 Apple Technical Procedures

Apple IIGS

Technical Procedures

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Apple IIGS

Section 1 – Basics

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❏ PRODUCT DESCRIPTION

Apple IIGS
Features

The Apple IIGS incorporates many features of the Apple IIe and the Apple IIc, making it possible to run many of the existing programs. The Apple IIGS supports the same peripherals as the Apple IIe.

The Apple IIGS includes these new or improved features (as compared to the Apple IIe or Apple IIc):

- A 16-bit, 65C816 microprocessor. The 65C816 can run at 2.8 MHz or at 1 MHz (selectable by the user or the application).

- A minimum memory configuration of 256K.

- The Apple Desktop Bus™, a simple I/O port that supports the detached keyboard and built-in mouse interface. This provides an inexpensive way to connect additional input devices.

- A built-in real-time clock, powered by a long-life battery.

- Built-in RGB and NTSC (composite) video outputs.

- The standard video modes include colored text (RGB only) and colored borders.

- Two super-high-resolution graphics display modes. Double Hi-Res is 320 x 200 pixels with sixteen colors. Super Hi-Res is 640 x 200 pixels with four colors.

- New sound-generating abilities from a special-purpose sound synthesizer IC that has fifteen independent voices.

- A built-in AppleTalk® interface.

**Apple IIGS, 1 MB
Features**

The Apple IIGS, 1 MB is the next generation in the Apple IIGS line. The system is designed to provide faster boot time, greater memory, and more built-in ROM-based tools.

The Apple IIGS, 1 MB includes these new or improved features (as compared to the Apple IIGS):

• A minimum memory configuration of 1 MB

• Two 128K ROMs for a total of 256K, double the ROM space

• A new keyboard microcontroller

• A new and improved FPI chip called the CYA, (Control Your Apple)

• A built-in real-time clock, powered by a long-life battery in a battery holder for ease of replacement

• Built-in RGB and NTSC (composite) video outputs

• Improved built-in ROM-based sound-generating abilities

• AppleTalk availability on slots 1 and 2

• Faster 800K drive support

*Control
Panel*

The Control Panel is a resident utility program that can be accessed from the keyboard. The operating speed, video display modes, I/O port assignments, and slot allocations can all be changed from this utility.

The Apple IIGS, 1 MB has a molex connector at location C7. If a jumper **is installed** on the connector, access to the Control Panel is denied. If a jumper **is not installed**, access to the Control Panel is available.

❏ CONNECTOR IDENTIFICATION

**Back
Panel**

The back panel of the Apple IIGS and IIGS, 1 MB logic board has eight ports, which are listed below. The number beside the port name corresponds to the numbered arrow in Figure 1 for the IIGS and in Figure 2 for the IIGS, 1 MB logic board.

     1) Apple Desktop Bus
     2) Composite video
     3) RGB video
     4) Disk I/O
     5) Game I/O
     6) Serial 1
     7) Serial 2
     8) Earphone

**Internal
Connectors**

There are seven connectors on the Apple IIGS logic board and five connectors on the IIGS, 1 MB logic board. Some of these connectors can only be found on an Apple Service exchange module or a retrofit board. The letter beside the connector name corresponds to the lettered arrow in Figure 1 for the IIGS and in Figure 2 for the IIGS, 1 MB logic board.

     A) Power connector for the Apple IIe (retrofit only)
     B) Power connector for the Apple IIGS system
     C) Fan connector (additional kit)
     D) Numeric keypad connector for the Apple IIe keypad (retrofit only)
     E) Game I/O connector
     F) Keyboard connector for the Apple IIe (retrofit only)
     G) Speaker connector
     H) Control panel bypass
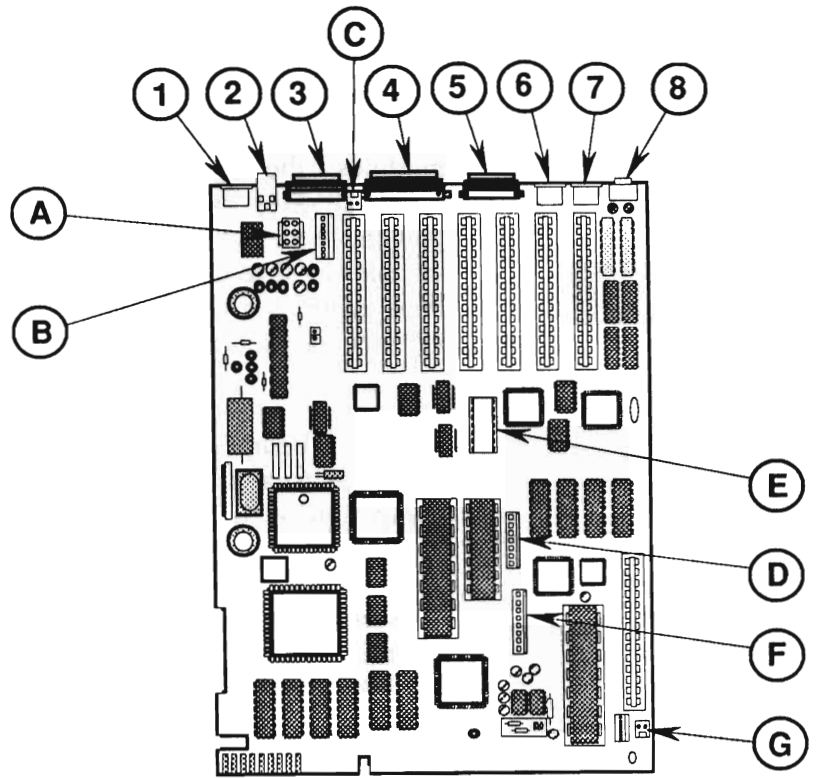
FIGURE 1
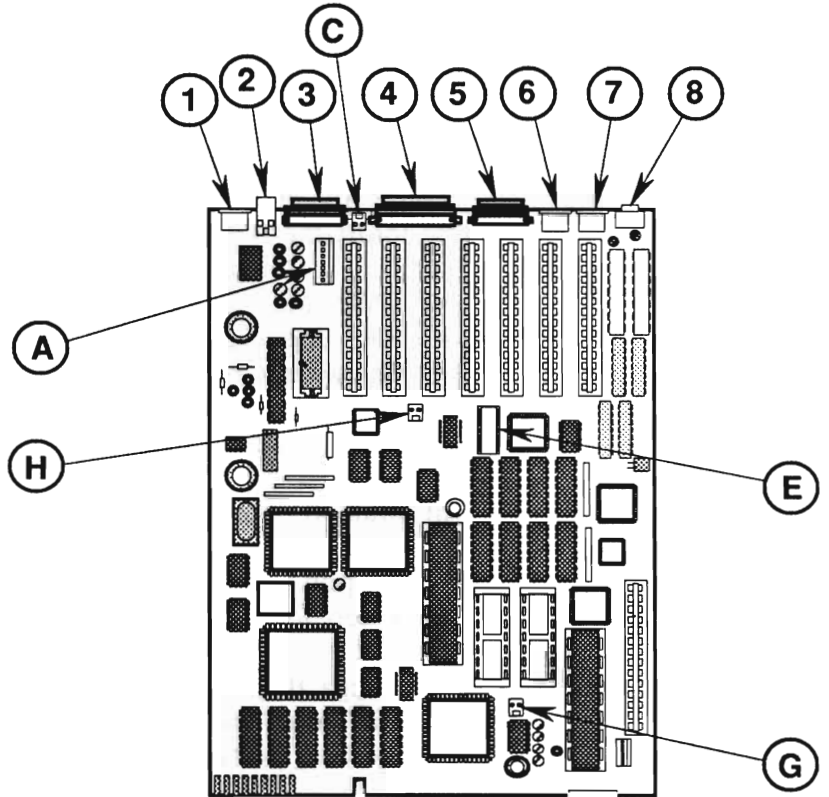
FIGURE 2

❏ THEORY OF OPERATION OVERVIEW

Introduction

The Apple IIGS and IIGS, 1 MB is made up of three basic modules: the logic board, the power supply, and the Apple Desktop Bus Keyboard. This section will give you the necessary information to perform logical troubleshooting on the Apple IIGS. The information here includes a description of each module and the various functions it performs.

**Apple IIGS
and IIGS, 1 MB
Logic Board**

The logic board is the heart of the system. The CPU is the 65C816, a 16-bit CMOS microprocessor that is compatible with the 6502 and 65C02.

The Apple IIGS logic board is divided into two subsystems: the Mega II IC provides support for existing Apple II software; the Fast Processor Interface IC (FPI) provides the new functions for the Apple II family.

The Apple IIGS, 1 MB logic board is divided into two subsystems: the Mega II IC provides support for existing Apple II software; the Control Your Apple (CYA) ASIC provides additional functions for the Apple II family.

Mega II IC

The Mega II is a custom IC and is found on both the Apple IIGS and the Apple IIGS, 1 MB logic boards. It performs the functions of the following IIe components:

- MMU (Memory Management Unit) Custom IC
- IOU (Input/Output Unit) Custom IC
- Character Generator ROMs (8 languages)
- TMG (Timing Management Generator) IC
- GLU (General Logic Unit) IC

In addition, it provides:

- Support of additional RAM
- Video logic

The Mega II IC is a full-function Apple II, providing the traditional support of slots as well as the support of the built-in ports.

*Fast
Processor
Interface IC*

The FPI is only on the Apple IIGS and provides the
following:

- Support of additional RAM

- I/O "shadowing" on page 1 (This allows I/O reads
  to be done at full system speed.)

*Control
Your
Apple ASIC*

The CYA is only on the Apple IIGS, 1 MB and provides
the following:

- Support of additional RAM and ROM on the fast side

- I/O "shadowing" on page 1 and 2 (This allows I/O
  reads to be done at full system speed.)

All communication with the outside world has to go
through the Mega II IC. The system has to run at 1
MHz to remain compatible with all the existing
interface cards and various peripherals.

The fast side of the Apple IIGS or IIGS, 1 MB is
controlled by either the FPI or CYA, respectively. Both
of these ICs are the processor and memory controller
for the fast side. The term *fast side* will be used
generically to explain how the machine operates.

During normal operation, the fast side of the system
runs at 2.8 MHz and the Mega II side at 1 MHz.
However, when it is necessary for the CPU to access an
I/O port or a RAM location on the Mega II side of the
system, the system is briefly slowed to 1 MHz and
synchronized with the Mega II timing so that the access
can be accomplished. When the access is complete, the
fast side returns to the normal 2.8 MHz operating
speed, and the Mega II continues at 1 MHz.

FPI and CYA
Differences

The following chart summarizes the differences in the FPI and CYA RAM and ROM built-in capabilities

Feature	FPI	CYA
Memory—Mega II side	128K	128K
Memory—fast side	128K	1 MB
Total memory	256K	1.128 MB
ROM	One 1 Megabit	Two 1 Megabit
ToolBox routines	RAM-based	ROM-based

Video
Graphics
Controller

The Video Graphics Controller (VGC) is a custom IC that provides

- Improved support of existing Apple II video
- New video display with borders
- New video modes
- An interface to the real-time clock chip
- Interrupt handling

Slotmaker

The Slotmaker is a custom IC that generates control signals for the Apple II family I/O bus. The Slotmaker decides which of more than two dozen select lines to enable by the information it receives from the Mega II.

Keyboard
General
Logic Unit

The keyboard General Logic Unit (GLU) works in conjunction with the keyboard microcontroller to form an intelligent input device interface.

Sound *General* *Logic Unit*	The sound General Logic Unit (GLU) serves as an interface between the sound chip, the reserved 64K by 8 dynamic RAM (used by the sound chip), and the Apple IIGS system.
Apple *Desktop* *Bus*	The Apple Desktop Bus is a method and protocol for connecting input devices with computers. The Apple IIGS controls the flow of data to all connected devices by issuing various commands through the Apple Desktop Bus. All devices connect with the Apple IIGS via a 3-wire shared bus that uses 4-pin mini DIN jacks at each device. A total of 16 devices can be connected to the bus.
IWM *Disk* *Controller*	The Apple IIGS uses 3.5-inch micro-floppy disk drives that utilize the Group Code Recording (GCR) disk format. The IWM, a self-contained disk controller card on one IC, simplifies the microprocessor's task of reading and writing data to and from the disk drives.
Memory *Expansion* *Slot*	The memory expansion slot allows you to add a memory card holding up to 4 megabytes of RAM or 896K of ROM memory. This slot supports memory only.
Power **Supply**	The power supply operates on standard line voltage and outputs various DC voltages, which are used by the logic board and by some peripheral devices (such as UniDisk™ and UniDisk 3.5).
Apple Desktop Bus **Keyboard and** **Mouse**	The keyboard connects to the Apple Desktop Bus port on the rear of the Apple IIGS. The keyboard has its own microprocessor, which is called the keyboard microcontroller.

All devices that are made for the Apple Desktop Bus have some kind of microprocessor that makes them intelligent devices. All except the mouse have ports for connecting other devices. The mouse must be the last device attached to the Apple Desktop Bus because the mouse has no port for connecting additional devices.

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Section 2 – Take-Apart

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Note: The underlined steps in the following section refers to the take-apart for that particular module.

WARNING: *Be sure the power has been disconnected before attempting any of these procedures.*

❏ ELECTROSTATIC DISCHARGE PREVENTION

**What
Is
ESD?**

ESD (Electrostatic Discharge) can cause severe damage to sensitive micro-circuits. 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.

**Rules
To
Follow**

Certain preventive measures must be taken to avoid ESD damage. When you are unwrapping, installing, or replacing any microcircuits, observe the following precautions:

- **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.

- **Ground the chassis to the same potential you hold.** Place the unplugged Apple IIGS chassis assembly on the grounded workbench pad and connect the chassis to the workbench pad via an alligator clip.

- **Use antistatic bags for carrying boards and ROMs.** Whenever ROMs or boards are to be stored or moved anywhere, first put them in antistatic bags. Be sure to touch the bags before touching the ROMs or boards.

- **Handle ROMs by the body, not the leads.** You may safely touch the leads only if you are grounded.

- **Do not wear polyester clothing or bring plastic, vinyl, or styrofoam into the area.** The static field around these materials cannot be removed.

