of the diagnostic has been changed, the startup routine will not be able to locate it, and the system will stay on the desktop.

Therefore, if the *MacTest SE* window does not reappear after a logic board test, check the name of the diagnostic's icon on the desktop. Correct it to *MacTest SE*, then select **Set Startup** from the desktop **Special** menu. When you are asked if you wish to change the name of the startup application to *MacTest SE*, click **OK**. Then double-click on the corrected *MacTest SE* icon to return to the test program.

□ 800K DRIVE COPY PROGRAM

1. Set up a Macintosh Plus with an external 800K drive.
2. Insert the *MacTest SE* master diskette into the internal drive of the Macintosh Plus, and power on the system.
3. An error message will warn you that this computer is not a Macintosh SE, and that this test (*MacTest SE*) works only with a Macintosh SE. Ignore the message and click on **Exit**. The desktop will appear.
4. Double-click on the **800K Drive Copy** icon. The following window will appear.



Wait until the **Wristwatch** icon disappears.

5. 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, then will eject the *MacTest SE* diskette. The message "Disk Successfully Downloaded" will appear in the box labeled **Notes**.

6. Insert a double-sided blank diskette into the external disk drive.
7. 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.

8. You now have two choices.

a) If you wish to make additional copies:

- 1) Insert another blank diskette 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 require.

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 SE* diskette, as instructed in the dialog box.

The desktop will return.

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

❑ RUNNING *MACTEST SE*

Materials Required

MacTest SE diagnostic diskette (copy)
Mini DIN-8 to mini DIN-8 Serial Port Cable
SCSI Loopback Test Card (modified with jumper—see
"SCSI Loopback Jumper Procedure")
Blank formatted 800K diskette for external drive test

Note: If there is an expansion card installed in the 96-pin Euro-DIN connector on the logic board, remove it before beginning.

Installing the Loopbacks

Before beginning *MacTest SE*, and **with the power off**, connect the serial loopback cable, the SCSI loopback card, the keyboard and mouse, and the external drive (optional).

The SCSI loopback card cable must be connected to the SCSI port on the back of the Macintosh SE. (No other connections between the card and the Macintosh SE are necessary.) To protect the SCSI circuitry, you must have the power off when you connect the SCSI card.

Note: When the SCSI loopback card is connected, the internal SCSI hard disk will not be able to respond, nor will it be recognized by the system.

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

Using the MacTest SE Menus

Insert the *MacTest SE* diskette into the internal drive, and power on the system. The *MacTest SE* test window will appear. The menus available from the *MacTest SE* window are described below.

Options Menu

The **Options** menu contains two submenu choices:

1. **Configuration:** This selection brings up a window that indicates the amount of memory and the version number of the ROMs in the Macintosh SE under test.
2. **Test Selections:** This window allows you to select the tests you wish to run:
 - a) **Logic:** This test verifies the correct functioning of the following components and connectors on the board:
 - VIA (Versatile Interface Adaptor)
 - Serial ports
 - Clock
 - SCSI bus
 - Memory (RAM)

You may select a short (1-minute) or long (5-minute) logic test.

- b) **800K Drives:** You may test any or all of the drives (except internal or external hard disks):
 - First (lower)
 - Second (upper)
 - External

Note: The diagnostic will not test an external disk drive that is connected through a non-SCSI Hard Disk 20.

- c) **Video:** This test provides a CRT grid pattern that allows you to check the adjustment of the video picture.

Note: This is not a pass/fail test, but a test pattern that is displayed on the screen before the other selected tests run. When you have made any necessary video adjustments, press the mouse button or hit any key to go on with the remainder of the selected tests or, if there are no other selected tests, to return to the *MacTest SE* window.

- d) **Loop on All Selected Tests:** This selection provides a continuous running (in sequence) of all selected tests except the CRT grid. To stop the looping, click the **Stop** box between tests (that is, when the screen displays an arrow rather than a wristwatch).

To select a test, click in the box next to the name of the item to be tested. The box will display an X. To deselect the test, click again in the box and you will notice that the X is gone. When you have selected all the tests you wish, click in the **OK** box. You will be returned to the *MacTest SE* window.

Note: You may cause a system error if you deselect all the tests and then click on **Start**.

File Menu

The **File** menu allows you two choices:

1. **Save Test Selections:** Allows you to customize your *MacTest SE* diskette by saving your selection of tests for the next time you use *MacTest SE*. The default configuration is the short logic test and first (lower) drive test.

IMPORTANT: *The diskette must be unlocked before you try to save your selections.*

2. **Quit:** Returns you to the desktop.

Apple Menu

The Apple (🍏) menu allows you to access the **KeyCaps** desk accessory to check the operation of the Apple DeskTop Bus keyboard. When selected, **KeyCaps** 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.

Running the Tests

After you have used the **Test Selections** window to specify the tests you wish to run, you are ready to start *MacTest SE*. Click on the **Start** box in the *MacTest SE* window. The testing will begin. Please note the following:

- If the SCSI loopback card is missing or improperly installed, you will be instructed at once to turn off the power, disconnect all external SCSI drives, and connect the SCSI loopback card.
- If the serial loopback cable is missing or improperly installed, the testing will begin, but the serial ports test will fail. You will be instructed to make sure the serial loopback cable is connected, then to click on **Continue** to retry the failed test. (You can connect the serial loopback cable without powering off the system.)
- The logic board test causes several seconds of startling graphics to be displayed on the screen before the program reboots to the MacTest SE window. Ignore them.
- You may halt the testing by clicking on **Stop** or **Pause** any time between tests (that is, when the screen displays an arrow rather than a wristwatch).
 - Choose **Stop** to halt the testing and to return to the **Waiting for Start** state. Choose **Start** when you wish to begin the testing sequence again.
 - Choose **Pause** if you wish to discontinue testing temporarily. Choose **Continue** to resume the tests from the point of interruption.

Replace any module that the test indicates is faulty. Then run *MacTest SE* again to make sure the problem has been corrected. If the system is still not operating properly, turn to Section 5, Troubleshooting, for more information.

If all tests pass, the Macintosh SE will return to the *MacTest SE* window. The message **All tests passed** will be displayed briefly. A **Happy Macintosh** icon will be displayed in the upper left corner of the screen's graphic area until you reboot or start the test again.

❑ SCSI LOOPBACK JUMPER PROCEDURE

To Determine If a Jumper Is Needed

To be used with *MacTest SE*, the SCSI loopback card must be jumpered between Pin 25 of J1 and Pin 14 of RP1. On new SCSI loopback cards, the jumper has been etched into the printed circuit. Only cards with the old PCB artwork need the jumper procedure.

Note: This modification does not interfere with the card's use on other Macintosh or Apple II family systems, except that to work on Apple II systems it must be connected to a notched mouse cable. (For further information on the notched cable, refer to *Hard Disk 20SC Technical Procedures*, Appendix A, "SCSI Interface Card.")

To Identify a New Card

To determine if you have a new card, which will not need to be jumpered, look at the back of the card. If the jumper is included in the artwork, there will be an **A** instead of double zeros (00) at the end of the part number, which is located under the words "APPLE COMPUTER" (Figure 1, #1). **These new cards do not have to be jumpered.**

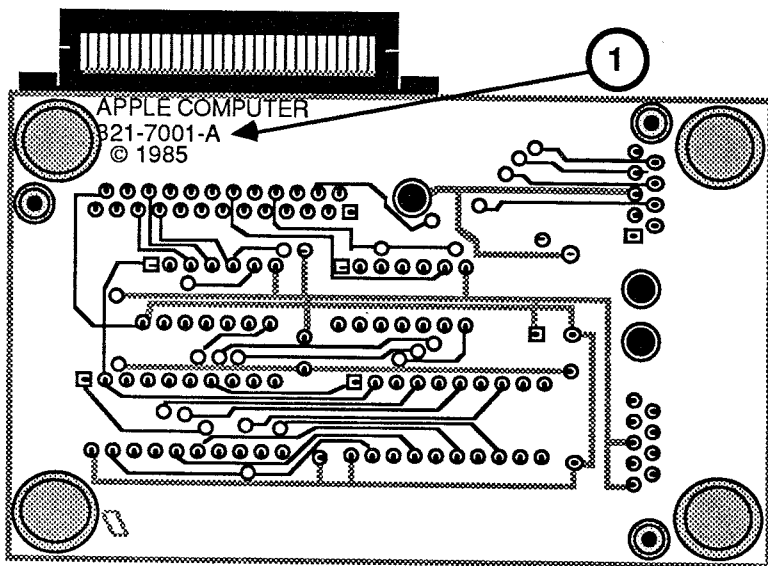


FIGURE 1

*External
Jumpers on
Old Cards*

Some cards with the **00** part number and the old artwork were modified with an external jumper during the manufacturing process. Therefore, if your card has a **00** part number, check to see if it has an external jumper from Pin 25 of J1 to Pin 14 of RP1 (Figure 2, #1). If it has no external jumper, you must install one yourself.

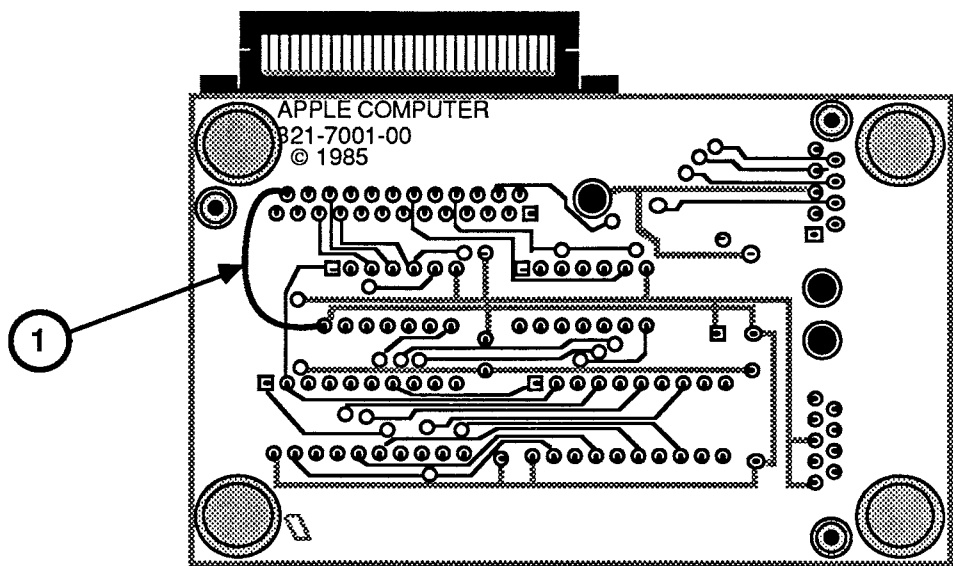


FIGURE 2

Summary

To summarize:

If # on back ends with:	Do this:
A	Nothing (Jumper is present in artwork.)
00	Check to see if external jumper is present. If not, install jumper.

**To Install
the Jumper**

If you find that the card must be jumpered, solder a wire connection between Pin 25 of J1 and Pin 14 of RP1, as shown in Figure 2. (The pins are not numbered on the board. In the orientation shown in Figure 2, Pin 25 is the pin closest to the upper left corner of the card, and Pin 14 is in the middle line of pins, closest to the left edge of the card.)

Macintosh SE

Section 5 – Troubleshooting

❏ CONTENTS

5.2	Introduction
5.2	General Information
5.2	How to Use the Symptom Chart
5.2	Things to Remember
5.3	Symptom Chart
5.3	Video Problems
5.4	Drive Problems
5.6	Peripheral Problems
5.7	Miscellaneous Problems
5.8	Isolating a Faulty SIMM

□ INTRODUCTION

General Information

There are two diagnostic tests that may be used to test portions of the Macintosh SE system:

- *MacTest™ SE*
- *Macintosh Hard Disk Drive Diagnostic* (version 3.0 or higher)

Use this troubleshooting section if you are unable to boot the diagnostic diskette or if the diagnostics are unable to detect a module failure. After you repair the system, run the diagnostic tests again to verify system operation.

How to Use the Symptom Chart

Find the symptom that most nearly describes the problem, then perform the corrective actions in the order listed. If a corrective action does not fix the problem, go to the next action. **If you replace a module and find that the problem remains, reinstall the original module before you go on to the next action.**

Things to Remember

1. Read all the safety precautions before removing or installing any modules. (See Section 1, Basics.)
2. Follow all ESD precautions when troubleshooting. (See *You Oughta Know* for more information.)
3. Perform the CRT discharge procedure before removing or installing any modules. (See Section 2, Take-Apart.)
4. Use known-good software. Bad software can produce symptoms that appear to be hardware problems.

□ SYMPTOM CHART

Video Problems

Solutions

- | | |
|--|---|
| <ul style="list-style-type: none">• <i>Screen dark, audio and drive operate</i> | <ol style="list-style-type: none">1. Turn brightness control clockwise.2. Check video cable connections.3. Replace analog board.4. Replace video board.5. Replace main logic board. |
| <ul style="list-style-type: none">• <i>Screen bright and audio present, but no video information visible</i> | <ol style="list-style-type: none">1. Replace main logic board.2. Replace analog board.3. Replace video board. |
| <ul style="list-style-type: none">• <i>Screen is completely dark and fan is not running</i> | <ol style="list-style-type: none">1. Replace power supply.2. Replace analog board. |
| <ul style="list-style-type: none">• <i>Screen is completely dark but fan is running</i> | <ol style="list-style-type: none">1. Replace logic board.2. Replace analog board.3. Replace video board. |

Drive Problems

Solutions

- *Audio and video present but one internal 800K drive does not operate*
 1. Replace bad diskette.
 2. Replace internal disk drive.
 3. Replace internal disk drive cable.
 4. Replace main logic board.
- *Audio and video present but neither internal 800K drive operates*
 1. Replace bad diskette.
 2. Replace main logic board.
- *External 800K drive does not operate*
 1. Replace bad diskette.
 2. Be sure the external drive is placed on the right side of the Macintosh SE.
 3. Replace external drive.
 4. Replace main logic board.
- *Disk ejects, display shows icon with blinking "X"*
 1. Replace diskette with known-good system diskette.
 2. Replace disk drive.
 3. Replace main logic board.
- *Unable to insert diskette all the way*
 1. Insert opened paper clip into hole beside the drive.
 2. Power off system and hold mouse button down while powering on (to complete eject cycle).
 3. Replace disk drive.
- *Will not eject diskette*
 1. Insert opened paper clip into hole beside the drive.
 2. Power off system and hold mouse button down while powering on.
 3. Replace disk drive.