- **Do not place board or ROMs on any metal.** Place them on the grounded workbench pad or on antistatic or nonconductive foam.
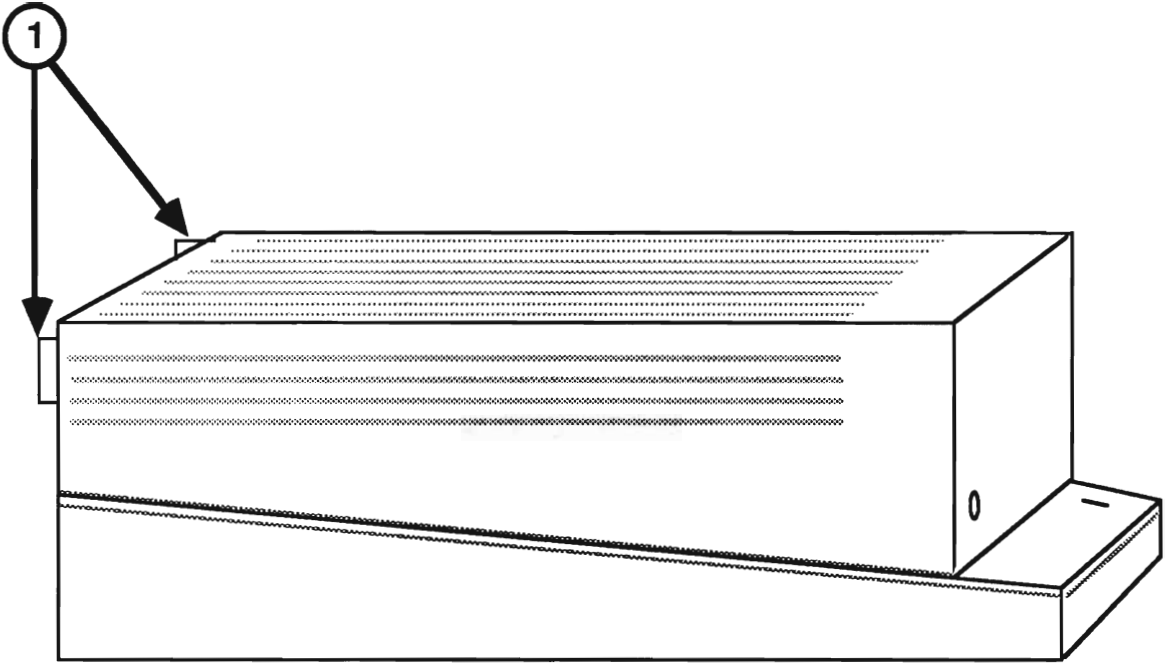
FIGURE 1

❏ TOP COVER

Materials Required   (None)

Remove

1. Disconnect the keyboard.

2. Place the machine with the front facing you.

3. Locate the tabs on the back of the machine (Figure 1, #1), one on each side. Push the tabs in with your index fingers and lift the top cover, back first, from the machine. No force is necessary. (Do not push down on the top of the machine with your thumbs.)

Replace

1. Position the top cover, front first. Align the bottom front edge with the plastic tabs on the front of the machine.

2. Lower the top cover until the rear tabs snap into position.

3. Connect the keyboard.
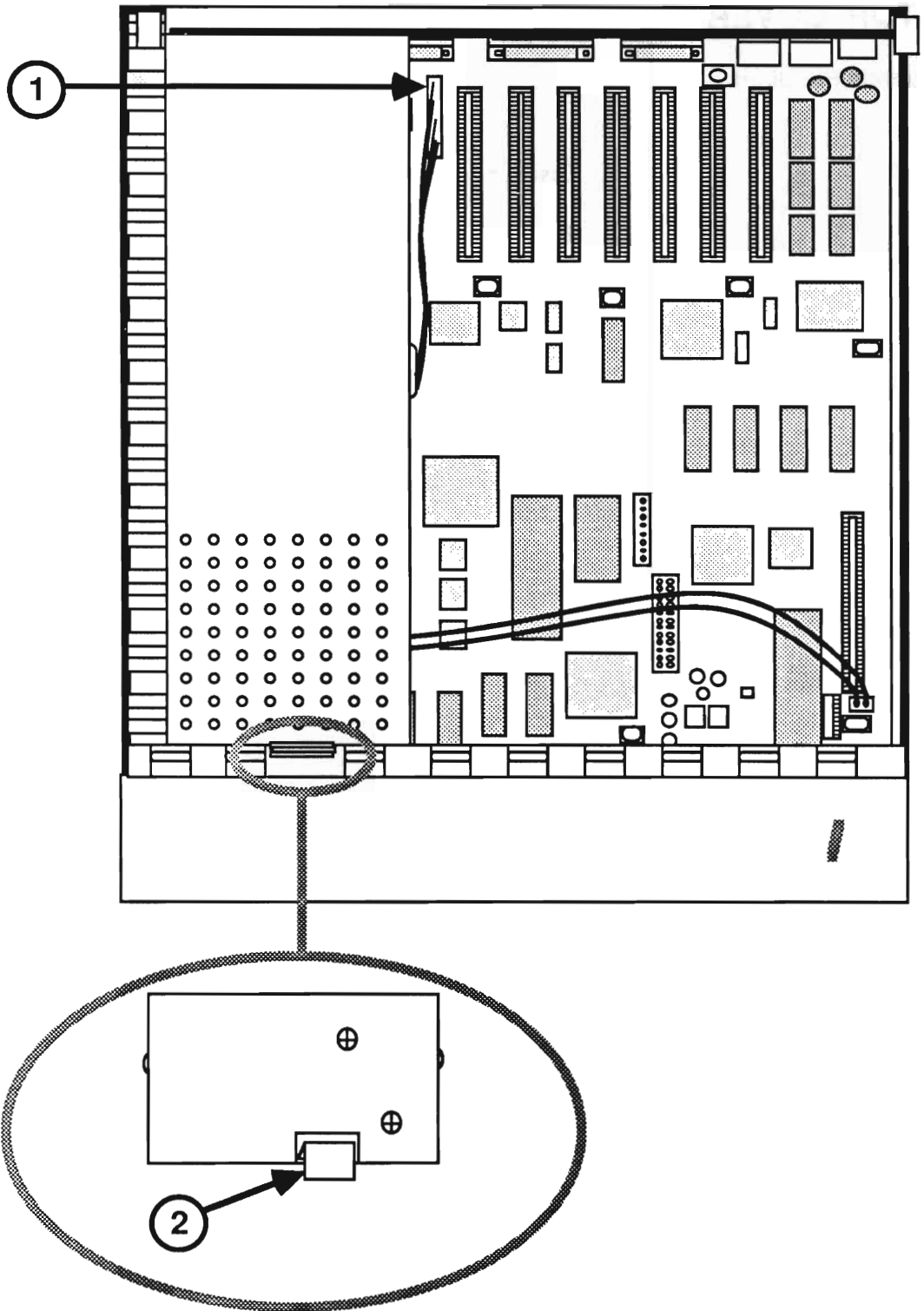
FIGURE 2

❏ POWER SUPPLY

Materials Required   (None)

Remove

1. <u>Remove the top cover.</u>

2. Locate and disconnect the power supply cable (see Figure 2, #1).

3. Locate the tab that holds the power supply in place (see Figure 2, #2).

4. Gently pull back the tab, lift the power supply up and slide it towards you off the tabs on the back of the case.

5. Lift the power supply from the case.

Replace

1. Position the power supply so that the three tabs on the back of the case slide into the power supply.

2. Lower the power supply into position so that the tab in the front clicks into place (see Figure 2, #2).

3. Reconnect the power supply cable (see Figure 2, #1).

4. <u>Replace the top cover.</u>
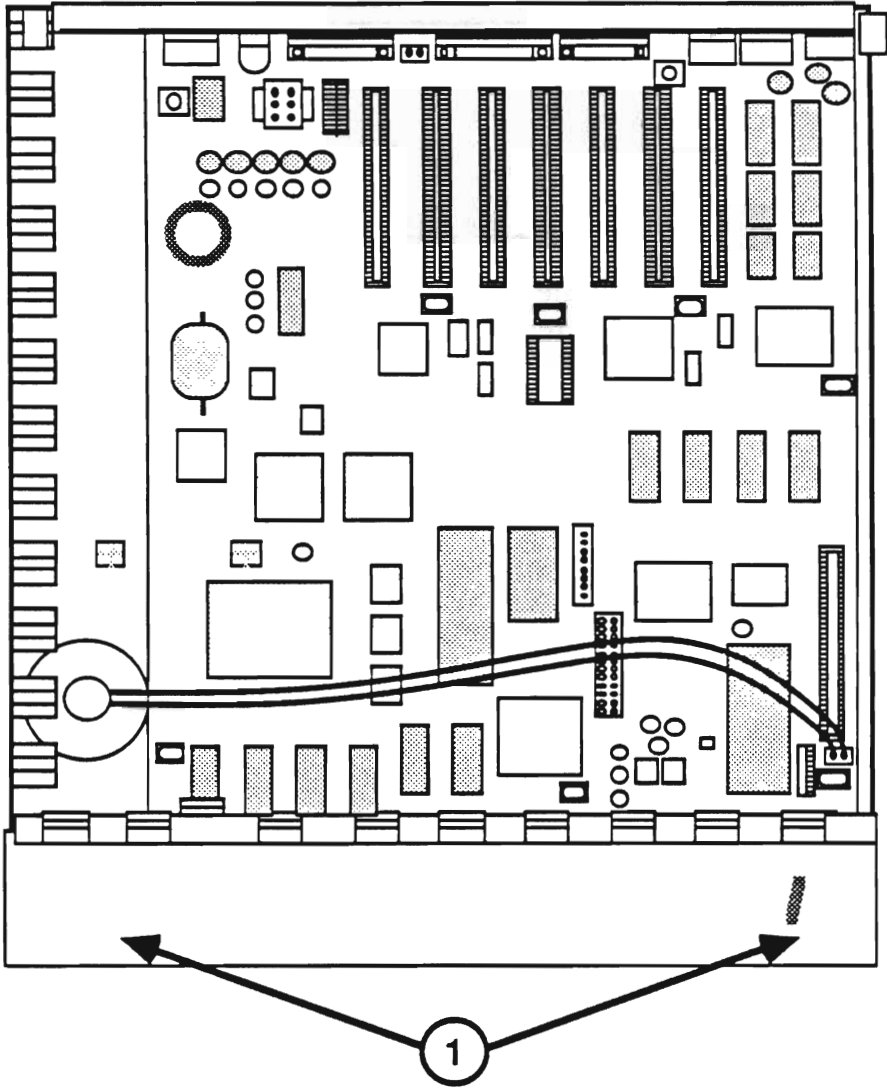
FIGURE 3
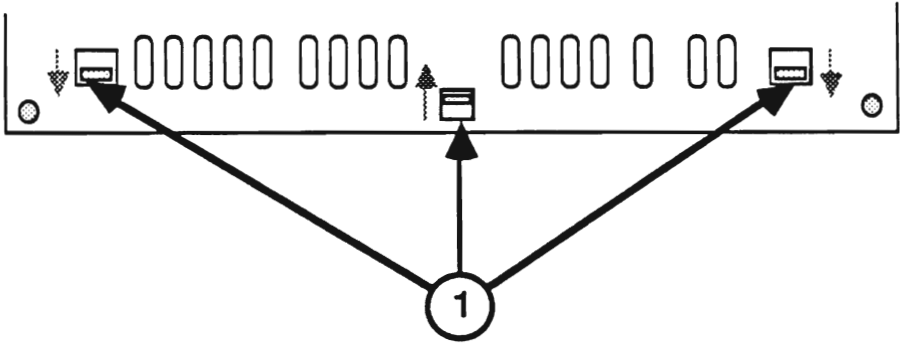
FIGURE 4

❏ THE CASE HINGE

Materials Required   Jeweler's screwdriver

Remove

1. Remove the top cover.

2. Remove the power supply.

3. Locate the case hinge (see Figure 3, #1).

4. Turn the machine over and remove the case hinge by inserting your finger or a small (jeweler's) screwdriver into each tab, one at a time (see Figure 4, #1). The case hinge will pop free when each tab is released.