- *800K disk drive runs continuously*
 1. Replace bad diskette.
 2. Replace disk drive.
 3. Replace main logic board.
 4. Replace disk drive cable.

- *Internal or external hard disk will not operate*
 1. Replace hard disk.
 2. Replace main logic board.
 3. Replace hard disk drive cable.

Peripheral Problems

Solutions

- *Cursor does not move*
 1. Check mouse connection.
 2. If mouse was connected to keyboard, connect it to a rear ADB port instead. If mouse works, keyboard should be replaced.
 3. If mouse does not work in any ADB port, replace mouse.
 4. Replace main logic board.
- *Cursor moves but clicking the mouse button has no effect*
 1. Replace mouse.
 2. Replace main logic board.
- *No response to any key on the keyboard*
 1. Check keyboard connection to ADB port.
 2. Replace keyboard cable.
 3. Replace keyboard.
 4. Replace main logic board.
- *Known-good ImageWriter or ImageWriter II will not print*
 1. Make sure that the Chooser and the Control Panel are set correctly.
 2. Replace software with known-good.
 3. Replace printer interface cable.
 4. Replace logic board.
- *Known-good LaserWriter will not print*
 1. Make sure that the Chooser and the Control Panel are set correctly.
 2. Replace software with known-good
 3. Refer to the *Networks* tab in the *Apple Technical Procedures*.

Miscellaneous Problems

Solutions

- *Clicking or chirping, or thumping sound*
 1. Verify analog board cable is connected at J12 on the logic board.
 2. Replace power supply.
 3. Replace analog board.
 4. Replace logic board.

- *Smoke/odor*
 1. Replace power supply.
 2. Replace analog board.

- *No video, no audio, and no drive operation*
 1. Connect power cord.
 2. Turn power on.
 3. Replace power cord.
 4. Replace power supply.
 5. Replace analog board.
 6. Replace main logic board.

- *"Sad Macintosh" icon*
 1. Replace bad diskette.
 2. Replace SIMM(s) if code matches any of those given in "Isolating a Faulty SIMM" chart.
 3. Replace logic board.

Isolating a Faulty SIMM

When the Macintosh SE is powered on, the ROM runs a series of logic board tests. Failure of any of these tests results in the display of a "Sad Macintosh" icon on the screen. The icon is shown with two rows of eight-digit numbers that indicate the particular fault identified by the test. The numbers that represent SIMMs faults are shown below (the designation XX indicates the presence of any number other than 0 in **either or both** of the two positions):

Code	Replace
0000000E 000000XX	SIMM # 1
0000000E 0000XX00	SIMM # 2
00000002 000000XX	SIMM # 1
00000002 0000XX00	SIMM # 2
00000004 000000XX	SIMM # 3
00000004 0000XX00	SIMM # 4

Note: Depending on the type of fault, the "Sad Macintosh" display may not be entirely readable. In such a case, press the reset/interrupt switch. The code may flash very quickly before the machine attempts to reboot. An unreadable code often indicates a fault with the SIMM at position 3 or 4, so if you cannot find a way to read the code, try replacing these two SIMMs, one at a time.

Macintosh SE

Illustrated Parts List

❑ CONTENTS

- IPL.3 Internal View (Figure 1)
- IPL.5 External Rear Housing (Figure 2)
- IPL.7 Front Bezel (Figure 3)
- IPL.9 Logic Board (Figure 4)
- IPL.11 Analog Board (Figure 5)
- IPL.13 Internal 800K Drive, Shipping Fixture (Figure 6)
- IPL.13 Dual Internal 800K Drives (Figure 7)
- IPL.15 Internal HDA (Figure 8)
- IPL.17 Keyboard (Figure 9)
- IPL.19 Extended Keyboard (Figure 10)
- IPL.21 Mouse (Figure 11)
- IPL.23 Service Packaging, 3.5 HDA (Figure 12)