5. Remove the case hinge.

Replace

1. Position the case hinge so that the tabs line up with the holes in the bottom case (see Figure 4, #1).

2. Gently pop the case hinge into place.

3. Replace the power supply.

4. Replace the top cover.
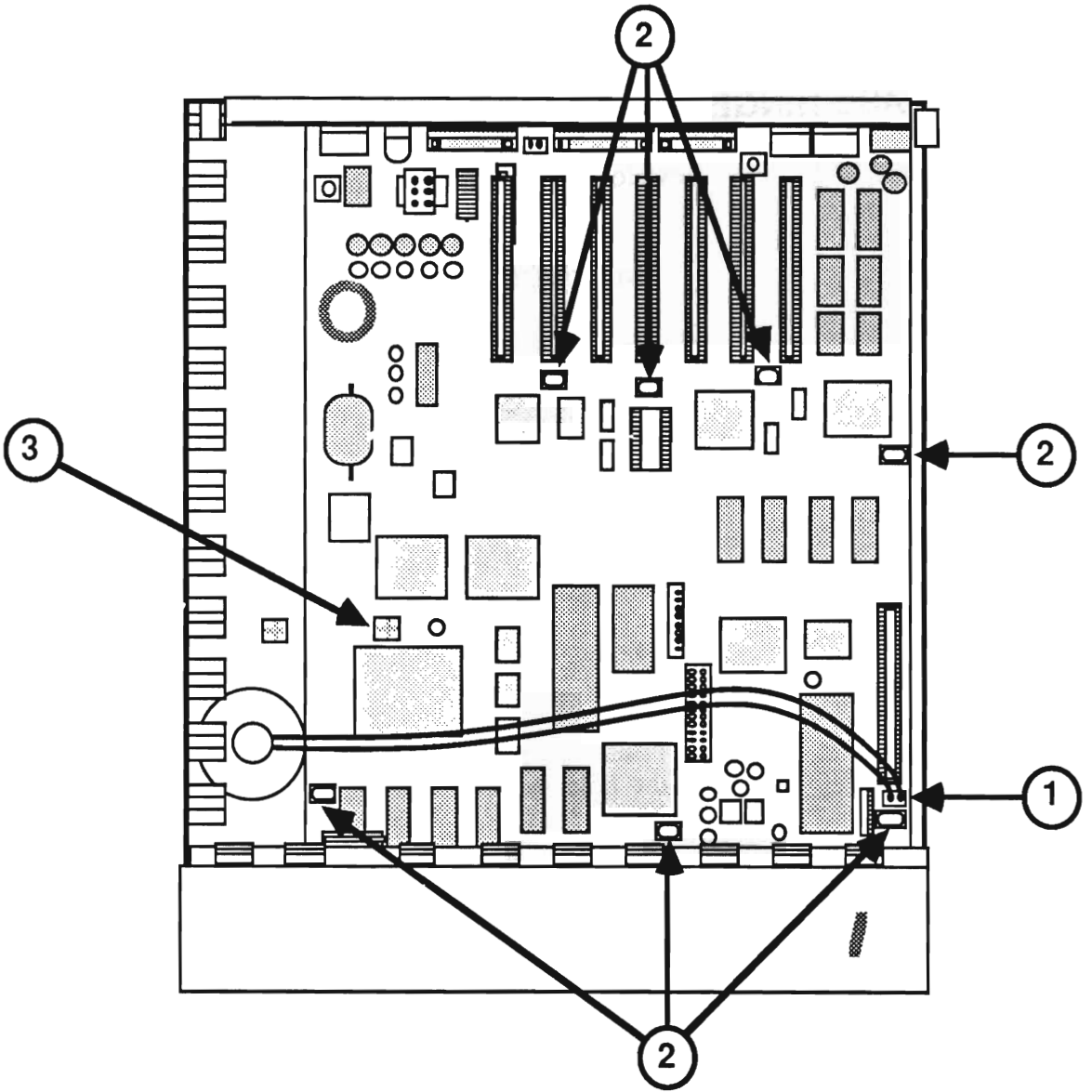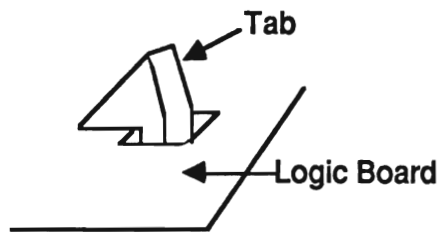
FIGURE 5

FIGURE 5a

❑ MAIN LOGIC BOARD

The logic board comes in various configurations. The boards vary slightly in appearance, but can be used interchangeably.

Materials Required

Small pair of needlenose pliers

Remove

1. Remove the top cover.

2. Remove the power supply.

3. Remove the case hinge.

4. Disconnect the speaker wire (Figure 5, #1).

5. Locate the seven tabs (Figure 5, #2) that hold the logic board in position.

CAUTION: *Flex the board as little as possible when removing it. Excessive flex and force may damage the board.*

---

6. Starting at the front of the board, squeeze each tab (Figure 5a) one at a time, gently lifting the board up as you proceed to the rear of the board. Be sure all seven tabs (Figure 5, #2) have been released.

7. Lift the board toward you and remove it from the case.

8. If a metal EMI Fence (shield) is installed on the rear of the board, remove it.

Replace

1. Line up the connectors on the rear of the logic board with the openings on the rear of the case. Be sure to position the board so that the large mounting tab (Figure 5, #3) slips into position.

2. If you removed an EMI Fence, replace it.

3. Gently press the board onto the seven tabs (Figure 5, #2).

4. Connect the speaker wire (Figure 5, #1).

5. Replace the case hinge.

6. Replace the power supply.

7. Replace the top cover.
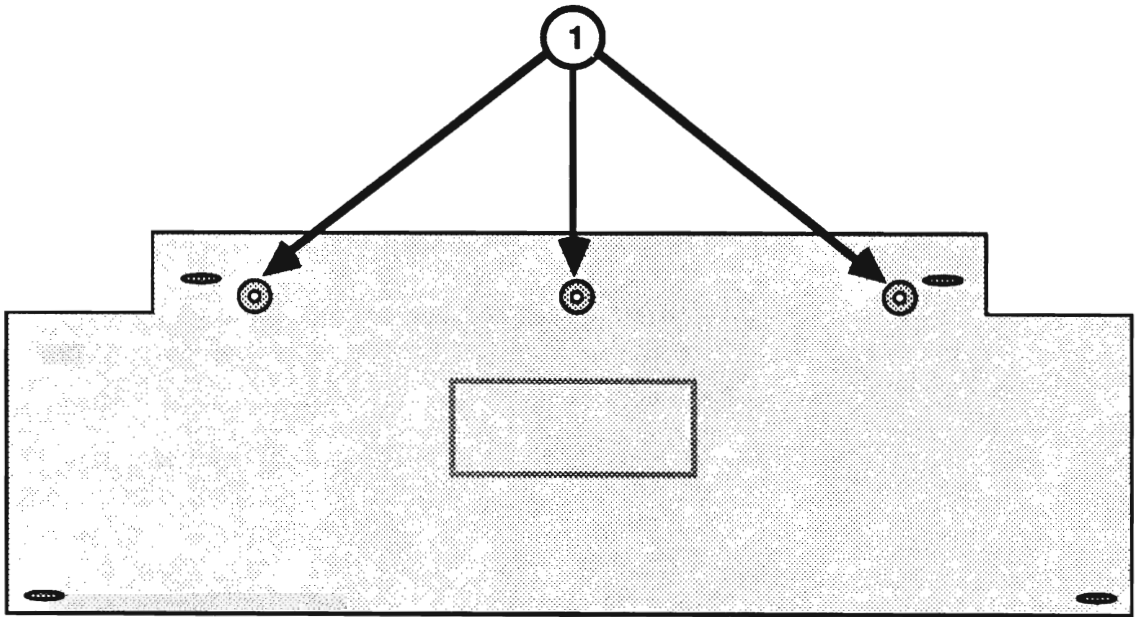
FIGURE 6

❏ APPLE DESKTOP BUS KEYBOARD

**Exchanging
the
Keyboard**

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

Materials Required

Medium Phillips screwdriver

Remove

1. Disconnect the keyboard from the Apple Desktop Bus port.

2. Remove the three screws from the back of the keyboard (see Figure 6, #1). Remove the small rectangular piece from the front of the keyboard.

3. Lift the mechanical assembly out of the bottom case.

4. Use the replacement procedures for Apple IIc keyswitches in *You Oughta Know.*

Replace

1. Set the mechanical assembly back into the bottom case.

2. Position the rectangular piece onto the front of the keyboard.

3. Hold the rectangular plastic piece in place, turn the keyboard over, and install the three screws (see Figure 6, #1).

♦ Apple Technical Procedures

Apple IIGS

Section 3 – Diagnostics

☐ CONTENTS

❏ INTRODUCTION

**General
Information**

This section describes general procedures for using the 3.5- or 5.25-inch Apple II Diagnostic Disk on the Apple IIGS and IIGS, 1 MB. This diagnostic allows you to select various tests you wish to run and the order in which you wish to run them. It also allows you to run a continuous test and keep a record of any failed tests. This record will prove valuable for pinpointing problems that cause intermittent failures.

**Before
You
Start**

Read the subsection entitled Things to Remember before you run the diagnostics. It will give you specific hints for using the diagnostic.

**Built-In
Diagnostics**

Before attempting to boot the disk-based diagnostics, run the built-in diagnostics. To run them, **disconnect the mouse** and hold down <Open-Apple> and <Option> while turning on the power. (To run the diagnostics if the power is on and the mouse is connected, hold down <Control>, <Open-Apple>, <Option>, and <Reset>. Release <Reset> first, then the other keys.)

The screen will display various patterns and solid colors, with a code displayed in the lower-left corner, for approximately one minute. The patterns and colors indicate that the RAM, ROM, and other components on the logic board are being tested.

Results

The results are displayed in the lower-left corner of the screen. **System Good** is accompanied by a high-pitched beep, **System Bad** by a low-pitched beep.

System Good

If you can access the built-in diagnostics and you receive the message **System Good**, connect a disk drive and continue with this section.

System Bad

If you cannot access the built-in diagnostics or you receive the message **System Bad**, exchange the keyboard or logic board and try again.

❏ THINGS TO REMEMBER

Backup
Information

1. **Make a backup disk before beginning!** When testing a defective Apple IIGS, it is possible to erase and/or damage a section of the disk.

   The *System Utilities* disk (Rev. 2.1.1 or higher) is used for making a backup copy. Follow the instructions in the *System Utilities* manual.

Diagnostic
Information

2. If you are going to select **Serial External Test**, the loopback cable must be installed.

3. To access the Help screen, hold down <u>Open-Apple</u> and <u>Shift</u>, and press <u>?</u>.

4. Before booting the diagnostic, enter the Control Panel Program (refer to Section 4, Troubleshooting). Set the Keyboard Buffering option to **No.** Set the Display Language option to the language you want the keyboard to display, and select the correct Keyboard Layout for the keyboard that is connected. Verify that Slot 4 is set for the **Mouse Port** and Slot 7 is set for **Your Card**. Press <u>Return</u> to save the selections and quit the Control Panel Program. Turn off the Apple IIGS, insert the *Apple II Diagnostic Disk*, and reboot. If you do not use this method, the diagnostic may lock up or give false results.

5. When loading or saving selected test sequences to disk, use a known-good system and disk drive.

6. When testing multiple disk drives, unique names must be given to each disk in each drive. ProDOS is unable to recognize more than one drive with the same disk name.

Diagnostic
Commands

7. Where input is required to start the next test (after video tests, for example), press <u>Spacebar</u>. If you press <u>Escape</u>, the testing will stop.

8. To abort the keyboard test, hold down <u>Control</u> and press <u>C</u>.

9. To make a selection, type the letter of the test or use the arrow keys until the selection is highlighted, and then press <<u>Return</u>>.

10. When chosen, the tests display a number that indicates the order in which the tests will be performed.

11. To deselect a test, type the letter of the test or use the arrow keys until the selection is highlighted; then press the <<u>Delete</u>> key. The numbers displayed will be corrected automatically. To deselect all tests, hold down <<u>Open-Apple</u>> and press <<u>Delete</u>>.

❏ APPLE II DIAGNOSTIC DISK

Materials Required

Apple II Diagnostic Disk
Loopback cable (optional)
Apple IIGS Memory Expansion Card (optional)
Known-good UniDisk 3.5, UniDisk, DuoDisk, Apple 3.5,
   or Apple 5.25 Drive
Apple IIGS/IIGS, 1 MB, or an Apple IIe that has the
   retrofit kit installed

**Main Menu
Selections**

The *Apple II Diagnostic Disk* main menu is
shown below.

```
┌─────────────────────────┐
│   Main Menu   └──────────────────────┐
│                                      │
│  ┌──┐                                │
│  │a.│    Execute All Diagnostic Tests│
│  └──┘                                │
│   b.     Execute Selected Tests      │
│   c. ▓   Choose Tests                │
│   d. ▓   Options                     │
│   e. ▓   Special                     │
│   f.     Exit & Run Workstation Card Diagnostic │
│   g.     Quit                        │
│                                      │
└──────────────────────────────────────┘
```
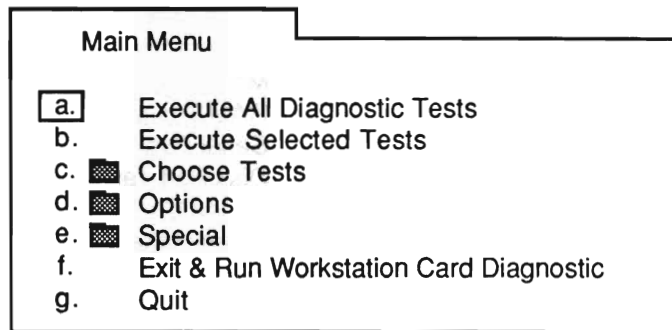
The following list describes each item in the main
menu:

Execute All Diagnostic Tests – Runs the standard Apple
IIGS test sequence.

Execute Selected Tests – Allows you to run only the
tests selected in the Choose Tests folder.

Choose Tests – Contains all the tests that can be
selected for the Apple IIGS.

Options – Contains various selections that allow you to
control how the tests are run.

Special – Contains various options for keeping track of
errors generated, for saving a test sequence, and for
loading a test sequence from a disk.

Exit & Run Workstation Card Diagnostic – Terminates the Apple IIGS diagnostic and starts the Apple II Workstation Card diagnostic. Refer to *Cross Family Peripherals, Volume Three* for instructions on running this portion of the diagnostic.

Quit – Stops all testing and displays a message saying **Shutdown and Restart the System**.

Choose Tests

The Choose Tests folder is shown below.

```
┌─────────────────────┐
│ Choose Tests        └─────────┐
│                               │
│  a.  ROM Test                 │
│  b.  System Speed/ Interrupts Test │
│  c.  MMU/ IOU Test            │
│  d.▓ RAM Tests                │
│  e.▓ Serial Port Test         │
│  f.▓ Disk Port Tests          │
│  g.▓ Sound Circuitry Tests    │
│  h.▓ Video Pattern Tests      │
│  i.▓ Keyboard/ Mouse Tests    │
└───────────────────────────────┘
```
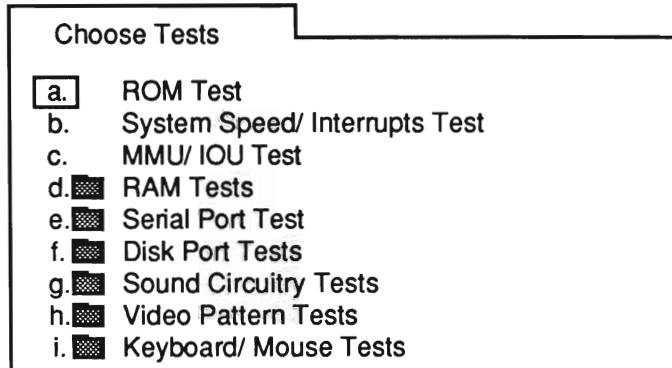
The following list describes the items in the Choose Tests folder:

ROM Test – Checks the ROM.

System Speed/Interrupts – Checks that the interrupts and both speeds (1 MHz and 2.8 MHz) are functioning correctly.

MMU/IOU Test – Checks the Memory Management Unit and the Input/Output Unit.

RAM Tests Folder

RAM Tests – This folder contains the following:

- Main Logic Board RAM Test – Checks the RAM on the logic board.

- IIGS Memory Expansion Card Test – Checks the RAM on an Apple IIGS Memory Expansion Card (if installed). This test will not run unless selected. Refer to "Running the Memory Card Tests" for further information.

- Clock RAM Test – Checks the RAM used for the clock and the clock timekeeping function.

Serial Ports – This folder contains the following:

- Serial Internal Test – Checks the logic board circuitry that handles the serial port.

- Serial External Test (Loopback is required) – Checks the ports to be sure they are sending and receiving data correctly.

- Serial Crystal Test (Loopback is required) – Checks the crystal to be sure it is functioning correctly.

Disk Port – This folder contains the following:

- Disk Port Test – Checks the drive circuitry on the logic board for all 3.5- or 5.25-inch drives attached to the system. The disk in the drive must be formatted with ProDOS in order to be tested.

Sound Tests – This folder contains the following:

- Sound Circuitry Test – Checks the specialized sound components and the sound RAM on the logic board.

- Speaker Tone Test – Checks the speaker by playing a sequence of beeps.

Video Pattern Tests – This folder contains the following:

- Color Bar Test – Displays vertical color bars with the name of each color below.

- Character Generator Test – Displays the Swedish, German, Italian, Spanish, Danish, French, British, Domestic, and Domestic2 character sets.

- 80/40 Column Text Test – Displays a few lines of 80- and 40-column characters.

- Low-Resolution Graphics Test – Displays both pages (one and two) of the low-resolution graphics mode with bars at the top of the screen.

- High-Resolution Graphics Test – Displays both pages (one and two) of a grid of 9 vertical lines intersected by 8 horizontal lines.

- Double High-Resolution Graphics Test – Displays a grid of 18 vertical lines intersected by 8 horizontal lines.

- Super High-Resolution Graphics Test – The screen displays a grid of 11 vertical lines intersected by 21 horizontal lines.

- Screen Text Color Test – Displays the 16 possible border colors.

Keyboard and Mouse Tests Folder

Keyboard/Mouse Tests – This folder contains the following:

- ADB Domestic Keyboard – Displays a keyboard layout for the Apple Desktop Bus keyboard used on the Apple IIGS. The instructions are given at the bottom of the screen.

- Standard IIe Keyboard Test – Displays a keyboard layout for the standard Apple IIe keyboard. The instructions are given at the bottom of the screen.

- Extended IIe Keyboard Test – Displays a keyboard layout for the Apple IIe Extended Keyboard (with built-in keypad). The instructions are given at the bottom of the screen.

- <u>Numeric Keypad IIe Test</u> – Displays a keypad layout for the Apple IIe Numeric Keypad. The instructions are given at the bottom of the screen.

- <u>Languages</u> – Displays a list of languages available for the keyboard tests. The default setting is U.S.A. English. The language selected here must match the one in the Control Panel setting.

- <u>ADB Mouse Test</u> – Displays a pointer that can be moved around the screen and indicates whether the mouse button is pressed or not.

- <u>Joystick/Paddle Test</u> – Displays a range from 0 to 255 that can be adjusted to indicate whether the joystick/paddle works.

Options

When the Options folder is open, the following list of selections appears on the screen:

- <u>Loop Tests Until Esc is Pressed</u>
- <u>Continue On Error Until Esc</u>

If an option is selected, a check mark appears beside the item. To deselect an option, just select the same option again.

Special

The following selections appear when the Special folder is opened:

- <u>Display Error Log</u> – Displays the names of the tests that failed since the last clearing of the error log (up to 255 names).

- <u>Clear Error Log</u> – Erases the log from RAM.

- <u>Clear Testing Status Line</u> – Clears the iterations and failure counts displayed.

- <u>Display Current System Status</u> – Indicates the type of system, the ROM version, the amount of memory available, and the memory card status.

- <u>Load Selected Test Sequence from Disk</u> – Loads a previously saved test sequence. The sequence can then be executed.

- <u>Save Selected Test Sequence to Disk</u> – Saves a selected test sequence to the test disk.

When any of the above items is selected and <<u>Return</u>> is pressed, the action is performed.

**Running the
Diagnostics**

The diagnostic program can be configured in various ways. All the tests can be run in their automatic sequence, or selected tests can be looped or run in an order you specify.

The diagnostic also has the ability to execute a test sequence that has been saved to the test disk. Saved test sequences make it easier to test upgraded Apple IIGS systems and other specially configured systems that require nonstandard tests (see "Customized Tests").

Note: The Apple IIGS, 1 MB logic board requires the *Apple II Diagnostic Disk*, version 4.0 or later.

*Control Panel
Setup*

Before booting the diagnostic, enter the Control Panel Program and make the following selections:

- Set the Keyboard Buffering option to **No**.
- Set the Display Language option to the language you want the keyboard to display.
- Select the correct Keyboard Layout for the keyboard connected.
- Verify that Slot 4 is set for **Mouse Port**.
- Verify that Slot 7 is set for **Your Card**.
- Verify that Startup is set for **Scan**.

Press <Return> to save the selections and quit the Control Panel Program. Turn off the Apple IIGS, insert the *Apple II Diagnostic Disk*, and reboot. If you do not use this method, the diagnostic may lock up or give false results.

*Standard
Test*

1. Install the appropriate loopback connector and the memory card, if available.

   If they are not available, type $\underline{N}$ when the diagnostic asks you if they are installed. The testing will continue.

2. Insert the *Apple II Diagnostic Disk* and power on the system.

3. Type the letter $\underline{a}$ or use the arrows to select **Execute All Diagnostic Tests**, and press <Return>.

4. To continue after certain tests (for instance, **Speaker Tone** and **Video Pattern** tests), press <Spacebar>. When an error is encountered, the testing stops and an alert box specifies which test failed. Refer to "Test Failures" at the end of this section for the appropriate actions to perform.

5. On completion, **Testing Finished** displays in the alert box.

Customized Tests

1. If you are going to test the serial ports and the memory card, install these items now.

2. Insert the *Apple II Diagnostic Disk* and power on the system.

3. Type the letter c or use the arrows to select **Choose Tests**, and press <Return>.

4. From the Choose Tests menu, select the first three tests (if desired) and press <Return>.

   Select the other test folders and press <Return> to display them. Select the tests you wish to run from each folder and press <Return>. To deselect a test, use the letters or arrows to select the test and press <Delete>.

Saving and Loading Test Sequences

5. To save your customized test sequence, return to the main menu and select **Special**. Select **Save Selected Test Sequence to Disk** and press <Return>.

   You now have saved the selected test sequence to disk. The sequence may be loaded when needed using **Load Selected Test Sequence From Disk**.

6. On completion, return to the main menu, select **Execute Selected Tests,** and press <Return>.

7. To continue after certain tests (for instance, **Speaker Tone** and **Video Pattern** tests), press <Spacebar>. If an error is encountered, the testing stops and an alert box specifies which test failed.

8. On completion, **Testing Finished** displays in the alert box.

Continuous
Test

A continuous (looping) test is possible with all tests. Select the tests you wish to loop by following the instructions under "Customized Test" (see above). Follow the steps below to run a continuous test.

1. After you have chosen the tests you want to run, return to the main menu, select **Options**, and press <u>Return</u>.

2. From the menu select **Loop Tests Until Esc is Pressed** and press <u>Return</u>.

    A check mark indicates which tests have been selected.

3. Select **Continue On Error Until Esc** if you want to continue looping regardless of the error until <u>Escape</u> is pressed. If you do not select this option, the testing will halt when an error is encountered.

    Errors will be logged to RAM.

4. Return to the main menu, select **Execute Selected Tests**, and press <u>Return</u>.

    The tests will run (depending on your selection in step 3) continuously until an error occurs or <u>Escape</u> is pressed. If <u>Escape</u> is pressed, the looping is canceled.

    If you press <u>Escape</u> to stop the testing, you can then check for errors by selecting **Special** and pressing <u>Return</u>, then selecting **Display Error Log**.

5. If you are going to run the test again, be sure to clear the error log and the status line to reselect **Loop Tests Until Esc is Pressed** before returning to the main menu.

**Running
the Memory
Card Tests**

The Apple IIGS Memory Expansion Card test is located on the *Apple II Diagnostic Disk*. The test can be run alone or with other tests in the order you specify. For information on Memory Card configuration, refer to Section 5, Additional Procedures.

Materials Required

Known-good Apple IIGS or IIGS, 1 MB
3.5-inch (or 5.25-inch) disk drive
Known-good RAM chips
Apple IIGS Memory Expansion Card
Apple II Diagnostic Disk

Testing the RAM

1. Install the Apple IIGS Memory Expansion Card into the memory slot.

2. Start up the *Apple II Diagnostic Disk*. Open the folder **RAM Tests**, select **Apple IIGS Memory Expansion Card Test** and run the test.

   A screen will appear stating the total number of banks installed on the card and the number of the bank it is currently testing. The test takes from 10 to 15 minutes to run.

3. Three types of failures are possible on the Apple IIGS Memory Expansion Card: defective replaceable RAM chips, defective soldered RAM chips, or out-of-specification RAM chips.

   a) If any replaceable RAM chips fail, the screen will list numbered location(s) on the board.
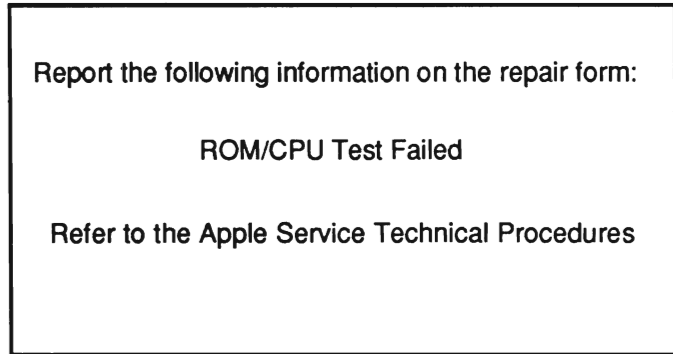
      Note: The top row of RAM on the card has the markings UA1 through UA16 above the sockets (UA1 through UA8 are not replaceable). The bottom row of RAM on the card has the markings UB1 through UB16 below the sockets.

      1) Locate and replace the failed RAM with known-good RAM chips.

      2) Retest the card.

      3) Repeat steps 1) and 2) until the card passes.

   b) If any of the soldered RAM chips are bad, the screen will display the message **Soldered IC's**.

1) Remove all the RAM from the customer's card.

2) Test the module used for exchange.

3) Install the customer's known-good RAM onto the new module.

c) If any replaceable RAM chips are out-of-specification, the screen will display the message **Out of Spec IC(s)** and will list the numbered location(s) on the board.

1) Locate and replace the failed RAM with known-good RAM chips.

2) Retest the card.

3) Repeat steps 1) and 2) until the card passes.

**Test
Failures**

When a test fails, the following or a similar message will be displayed:

```
┌─────────────────────────────────────────────────┐
│                                                 │
│   Report the following information on the repair form: │
│                                                 │
│            ROM/CPU Test Failed                  │
│                                                 │
│   Refer to the Apple Service Technical Procedures │
│                                                 │
│                                                 │
└─────────────────────────────────────────────────┘
```

The following is a list of the tests, along with the recommended remedial actions.

Test   **Remedial Action**

• *ROM/CPU*   – Exchange logic board.

• *System Speed/*   – Exchange logic board.
  Interrupts

• *MMU/IOU*   – Exchange logic board.

• *Main Logic*   – Exchange logic board.
  Board RAM

• *Memory Expansion*   – Refer to Section 5, Additional
  Card   Procedures.

• *Clock RAM*   – Exchange logic board.

• *Serial Internal*   – Exchange logic board.

• *Serial External*   1. Exchange loopback cable.
                                 2. Exchange logic board.

<u>Tests</u>	<u>Remedial Action</u>
• *Disk Port*	1. Exchange drive. 2. Exchange logic board.
• *Sound Circuitry*	1. Exchange logic board. 2. Exchange speaker.
• *Speaker*	1. Exchange speaker. 2. Exchange logic board.
• *All Video*	– Exchange logic board.
• *ADB Domestic Keyboard*	1. Exchange cable. 2. Exchange keyboard. 3. Exchange logic board.
• *Standard Apple IIe Keyboard*	1. Exchange cable. 2. Exchange keyboard. 3. Exchange logic board.
• *Extended Apple IIe Keyboard*	1. Exchange cable. 2. Exchange keyboard. 3. Exchange logic board.
• *ADB Mouse*	1. Exchange mouse. 2. Exchange cable for keyboard. 3. Exchange keyboard. 4. Exchange logic board.
• *Joystick/Paddle*	1. Exchange joystick/paddle. 2. Exchange logic board.

Apple Technical Procedures

Apple IIGS

Section 4 – Troubleshooting

❏ CONTENTS

❏ INTRODUCTION

**General
Information**

This troubleshooting section can be used if the diagnostics are unable to detect a module failure or if the diagnostic diskette cannot be booted. After repairing the system, the diagnostic should be run to verify system operation.

**Before
You
Start**

Read the section entitled "Things to Remember" before you begin troubleshooting. There are numerous things you need to know about the Apple IIGS in order to troubleshoot the system effectively.

**How to Use
the Symptom
Chart**

The symptom chart has two columns. The left hand column lists the problem of the defective system, the right hand column lists corrective actions. For each 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.

❏ THINGS TO REMEMBER

Safety
Information

1. Follow the basic ESD precautions when troubleshooting. (Refer to Section 2, Take-Apart, for more information.)

2. Be sure the power is off before installing any interface cards, connecting any peripherals to the ports on the rear of the system, **or** connecting the keyboard to the Apple DeskTop Bus.

Control
Panel
Information

3. The Apple IIGS is configured by accessing the *Control Panel.* The Control Panel allows you to change the video display modes, the sound, the system speed, the clock, the language, the slots, port 1 and port 2, and the RAMdisk. (Refer to the *Apple IIGS Owner's Manual* for more detailed information.)

4. To gain access to the Control Panel on an Apple IIGS, hold down the <Option> key as you turn the system on. A menu with four possible selections will appear. Select number 1 and press <Return>. This will bring you to the Desk Accessories window.

   To gain access to the Control Panel on an upgraded Apple IIe, hold down the <Control>,<Closed-Apple>, and <Reset> keys as you power on the system. Release the <Reset> key. When the Control Panel appears, release the other keys.

5. On an upgraded Apple IIe, use the <Closed-Apple> key where Apple IIGS instructions ask for the <Option> key.

Port and Slot
Configuration

6. The printer port is configured to work automatically with the ImageWriter series of printers. There are two ways to set the port configuration: from an application program or from the Control Panel.