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

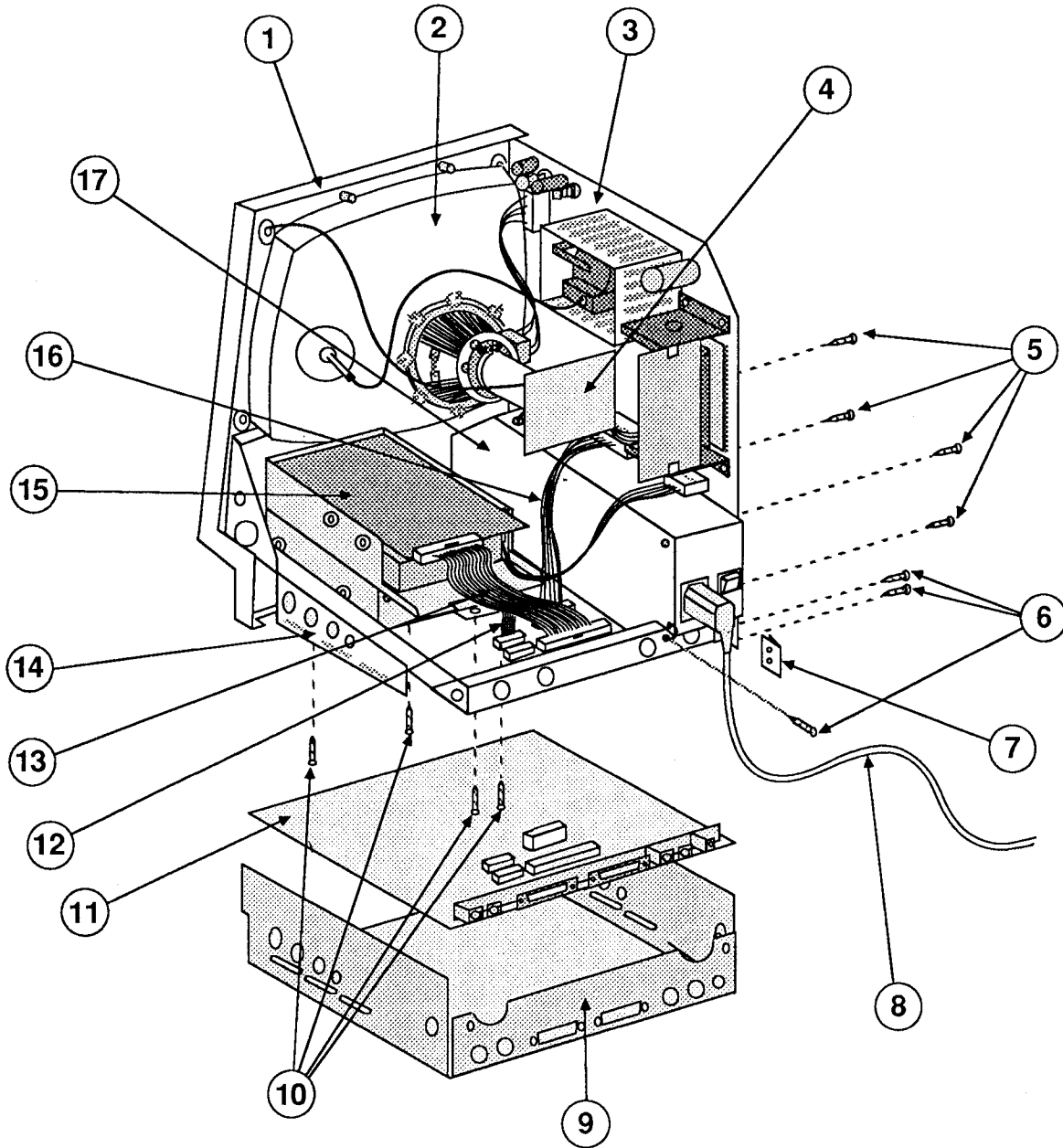


FIGURE 1

□ MACINTOSH SE – INTERNAL VIEW (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	810-0399	Front Bezel with Speaker, Slot Cover
2	076-0103	CRT and Yoke Assembly
3	661-0371	Macintosh SE Analog Board
4	661-0372	Macintosh SE Video Board
5	462-3100	Screw, 3 x .5 x 6 mm
6	470-2101	Screw, 2.9 x 10 mm
7	805-0576	Lower Ground Clip
8	590-0380	AC Power Cable
9	805-5060	RFI Shroud
10	462-4100	Screw, 3.5 x .6 x 8 mm, Pn Crs Rec
11	661-0369	Macintosh SE Logic Board
12	590-0437	3.5-Inch Internal Drive 1 Cable (yellow stripe)
13	590-0211	HDA I/O Cable
14	630-5303	Chassis
15	661-0373	HDA, 3.5, 20M, SCSI
16	590-0392	Logic Board Power Cable
17	661-0370	Macintosh SE Power Supply

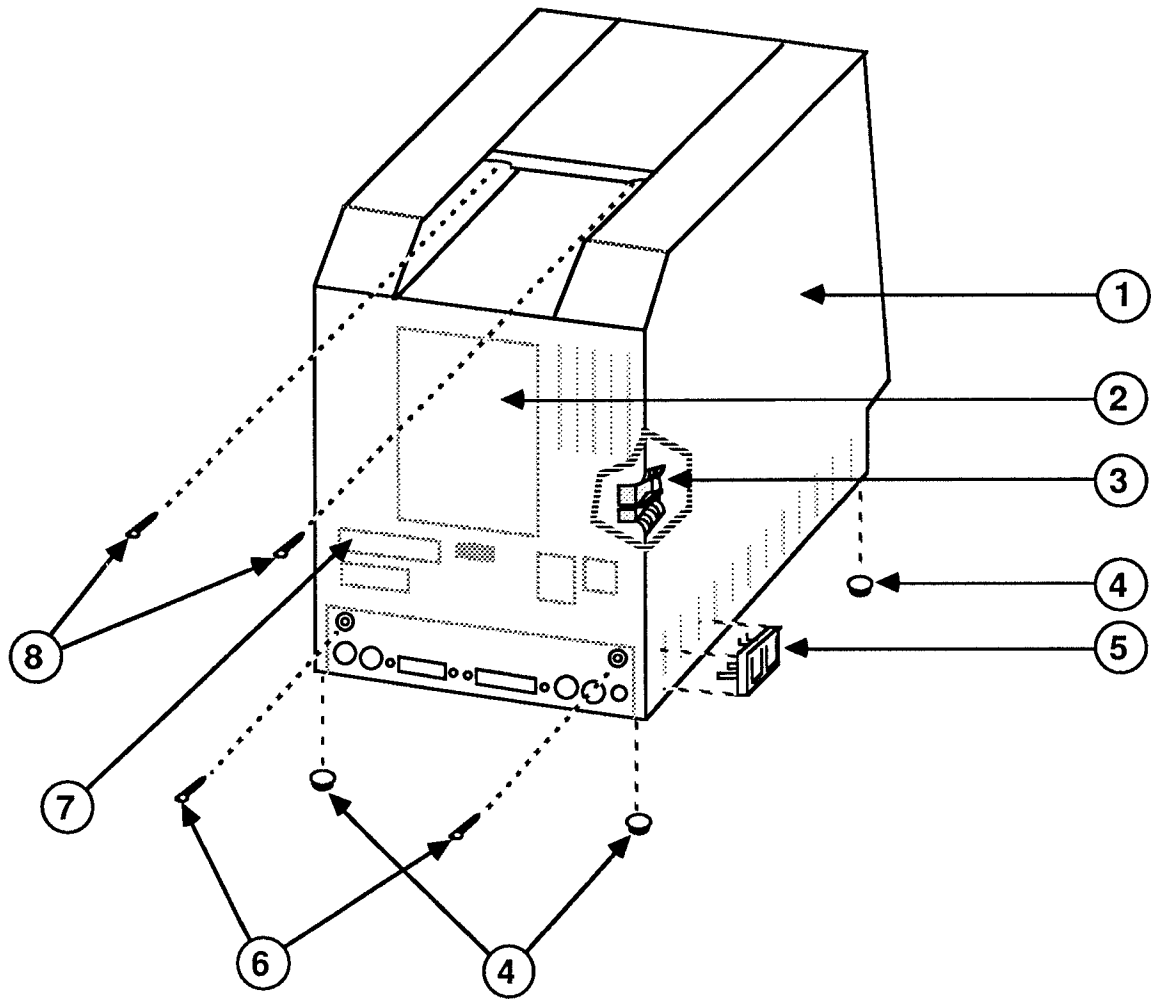


FIGURE 2

□ MACINTOSH SE – EXTERNAL REAR HOUSING (Figure 2)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5271	Rear Housing Assembly with Door and Feet
2	825-1470	Agency Approval Label with HDA
	825-1471	Agency Approval Label with Dual Drive
3	805-0575	Upper Ground Clip
4	865-0051	Platinum Foot
5	815-1008	Push-Button Programmer's Switch
6	426-1001	Tapping Screw
7	815-0986	Rear Housing Door
8	435-5002	Screw, Tap, 8-32 x .625, Fill, Torx, Zinc Oxide

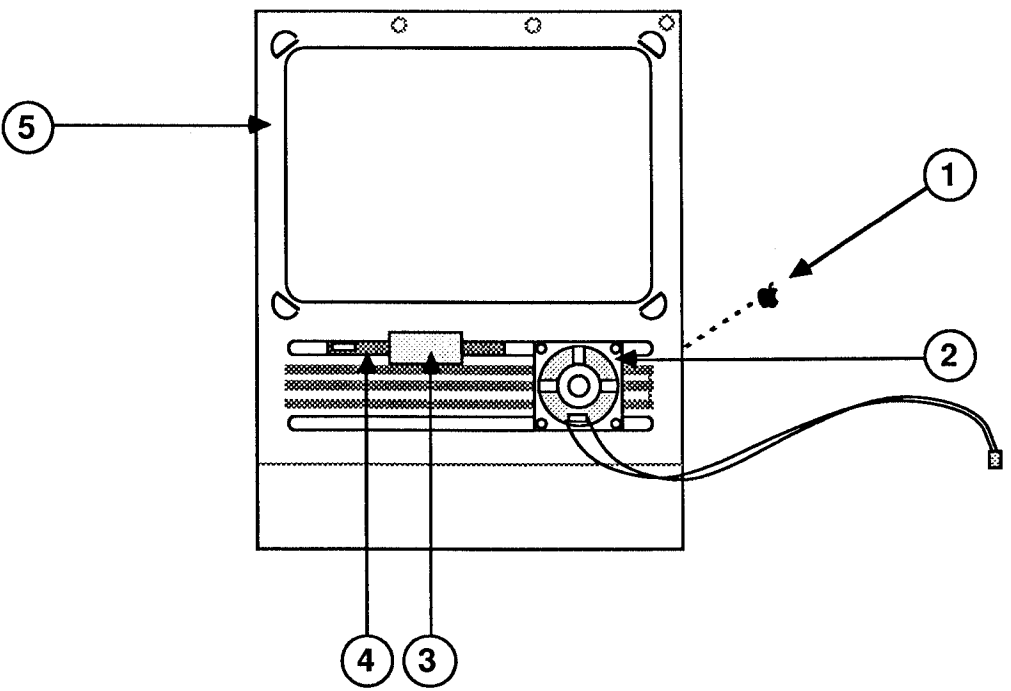


FIGURE 3

□ MACINTOSH SE – FRONT BEZEL (Figure 3)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	825-1256	Macintosh Plus/SE Logo Plate Label
2	600-0393	Speaker
3	805-0908	Slot Cover Retainer
4	630-5330	Bezel Slot Cover
5	810-0383	Front Bezel

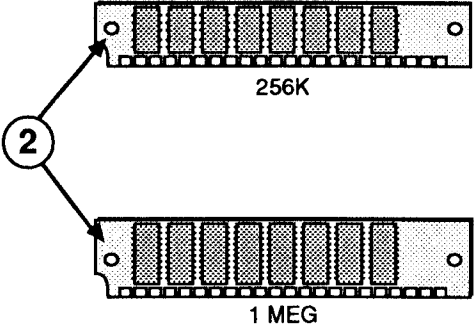
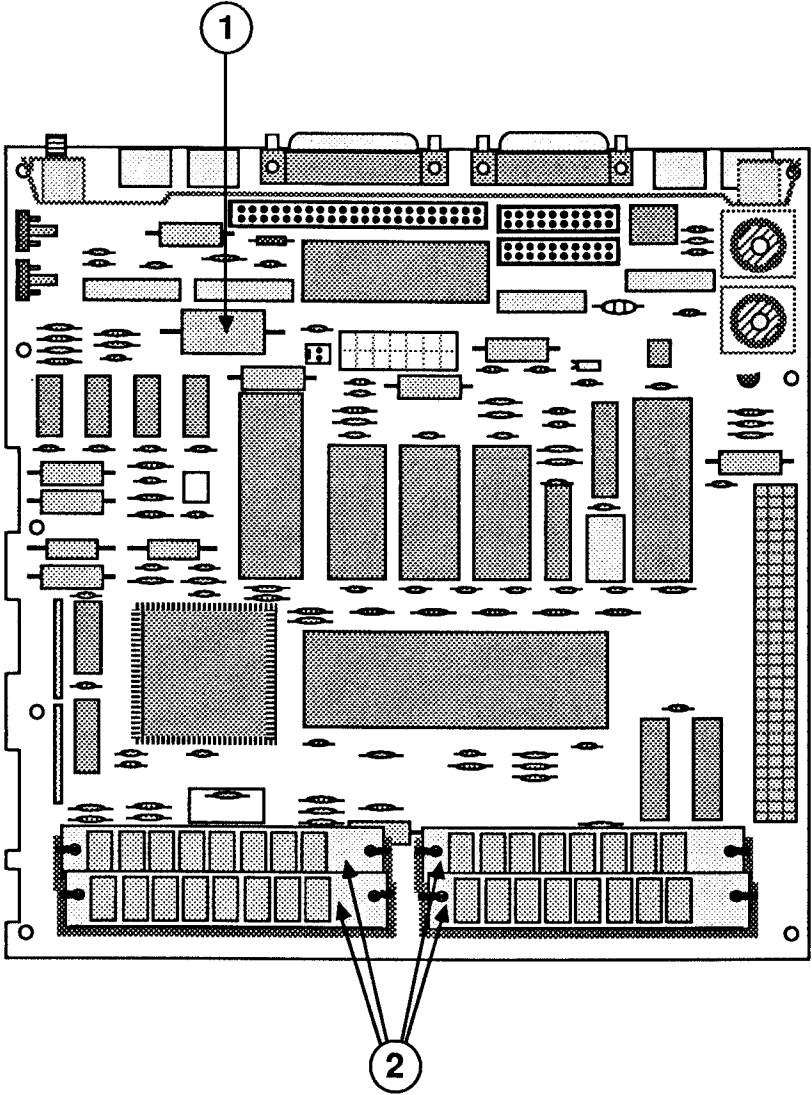


FIGURE 4

□ MACINTOSH SE – LOGIC BOARD (Figure 4)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	742-0009	Battery
2	661-0402	SIMMs RAM, 120ns, 256K
	661-0403	SIMMs RAM, 120ns, 1M