7. The Memory Expansion slot is designed only for the Apple IIGS Memory Expansion Card. **Do not** insert any other card into this slot unless the manufacturer specifies to do so.

8. Each port on the Apple IIGS is designed to impersonate an Apple II slot containing a card.

Device	Connected To	Looks like
Printer	Port 1	Slot 1
Modem	Port 2	Slot 2
Drives		
3.5	Disk Drive Port	Slot 5
5.25	Disk Drive Port	Slot 6
AppleTalk	Port 1 or 2	Slot 7
Mouse	Mouse Port Keyboard	Slot 4

Because each port impersonates a slot, you can't have both the port and the corresponding slot active at the same time. You activate one or the other by using the Control Panel. When a slot is activated, the words **Your Card** replace the words describing the port.

9. The configuration of ports and/or slots which is specified within an application overrides the Control Panel setting.

❑ APPLE IIGS SYMPTOM CHART

System Problems	Solutions
• *Does not boot*	1. Check battery (refer to "Battery Verification" in Section 5, Additional Procedures). 2. Exchange logic board. 3. Exchange power supply.
• *Shuts down intermittently*	1. Check battery (refer to "Battery Verification" in Section 5, Additional Procedures). 2. Exchange logic board. 3. Exchange power supply.
• *Screen is totally dark and LED is not lit*	1. Check battery (refer to "Battery Verification" in Section 5, Additional Procedures). 2. Exchange logic board. 3. Exchange power supply.
• *Fails ROM/CPU diagnostic test*	1. Check that the diagnostic is the correct version (version 4.0 or later for the Apple IIGS, 1 MB logic board). 2. Exchange logic board.

Video Problems	Solutions
• *Display is fuzzy on a known-good monitor*	1. Verify Control Panel setting for video. 2. Verify that the application software supports the monitor (e.g., color or monochrome). 3. Exchange logic board.
• *Garbage displayed on known-good monitor; no beep*	1. Exchange logic board. 2. Exchange power supply.
• *Cosmetically flawed video display*	1. Verify VGC revision; if necessary upgrade the VGC (refer to "VGC Upgrade" in Section 5, Additional Procedures). 2. Exchange power supply.

• *No video, no beep; power light on*	1. Exchange logic board.
	2. Exchange power supply.
• *Cannot adjust horizontal hold on monitor*	1. Verify Control Panel setting is 60 Hz for domestic use or 50 Hz for international use.
	2. Exchange logic board.

Drive Problems	**Solutions**
• *Won't boot from known-good disk drive*	1. Verify Control Panel setting for correct slot assignment.
	2. Exchange software.
	3. Exchange logic board.
• *Known-good drive does not turn on*	1. Verify Control Panel setting for correct slot assignment.
	2. Exchange logic board.

Peripheral Problems	**Solutions**
• *No keyboard output or wrong output is displayed*	1. Verify Control Panel setting for correct language selection.
	2. Exchange Apple DeskTop Bus cable.
	3. Exchange keyboard.
	4. Exchange logic board.
• *No output from specific keyswitch(es)*	1. Exchange keyboard or keyswitches.
	2. Exchange logic board.
• *Mouse cursor moves too fast or too slow*	1. Verify Control Panel setting for desired mouse tracking and speed.
	2. Exchange logic board.
• *No audio*	1. Verify Control Panel setting for sound.
	2. Exchange speaker.
	3. Exchange logic board.

- *Problems transmitting and receiving data with a known-good modem*

  1. If a port is being used, verify that modem DIP switch settings match the settings in the Control Panel. If a slot is being used, verify that modem DIP switch settings match the settings on the interface card and that the correct slot is selected in the Control Panel.
  2. Exchange logic board.

- *Can't read or write to ProFile*

  1. Add a jumper to the interface card (refer to "ProFile Interface Card Modification" in Section 5, Additional Procedures).
  2. The ROM must be P/N 341-0299-B to work with operating system 4.0 or higher.

- *Won't print to a known-good printer*

  1. If a port is being used, verify that printer DIP switch settings match the settings in the Control Panel. If a slot is being used, verify that printer DIP switch settings match the settings on the interface card and that the correct slot is selected in the Control Panel.
  2. Exchange logic board.

- *Unidentifiable system crashes when accessing the Hard Disk 20SC*

  1. Check the ROM version on the interface card (refer to "SCSI Interface Card ROM Upgrade" in Section 1, SCSI Interface Card and SCSI High-Speed Interface Card, under the *Apple II Family Cards* tab).
  2. The ROM must be 341-0437-A to work with operating system 4.0 or higher.

Miscellaneous Problems   Solutions

- *No power light, no video*

  1. Exchange AC power cord.
  2. Exchange power supply.
  3. Exchange logic board.

- *Programs run erratically and often crash*

  1. Verify Control Panel setting for speed (normal or fast). Different software requires different settings.
  2. Exchange logic board.

- *System crashes or locks up randomly*

1. Verify that the RAM on the Apple IIGS Memory Expansion Card is standard Apple RAM (refer to Section 5, Additional Procedures). If the RAM is not Apple RAM, or does not meet the requirements of Apple RAM, replace it with Apple RAM.

2. Some Apple IIGS Memory Expansion Cards and Memory Expansion Kits shipped from Apple may contain RAM chips that do not meet the "CAS before RAS" criteria. Replace the socketed RAM if either of the following conditions exist:

   - The code **"UK"** is stamped beneath the NEC name

   - The code **"Japan"** is stamped beneath the NEC name **and** the letter "P" is the **first letter** in the date code (the fifth character)

   Note: If the RAM to be replaced is soldered to the PCA, replace the Memory Expansion Card.

É Apple Technical Procedures

Apple IIGS

Section 5 – Additional Procedures

❏ CONTENTS

❏ APPLE IIGS FAN KIT

The optional Apple IIGS fan uses the vents on the top and bottom of the case to circulate fresh air through the inside of the case. The fan keeps the system running cooler and prolongs system life. The user installs the fan with the instructions provided in the *Apple IIGS Fan Kit Owner's Guide*.

The fan is mounted on the power supply by plastic hooks that snap into place. The connector from the fan is then plugged into two prongs marked *fan* on the logic board (located between the RGB monitor port and the disk drive port).

❏ PROFILE INTERFACE CARD MODIFICATION

Some ProFile interface cards cause incompatibility problems when used with the Apple IIGS Adding a jumper wire, as described in the following procedure, corrects the problem.

Materials Required

Soldering iron
Solder sucker
60/40 resin core solder
Small wire cutters
Piece of insulated wire with both ends stripped of about 1/4 inch of insulation
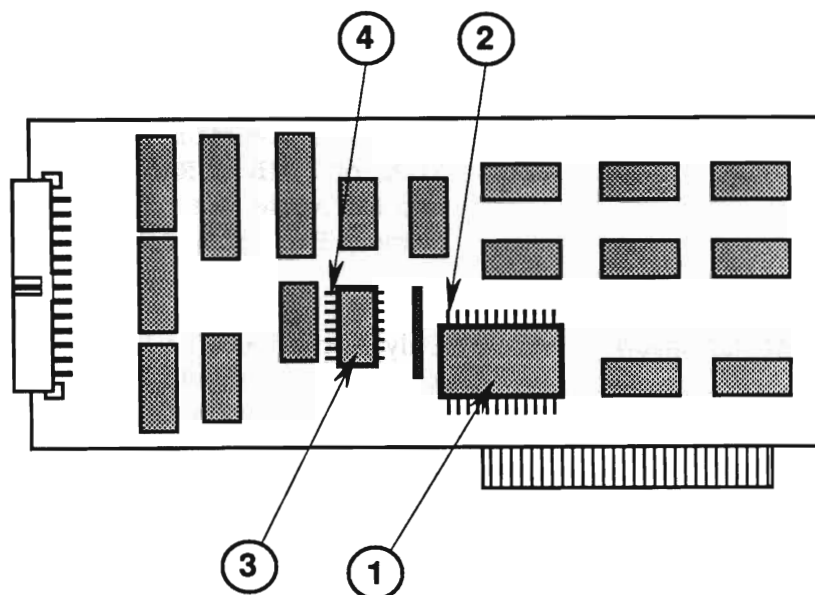
FIGURE 1

Procedure

1. On the IC at C6 (Figure 1, #1), locate pin 12 (Figure 1, #2).

2. On the IC at B4 (Figure 1, #3), locate pin 1 (Figure 1, #4).

3. Turn the board over and verify the locations on the back of the board.

   Note: If a jumper is already installed between these pins, exchange the interface card.

4. Solder one end of the wire to pin 1 on the IC at B4.

5. Solder the other end of the wire to pin 12 on the IC at C6.

6. Install the interface card in the Apple IIGS and verify that the Control Panel is set correctly. Try to read and write to the ProFile. If the original problem persists, refer to the *ProFile Technical Procedures* for troubleshooting information.

❏ APPLE IIGS MEMORY EXPANSION CARD

Introduction

The Apple IIGS Memory Expansion Card adds 256K, 512K, or 1 MB of RAM to the 256K of RAM built into the Apple IIGS. The card is installed in the Memory Expansion slot on the Apple IIGS logic board.

RAM Installation

Only Apple RAM, or RAM that meets the following specifications, should be installed on the Apple IIGS Memory Expansion Card:

- The minimum speed must be 150 nanoseconds.
- The configuration must be 256K by 1 bit.
- There must be CAS before RAS refresh.

RAM chips identified by the diagnostic as **Out of Spec IC** will not work on Apple products and need to be replaced.

There is no way to physically identify whether a RAM chip has CAS before RAS refresh. It is important to specify this requirement when ordering RAM from non-Apple vendors.

256K Configuration

The dark rectangles in Figure 2 indicate the location of the RAM chips for 256K. These eight chips are soldered onto the card at the locations labeled UA1 through UA8 and are not replaceable.
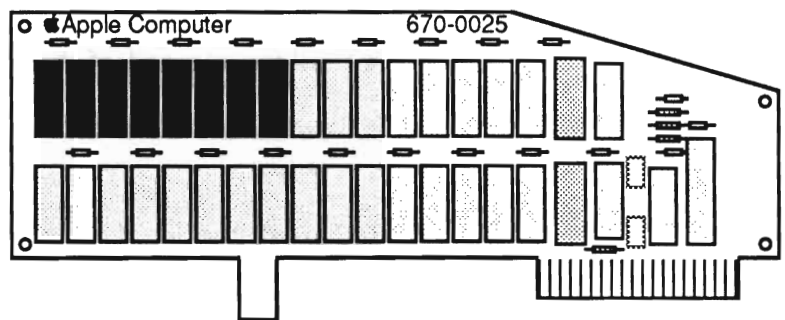
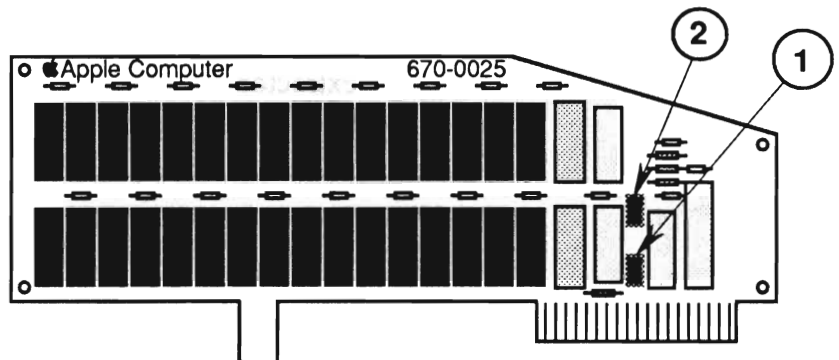**FIGURE 2**

512K Configuration

The dark rectangles in Figure 3 indicate the location of the RAM chips for 512K. (The 256K RAM locations described above are included.) The eight additional chips (256K) must be installed in the sockets at locations UA9 through UA16 on the card. Jumper J2 (Figure 3, #1) must be installed for the card to "see" the 512K RAM.
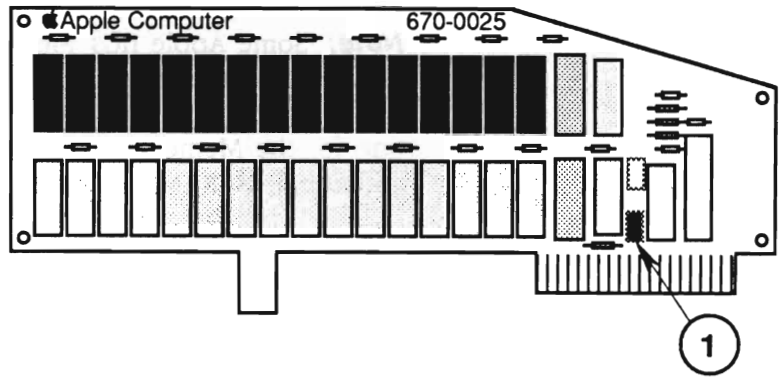
FIGURE 3

1 MB Configuration

The dark rectangles in Figure 4 indicate the location of the RAM chips for 1 MB. (The 512K RAM locations described above are included.) The 16 additional chips (512K) must be installed at the locations labeled UB1 through UB16 on the card. Jumpers J2 (Figure 4, #1) and J1 (Figure 4, #2) must be installed for the card to see the full 1 MB.

FIGURE 4

Troubleshooting

Use the *Apple II Diagnostic Disk* to assist you in troubleshooting the Apple IIGS Memory Expansion Card. Refer to Section 3, Diagnostics for additional information.

The Memory Expansion Card exchange module is shipped **without** socketed RAM. All socketed RAM must be removed from the card before returning the card to Apple.

Note: Some Apple IIGS Memory Expansion Cards have all the RAM soldered to the card. To exchange this type of card, you will need to fill out two SRO forms, one for the Memory Expansion Card and one for the additional 24 RAM chips.

❏ ROM AND VIDEO GRAPHICS CONTROLLER UPGRADES

Introduction

There are two IC upgrades available for the Apple IIGS:

- ROM
- Video Graphics Controller (VGC)

ROM Upgrade

The ROM upgrade corrects some minor bugs and provides enhancements for future software releases. The old ROM is P/N 342-0077-A; the new replacement ROM is P/N 342-0077-B.

Materials Required

ESD equipment
IC extractor
ROM P/N 342-0077-B

Procedure

1. Set up the ESD equipment (refer to *You Oughta Know*).

2. Remove the top cover.
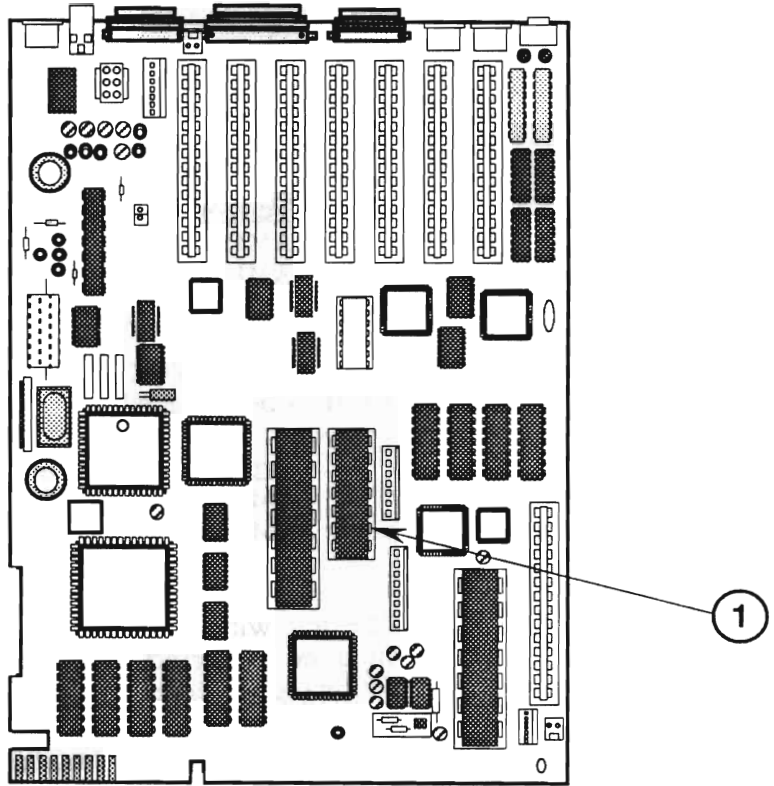
FIGURE 5

3. Locate the ROM at location H10 (Figure 5, #1), and verify that it is the old ROM (P/N 342-0077-A).

4. Using an IC extractor, remove the old ROM installed at location H10 (Figure 5, #1).

5. Install the new ROM in the same location, H10 (Figure 5, #1). The notch at one end of the ROM should be installed facing the front of the machine.

6. Run the diagnostics to verify that the machine is functioning correctly.

VGC Upgrade

The VGC upgrade corrects screens that may be cosmetically flawed in various modes of display. The VGC is located at H5 on the Apple IIGS logic board.

Defective VGCs

The following is a list of the VGCs that display this problem and should be replaced:

Vendor	Number
AMI	344S0046-1
AMI	344S0046-A

Good VGCs

The following VGC versions, if already installed, do **not** need to be replaced:

Vendor	Number
AMI	344S0046-2
AMI	344S0046-B

Replacement VGCs

The following are versions of the VGC that should be installed to correct the display problem. Any of the following versions can be used:

Vendor	Number
AMI	344S0046-3
IMP	344S0046
IMP	344S0056

Materials Required

ESD equipment
VGC IC extraction tool (special tool)
VGC, as indicated above

Procedure

1. Set up the ESD equipment (refer to *You Oughta Know*).

2. Remove the top cover.

3. Remove the power supply.

4. Locate the VGC at location H5 (Figure 6, #1) and verify that it needs to be replaced by comparing the vendor and number on the IC with the list above.

5. Remove the logic board.

CAUTION: *To prevent physical damage to the VGC socket and the logic board, the logic board must be removed before attempting to use the special VGC extraction tool.*
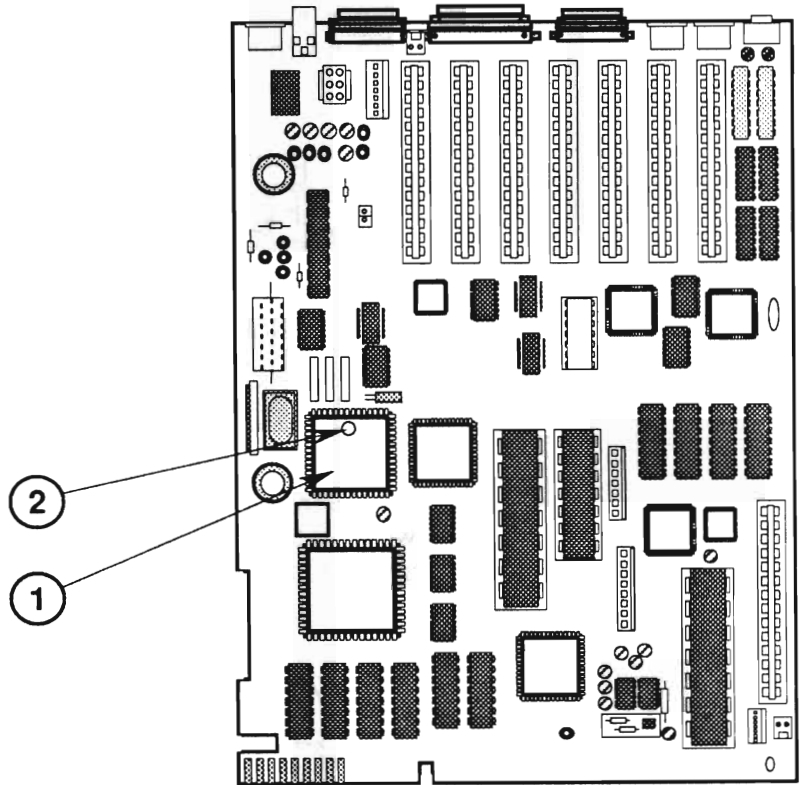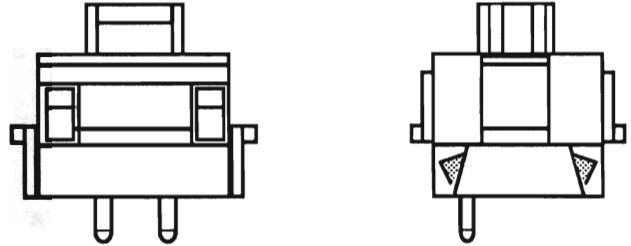

FIGURE 6

6. Remove the old VGC installed at location H5 (Figure 6, #1) using the VGC extraction tool.

7. Using the VGC extraction tool, install the new VGC in the same location, H5 (Figure 6, #1). The dot at pin 1 on the IC should face the rear of the machine (Figure 6, #2).

8. Run the diagnostics to verify that the machine is functioning correctly.

❏ KEYSWITCHES

The Apple IIGS can use two types of keyswitches: Alps or SMK. To replace a faulty keyswitch, you must first identify the type currently installed.

The Alps keyswitch (Figure 7) is identified by the orange stem. The overall shape of the switch is square with no rounded corners.

FIGURE 7

The SMK keyswitch (Figure 8) is identified by the white stem. The corners at the top of the keyswitch are rounded.
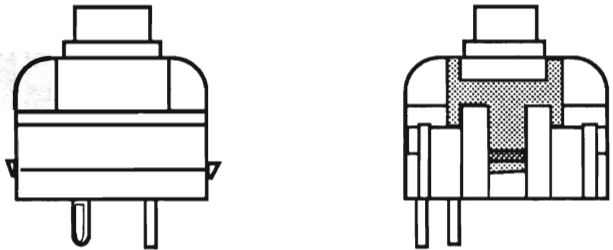
FIGURE 8

❏ BATTERY VERIFICATION

Introduction

The Apple IIGS and Apple IIGS, 1 MB, logic boards each have a long-life lithium battery. Use the following procedure to check battery operation. If the battery falls below specifications, it must be replaced (refer to "Battery Replacement" in Section 5, Additional Procedures).

WARNING: *Lithium batteries, the type used in the Apple IIGS and Apple IIGS, 1 MB, have some potential for explosion if improperly handled. Follow the procedure below exactly as written.*

Materials Required

Voltmeter

Verification Procedure

1. Be sure the power is off. Then remove the logic board from the Apple IIGS and Apple IIGS, 1 MB.

2. Locate the lithium battery. Figure 9, #1 shows the location of the battery on a Apple IIGS logic board; Figure 10, #1 shows the battery location on an Apple IIGS, 1 MB logic board.

3. Set the voltmeter range to measure 10 volts DC.

   Note: The battery in the Apple IIGS is installed in a plastic battery holder. It may be necessary to remove the battery holder cover (Figure 10, #2) and pull out the battery by hand to measure battery voltage.

4. Touch and hold the positive probe of the voltmeter to the positive side of the battery. The positive side of the battery is marked "+" on the logic board.

5. Touch and hold the ground probe of the voltmeter to the negative side of the battery.

6. The reading for a good battery should be above 2.8 volts.

   If the battery voltage is below 2.8 volts, replace the battery. To replace the Apple IIGS or Apple IIGS, 1 MB battery, refer to "Battery Replacement" in this section.
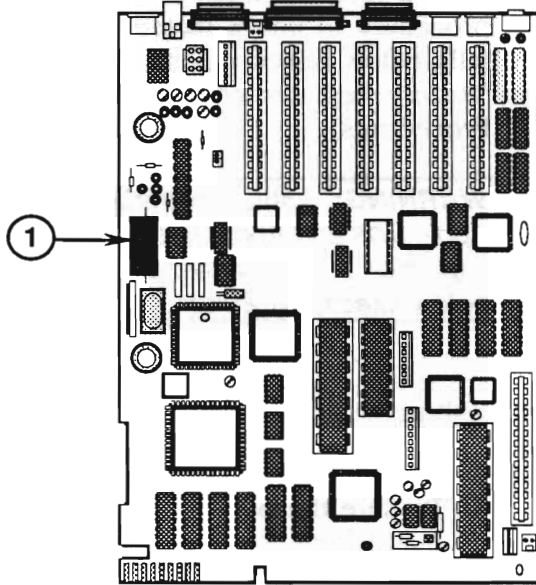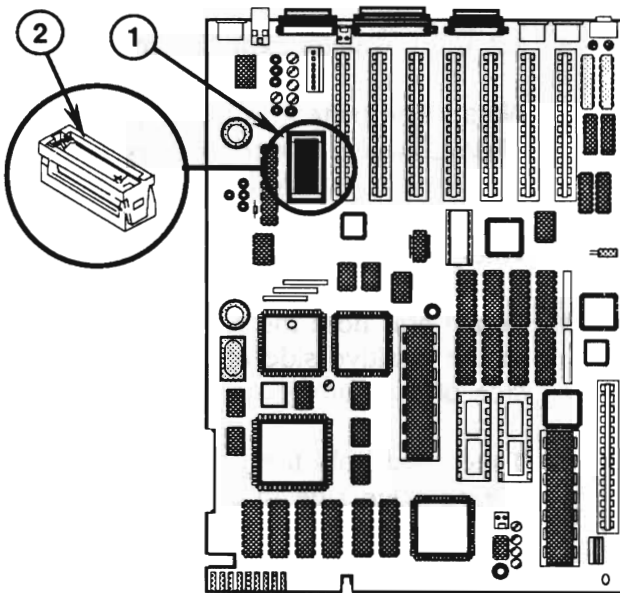
FIGURE 9

FIGURE 10

❏ BATTERY REPLACEMENT

Lithium thionyl chloride batteries, the type used in the Apple IIGS, have a 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 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.**

Introduction

The Apple IIGS and IIGS, 1 MB logic boards contain a single, long-life, lithium battery; if a battery fails, replace it according to the appropriate procedure.

Apple IIGS

The battery on the Apple IIGS is soldered directly to the logic board. This procedure involves unsoldering the defective battery and soldering in a new one.

Materials Required

Soldering iron
Solder sucker
60/40 resin core solder
Small wire cutters
Battery

Remove

1. Remove the Apple IIGS logic board from the case. (Refer to Section 2, Take-Apart.)

2. Locate the battery on the front of the logic board (Figure 11, #1). Turn the logic board over. The battery is held in place by two soldered leads. Apply fresh solder to the two connections.

3. Desolder the two connections.

CAUTION: *Do not force the connections free. Force can remove the traces on the board. Repeat step 3 if you have problems.*
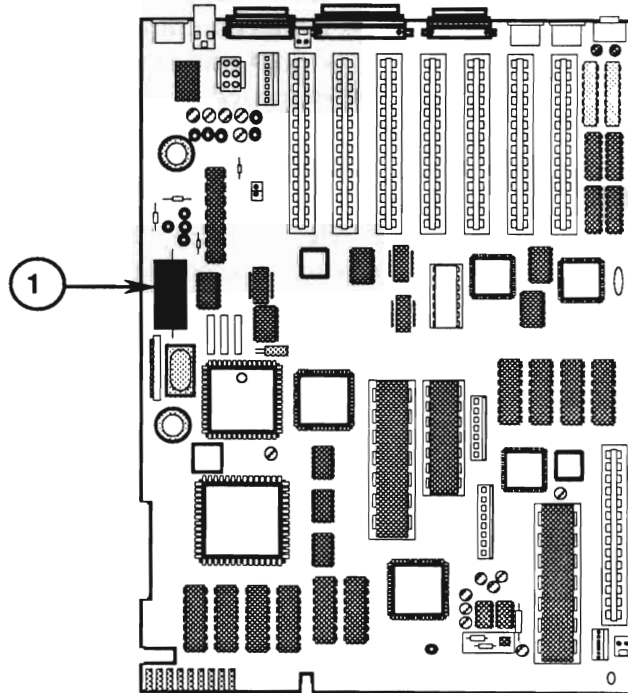
FIGURE 11

4. Package and label the old battery as directed in the beginning of this subsection, and return the battery to Apple for proper disposal.

Replace

1. Insert the new battery so that it is flush with the board. Be sure to orient the battery so that the end marked "+" matches the "+" on the logic board.

2. Solder the battery into place and then clip the excess ends from the back of the board. A length of about 1/16 inch is sufficient.

3. Replace the logic board. (Refer to Section 2, Take-Apart.)

4. Set the clock by using the Control Panel.

Apple IIGS, 1 MB

A dead battery needs to be removed from the battery holder and replaced. No soldering is involved.