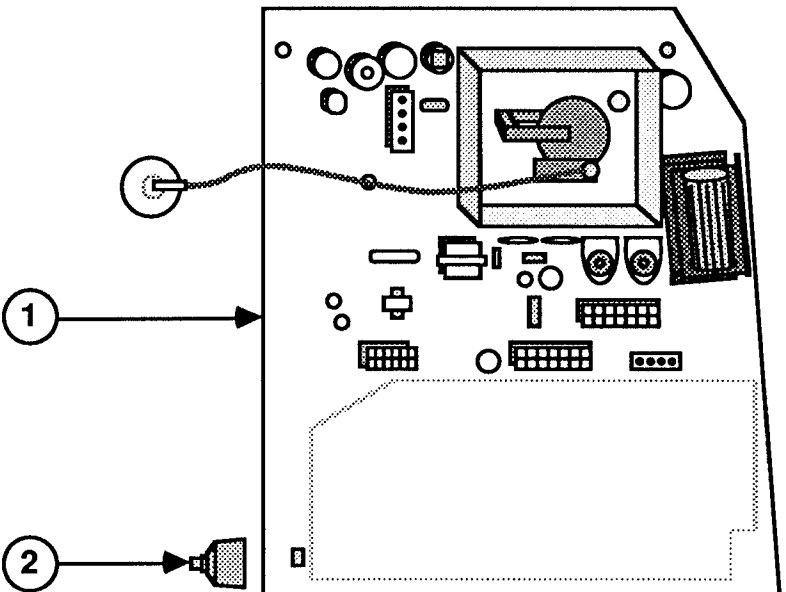


FIGURE 5

□ MACINTOSH SE – ANALOG BOARD (Figure 5)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0371	Macintosh SE Analog Board
2	865-0047	Brightness Knob

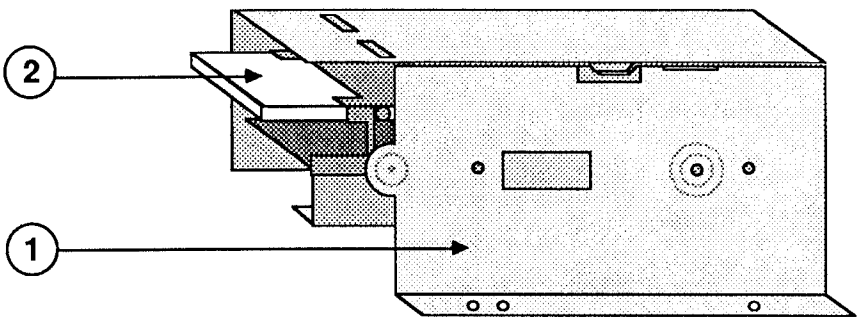


FIGURE 6

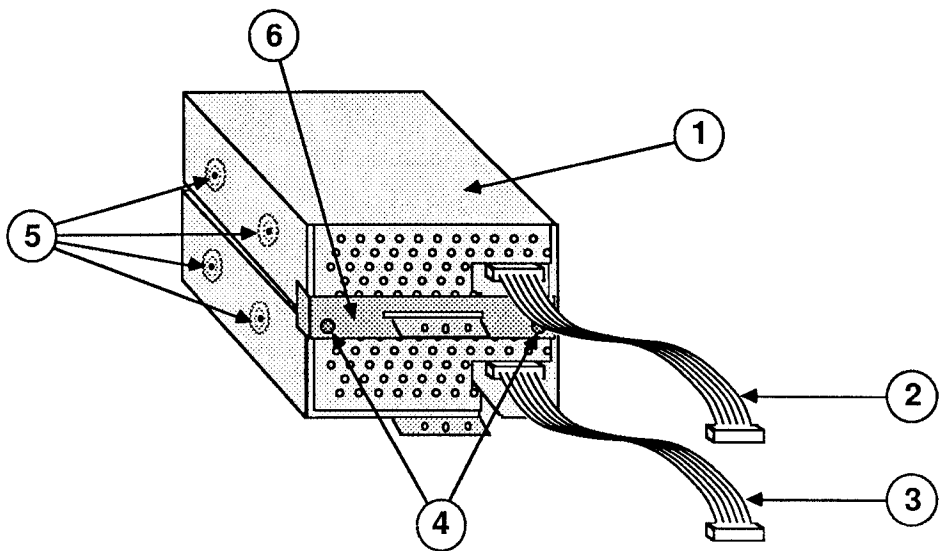


FIGURE 7

**❑ MACINTOSH SE – INTERNAL 800K DRIVE, SHIPPING FIXTURE
(Figure 6)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	805-0217	Shield for Internal 800K Drive (shipping fixture)
2	003-0003	Packing Diskette, 2-Sided (for transporting)

❑ MACINTOSH SE – DUAL INTERNAL 800K DRIVES (Figure 7)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0345	800K Mechanism, Apple 3.5 Drive
2	590-0188	3.5-inch Internal Drive Cable (yellow stripe)—SE upper drive
3	590-0437	3.5-inch Internal Drive 1 Cable (yellow stripe)
4	462-4100	Screw, 3.5 x .6 x 8 mm, Pn Crs Rec
5	462-3401	Screw, 3 x 6 mm, with two washers
6	805-0915	Back Plate, Drive 2

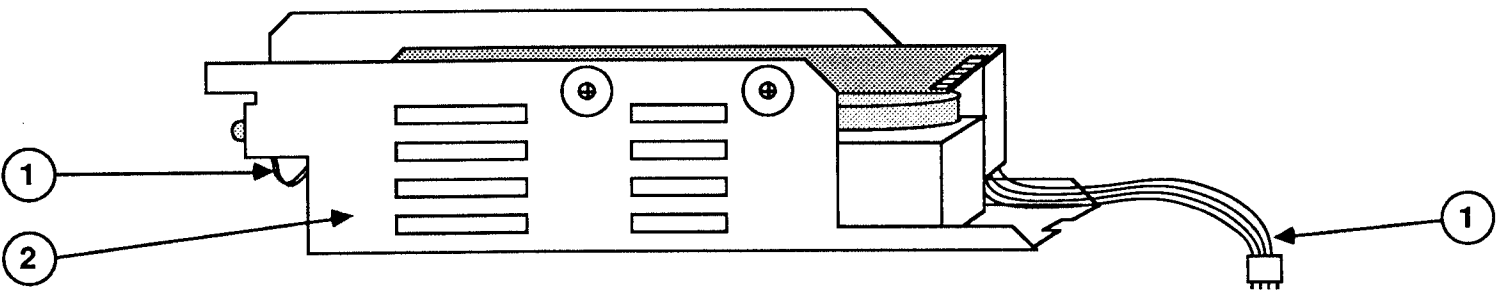


FIGURE 8

□ MACINTOSH SE – INTERNAL HDA (Figure 8)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0373	HDA, 3.5, 20M, SCSI
1	590-0364	HDA Power Cable
2	805-5066	HDA Metal Housing
3	590-0237	LED Cable

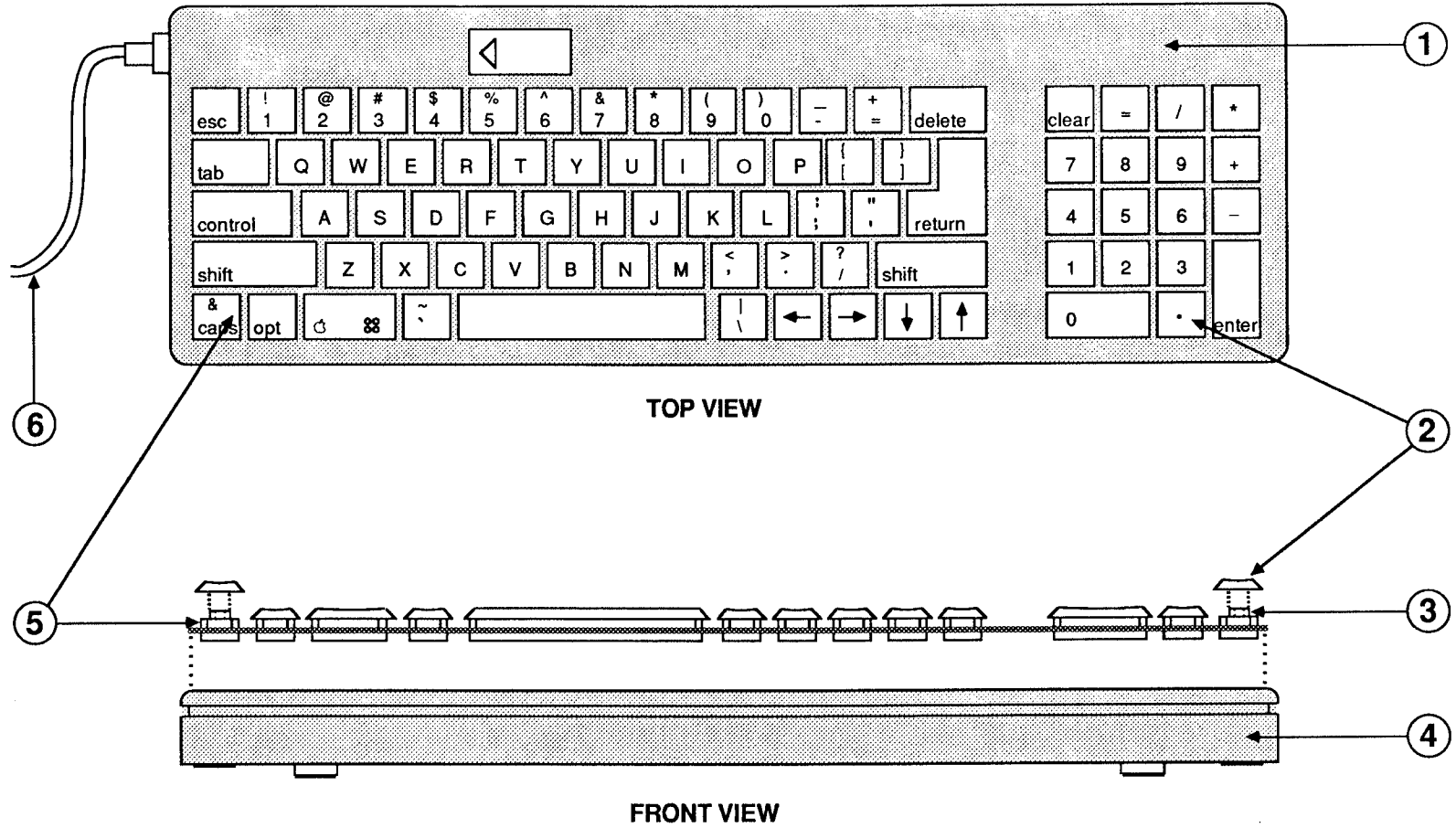


FIGURE 9

□ MACINTOSH SE – KEYBOARD (Figure 9)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0383	Apple Keyboard
1	815-1016	Top Case
2	658-7010	Key Cap Set
3	076-0209	Keyswitch Set
4	815-1017	Case Bottom
5	970-1263	Alps Locking Keyswitch
6	590-0361	Cable, Keyboard