Materials Required

Small, flat-blade screwdriver
Battery

Remove

1. Remove the Apple IIGS logic board from the case. (Refer to Section 2.)

2. Locate the battery holder (Figure 12, #1). Remove the plastic cover by inserting a small, flat-blade screwdriver into the top (Figure 12, #2) of the holder, and gently pushing the screwdriver through the hole (Figure 12, #3) on the side of the battery holder. The battery holder cover will lift off.
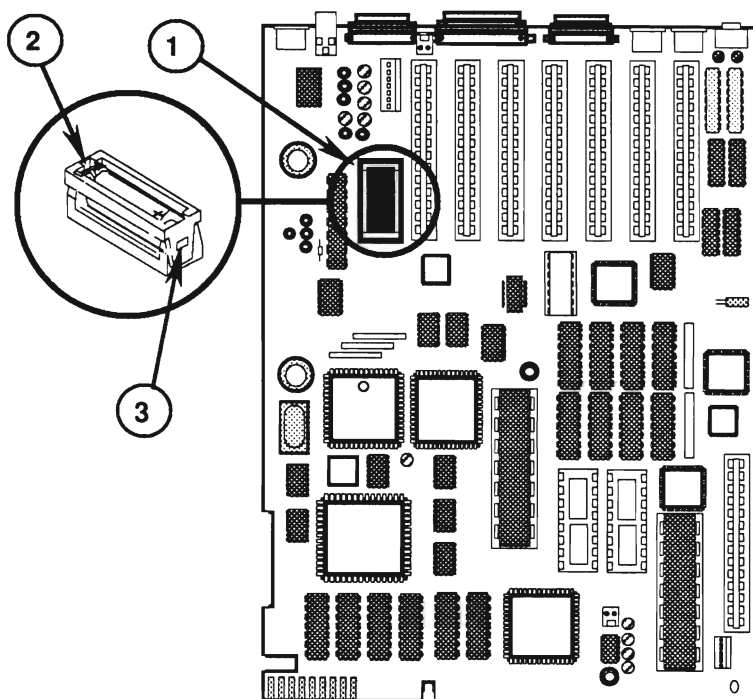
FIGURE 12

3. Use your fingers to remove the battery from the battery holder.

4. Package and label the old battery as directed in the beginning of this subsection, and return the battery to Apple for proper disposal.

Replace

1. Orient the new battery so that the end marked "+" matches the "+" on the main logic board. Insert the battery in the battery holder, and replace the plastic cover.

2. Replace the logic board. (Refer to Section 2, Take-Apart.)

3. Set the clock by using the Control Panel.

❑ SHIELD TABS

Apple IIGS

On the Apple IIGS, the tabs on the metal shield must be bent at approximately a 45-degree angle (Figure 13, #1) to form a good metal-to-metal contact between the tabs and the metal portion of the I/O ports.
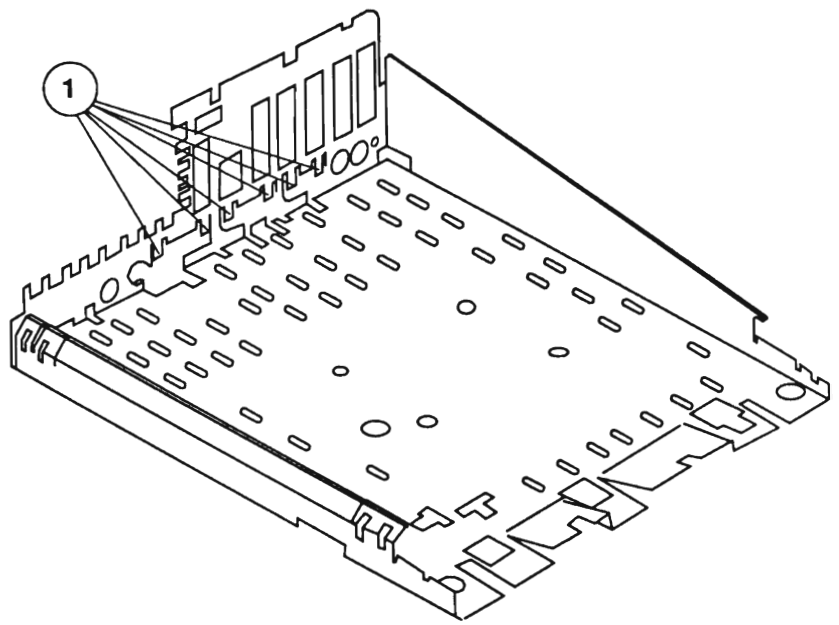
Use a small, flat-blade screwdriver to carefully bend the metal shield tabs to approximately a 45-degree angle.
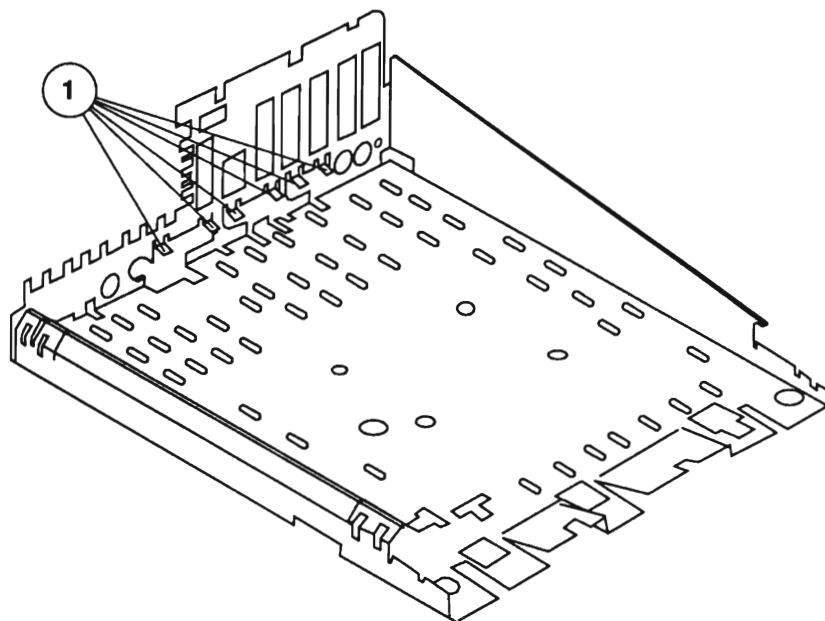
FIGURE 13

Apple IIGS, 1 MB

On the Apple IIGS, 1 MB, the tabs on the metal shield must be in a vertical position, flush against the plastic case (Figure 14, #1).

FIGURE 14

᭙ Apple Technical Procedures

Apple IIGS

Illustrated Parts List

❑ CONTENTS

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Apple IIGS, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.
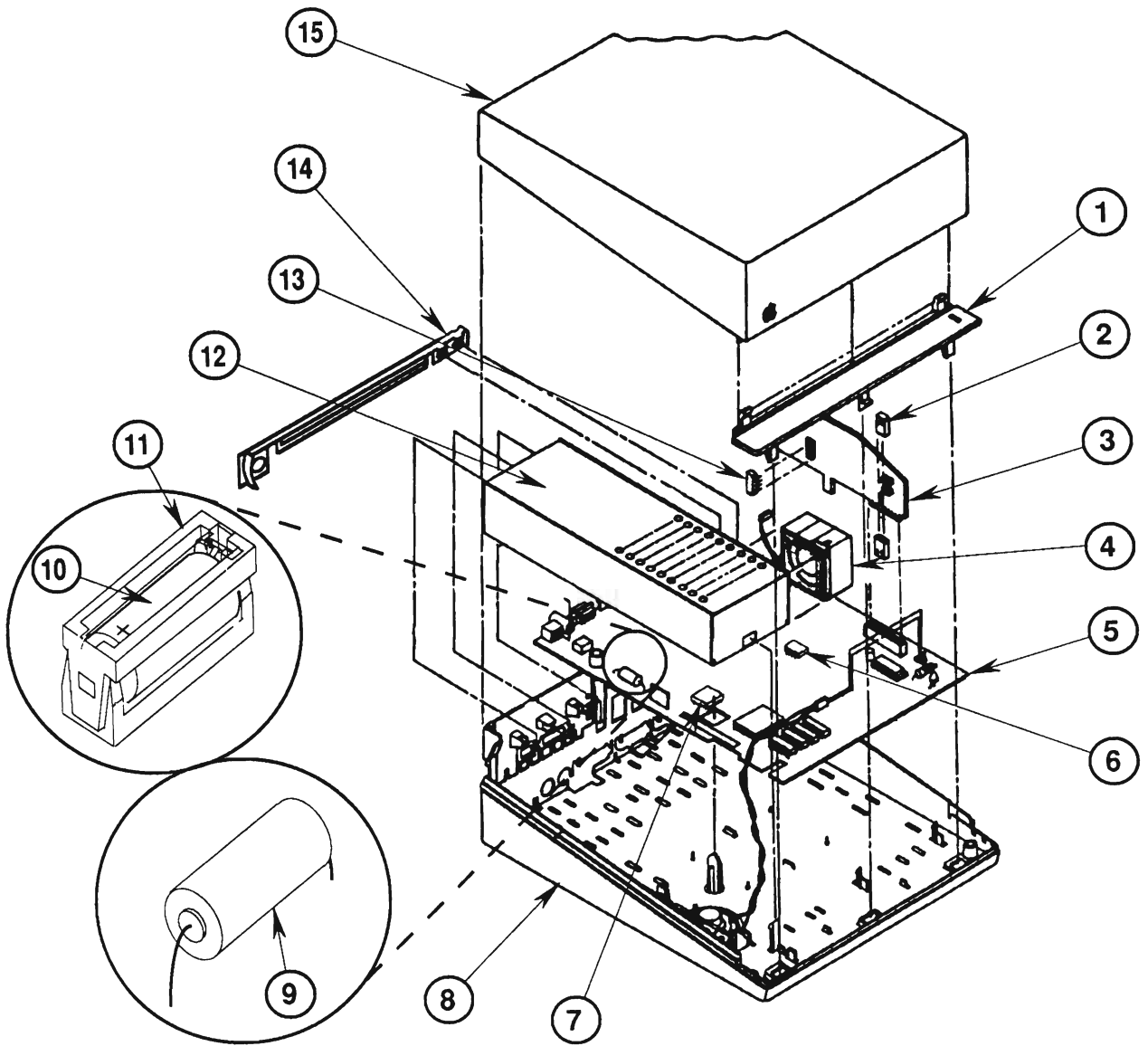
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FIGURE 1

❏ APPLE IIGS—MAIN ASSEMBLY (Figure 1)

Item	Part No.	Description
1	607-5006	Case Hinge
2	517-1230	RAM Expansion Card Jumper*
3	661-0336	Memory Expansion Card
4	607-5007	Fan
5	661-0334	Logic Board, Apple IIGS
	661-0515	Logic Board, Apple IIGS, 1 MB
6	342-0077	IC, 1 MB ROM
7	344S0046	IC, VGC
8	607-5005	Base
9	742-0009	Lithium Battery (with leads)
10	742-0011	Lithium Battery (without leads)
11	520-0344	Battery Holder Cover
12	661-0335	Power Supply
13	334-0021	RAM, 256K
14	805-0169	EMI Fence
15	607-5004	Top Cover

*Also used on the Apple IIGS, 1 MB Logic Board
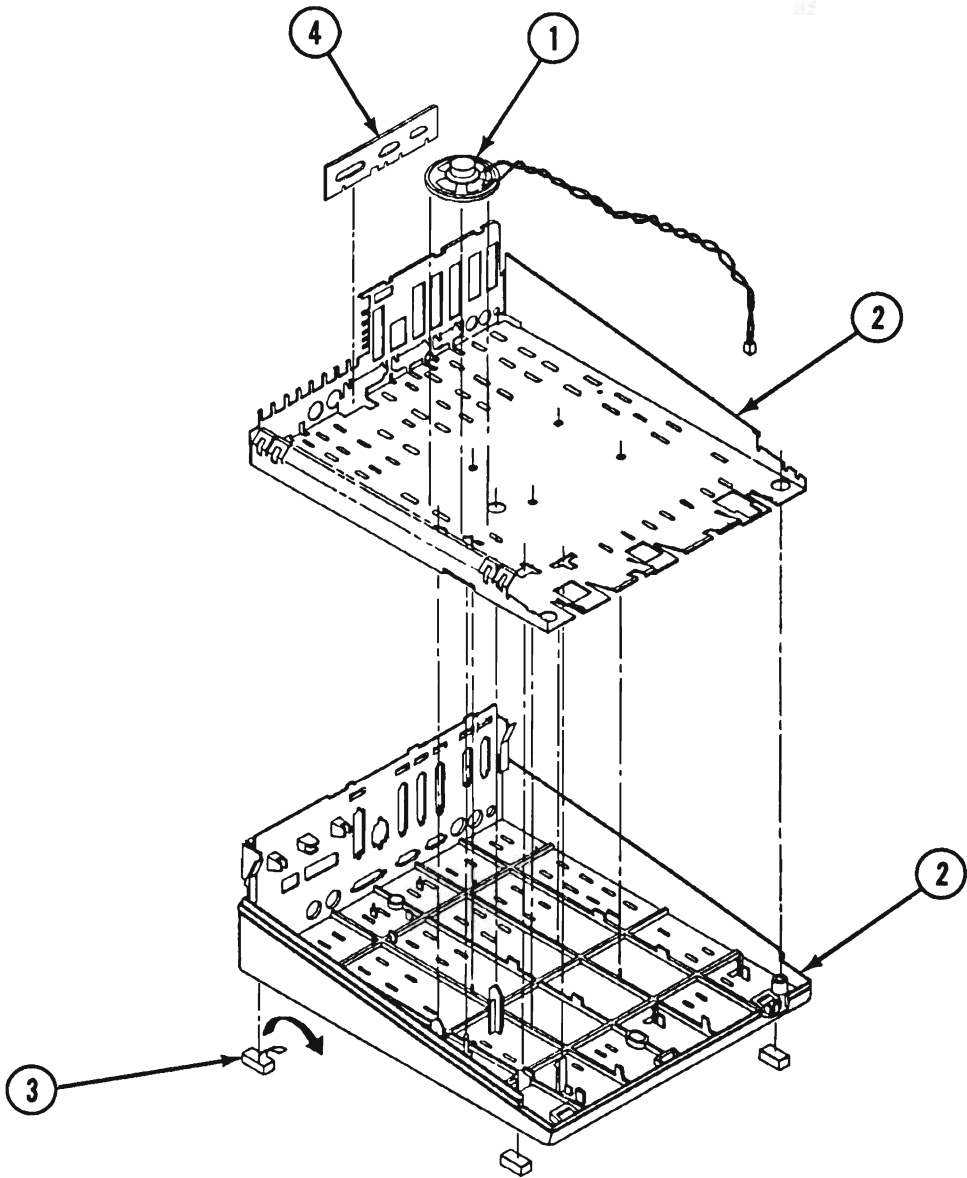
FIGURE 2