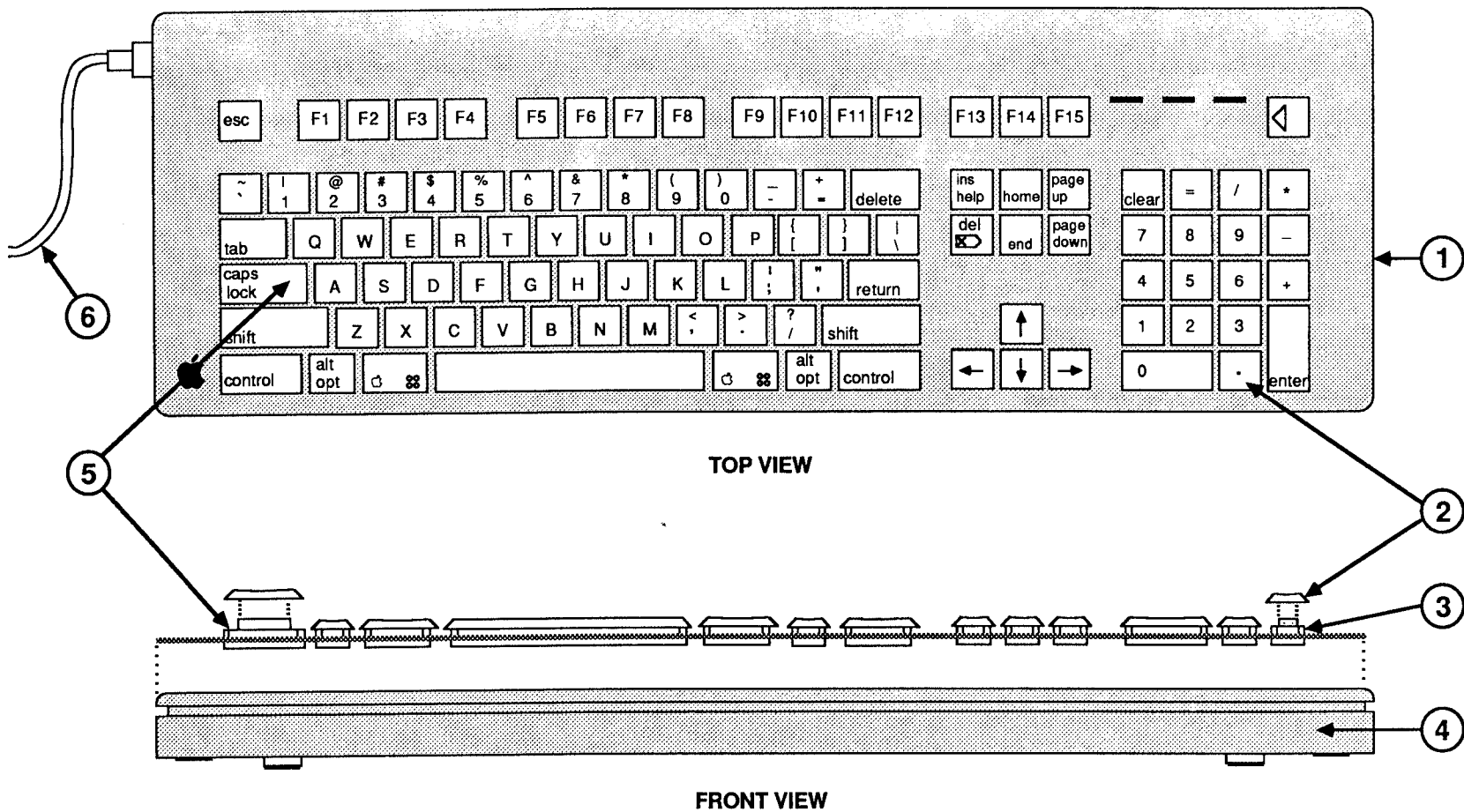


FIGURE 10

❑ MACINTOSH SE – EXTENDED KEYBOARD (Figure 10)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0384	Apple Extended Keyboard
1	815-1018	Top Case
2	658-7010	Key Cap Set
3	076-0209	Keyswitch Set
4	815-1019	Bottom Case
5	970-1263	Alps Locking Keyswitch
6	590-0361	Cable, Keyboard

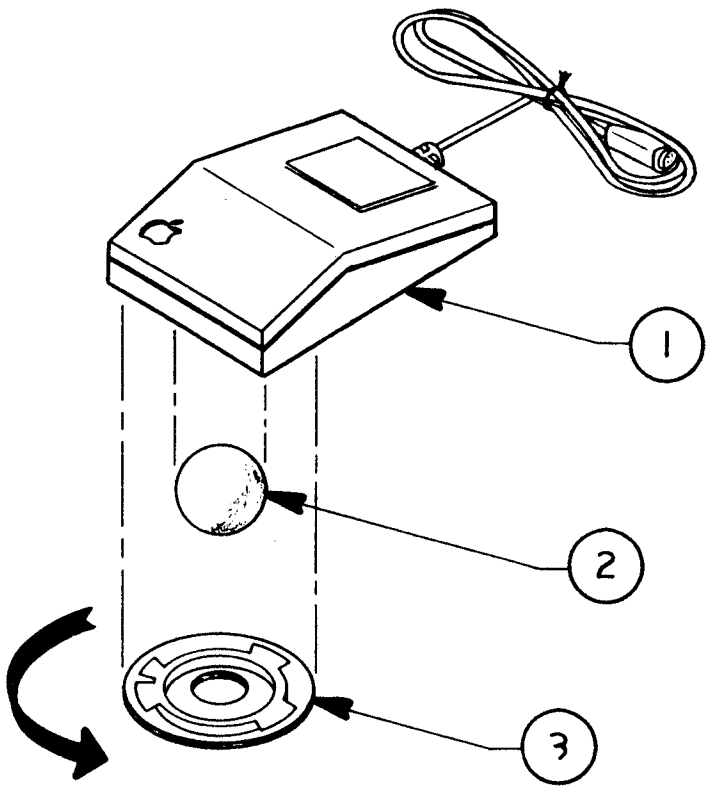


FIGURE 11

□ MACINTOSH SE – MOUSE (Figure 11)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0338	Apple Desktop Bus Mouse
1	699-8007	Rubber Coated Mouse Ball
2	076-0231	ADB Mouse Ball Retainer

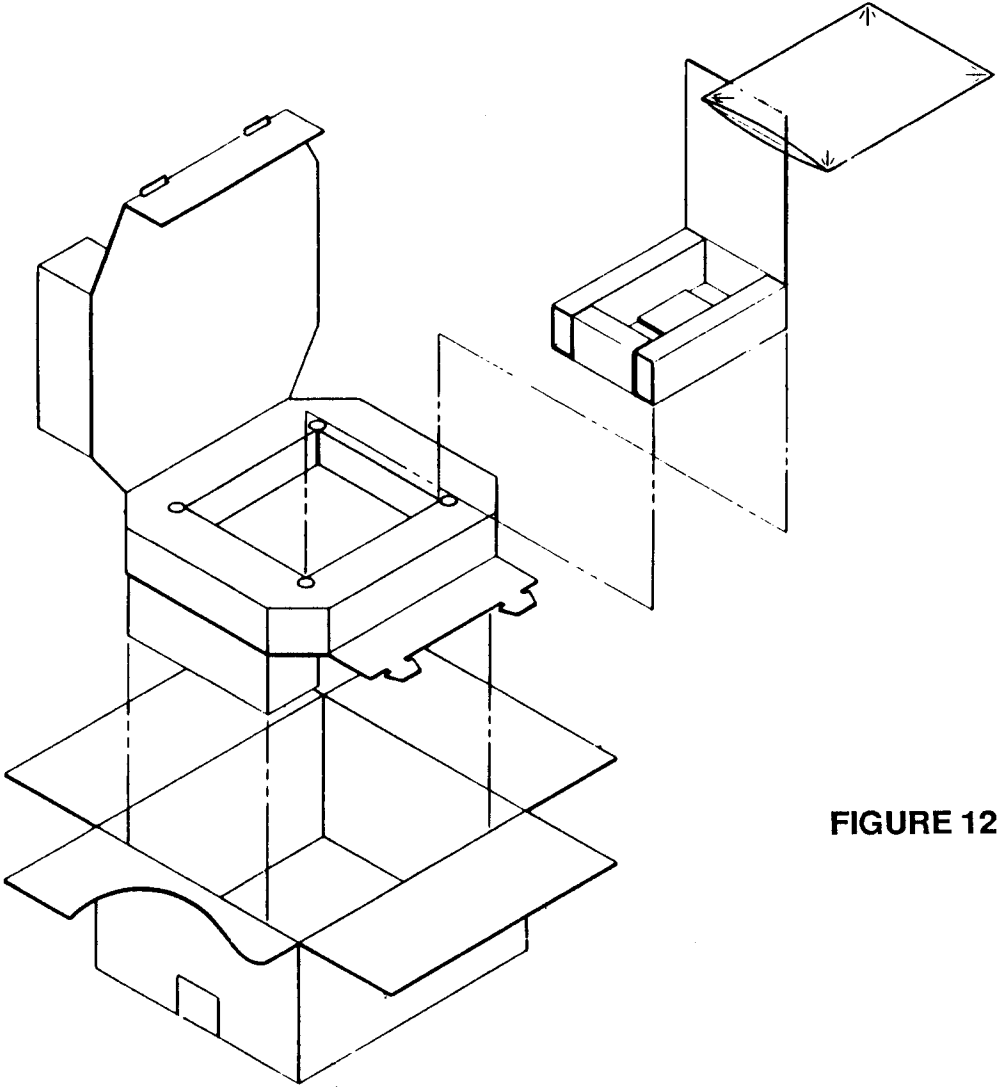


FIGURE 12

❑ **MACINTOSH SE – SERVICE PACKAGING, 3.5 HDA (Figure 12)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	602-0164	Service Packaging, 3.5 HDA