❏ APPLE IIGS—BASE ASSEMBLY (Figure 2)

Item	Part No.	Description
1	607-5174	Speaker
2	607-5005	Base
3	865-0024	Foot (4/pk)
4	944-1189	Thin EMI Foam

TOP VIEW

FRONT VIEW
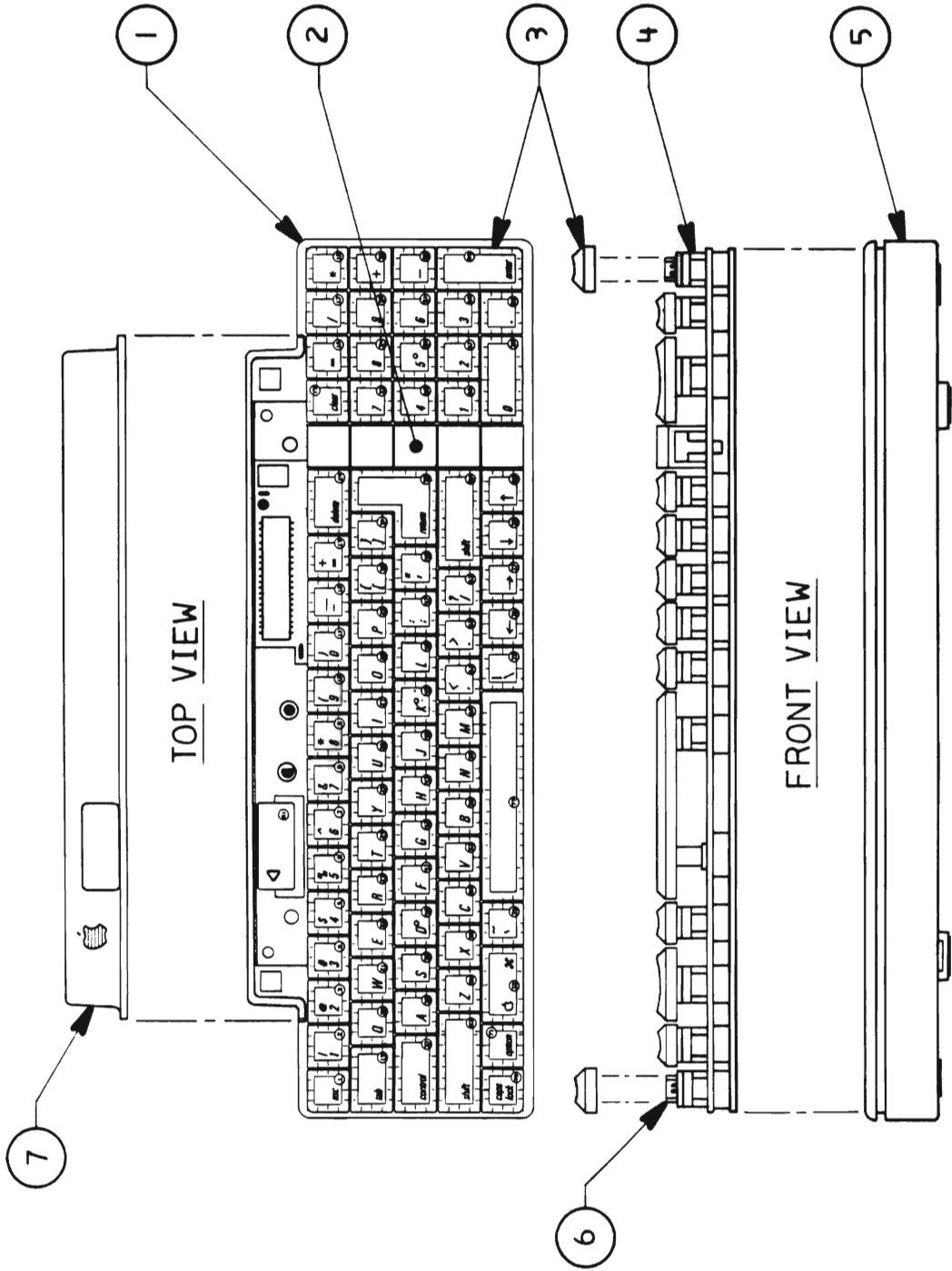
FIGURE 3

❏ APPLE IIGS – KEYBOARD (Figure 3)

Item	Part No.	Description
1	661-0337	Apple DeskTop Bus Keyboard
2	815-0418	Keypad Spacer Case, ADB Keyboard
3	658-7093	Keycap Set, ADB Keyboard
4	076-0209	Keyswitch Set, ADB Keyboard
5	815-0416	Case Bottom, ADB Keyboard
6	970-1263	Alps Locking Keyswitch
7	815-0417	Case Top, ADB Keyboard
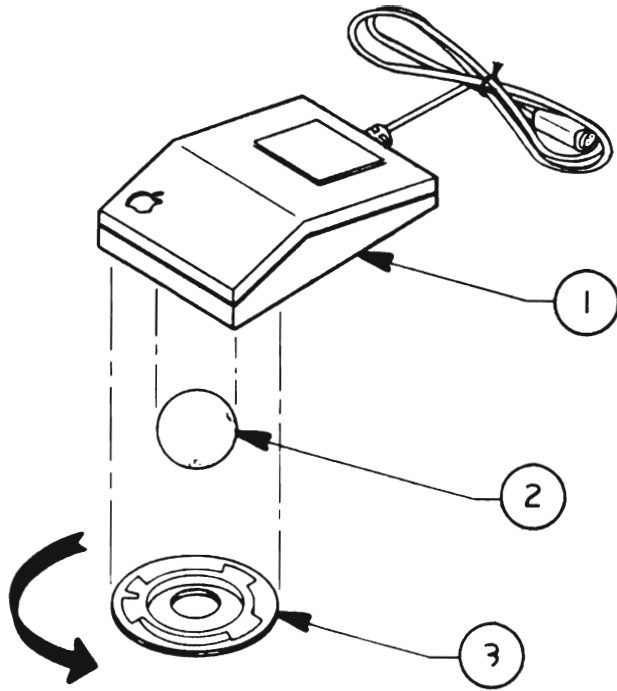
FIGURE 4

❏ MOUSE (Figure 4)

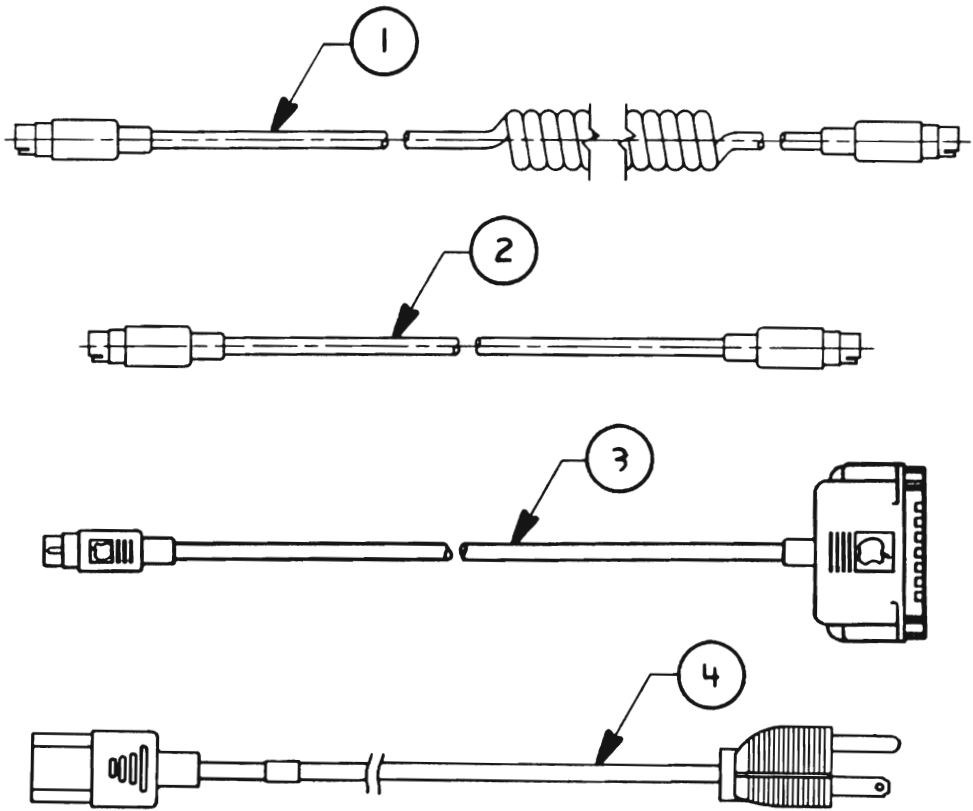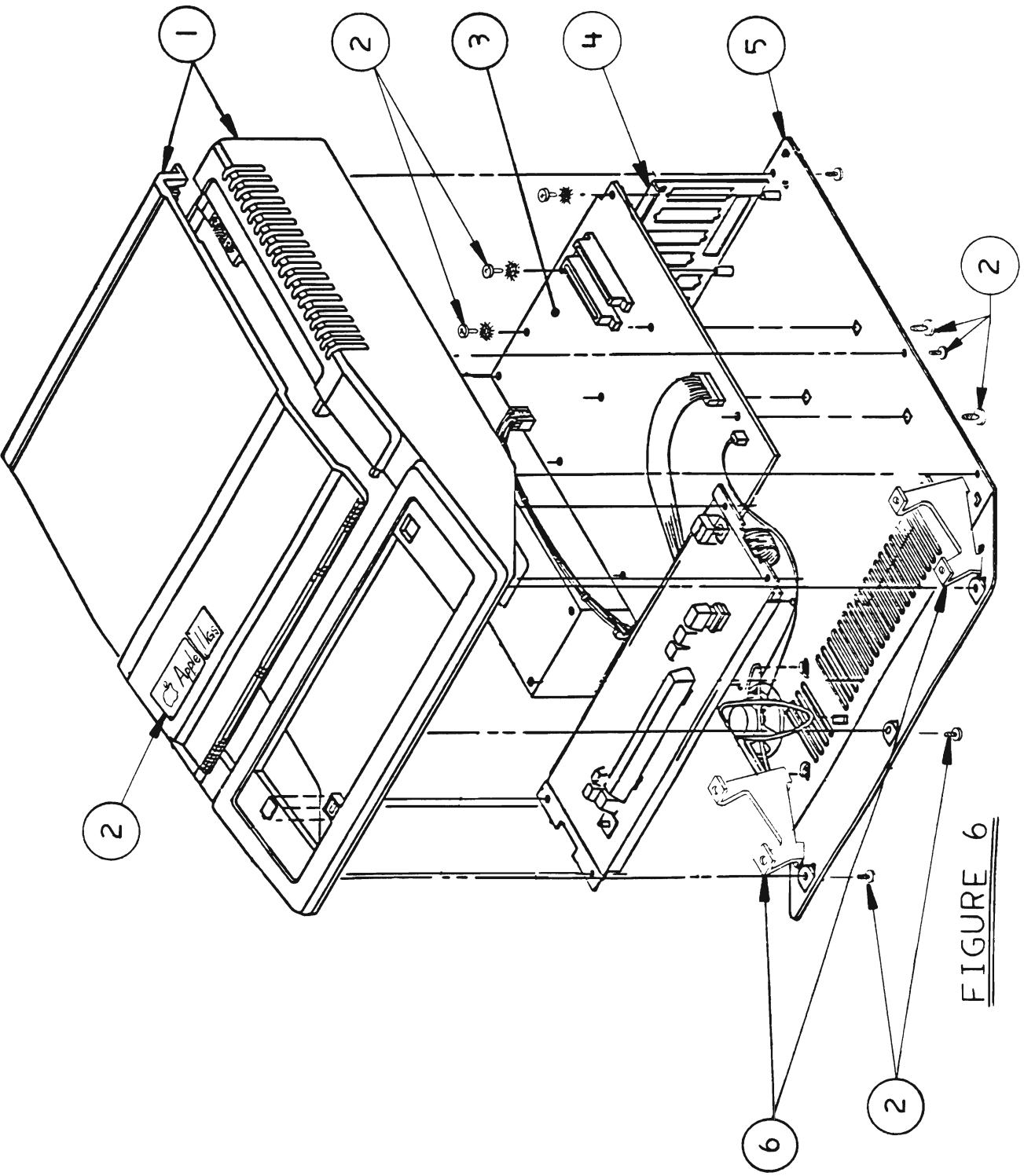| Item	Part No.	Description
1	661-0338	Apple DeskTop Bus Mouse
	661-0479	ADB Mouse (replacing part number 661-0338)
2	699-8001	Mouse Ball (25.4mm dia)
	699-8038	Mouse Ball (21.9mm dia)
	815-1135	Mouse Ball (for part number 661-0479)
3	076-0231	Retainer, ADB Mouse (38mm dia)
	815-0816	Retainer, ADB Mouse (34mm dia)
	815-1136	Retainer, ADB Mouse (for part number 661-0479)

FIGURE 5

❏ APPLE IIGS – CABLES (Figure 5)

Item	Part No.	Description
1	590-0361	ADB Keyboard Cable
2	590-0109	ADB Cable
3	590-0550	Peripheral Adapter Cable, Apple IIGS
4	590-0380	AC Power Cable, Platinum

FIGURE 6

❏ APPLE IIGS —UPGRADE (Figure 6)

Item	Part No.	Description
1	076-0127	Apple IIe Case and Lid, Beige
2	607-5183	Assembly Hardware Package
3	661-0334	Apple IIGS Main Logic Board
4	875-0063	Shielding Strip
5	607-5012	Bottom Pan, Apple IIGS Upgrade
6	805-0168	Bracket, Apple IIGS Upgrade Keyboard