

Apple Service Technical Procedures Apple II Family

Volume One

PN: 072-0229

Apple IIc

Table of Contents

Section 1 – Basics

1.2	Product Description
1.2	Display
1.2	CPU
1.2	Memory
1.2	Disk Drives
1.3	Input/Output
1.3	Keyboard
1.3	Indicators
1.4	Interface Ports
1.6	Other Information
1.6	Differences Between the Apple IIc's
1.7	Theory of Operation
1.7	Introduction
1.9	Logic Board
1.10	AC Power Pack
1.10	Internal Power Supply
1.11	Internal Disk Drive
1.11	Keyboard
1.12	Electrostatic Discharge (ESD) Precautions

Section 2 – Take-Apart

2.3	Electrostatic Discharge Precautions
2.4	Top Cover
2.6	Keyboard and Memory Expansion Card
2.8	Disk Drive
2.9	Analog Card
2.12	Mechanical Assembly
2.12	Bezel, Door, and Spring Assembly
2.14	Internal Power Supply
2.15	Speaker
2.17	Logic Board
2.18	Volume Control
2.19	Power Switch

**Section 3 –
Preventive
Maintenance**

- 3.2 Introduction
- 3.2 Disk Drive Read/Write Head
- 3.3 Disk Drive Head Load Button

**Section 4 –
Diagnostics**

- 4.2 Introduction
- 4.3 Things to Remember
- 4.3 Before You Begin
- 4.3 Setting Up
- 4.4 While Testing
- 4.5 Built-In Diagnostic
- 4.5 Running the Diagnostic
- 4.5 Results
- 4.6 Apple IIc Diagnostic Diskette
- 4.6 Materials Required
- 4.6 Main Menu
- 4.7 Choose Tests
- 4.10 Options
- 4.10 Special
- 4.11 Running the Diagnostics
- 4.15 Test Failures

**Section 5 –
Troubleshooting**

- 5.2 Introduction
- 5.2 General Information
- 5.2 Before You Start
- 5.2 How to Use the Symptom Charts
- 5.3 Things To Remember
- 5.3 Symptom Chart
- 5.3 Video Problems
- 5.3 Display Problems
- 5.3 Peripheral Problems
- 5.4 Miscellaneous Problems
- 5.5 Special Problem Symptom Chart

**Section 6 –
Additional
Procedures**

- 6.2 Apple IIc - Model A2S4100
- 6.2 Memory Expansion Card Installation
- 6.6 Diagnostics and Troubleshooting
- 6.9 Logic Board Rubber Feet Installation
- 6.10 Apple IIc - Model A2S4000
- 6.10 UniDisk 3.5 Compatibility
- 6.10 Serial Port Upgrade
- 6.10 AC Power Pack Upgrade
- 6.11 Internal Power Supply Shield Retrofit
- 6.12 Upper Head Shield Plate Installation
- 6.16 Internal Power Supply Upgrade
- 6.17 Expandable Logic Board Installation

**Section 7 –
Adjustments**

- 7.2 DSPEED

**Illustrated –
Parts List**

- IPL.3 Finished Goods Assembly
- IPL.5 Memory Expansion Card

©Apple Computer, Inc., 1986, 1987. No portion of this document may be reproduced in any form without the written permission of Apple Computer, Inc.

Apple II GS, Apple 5.25 Drive, UniDisk 3.5, AppleColor, and AppleMouse are trademarks of Apple Computer, Inc.

Apple IIc, ProDOS, Apple, and the Apple logo are registered trademarks of Apple Computer, Inc.

Apple IIc

Section 1 – Basics

□ CONTENTS

1.2	Product Description
1.2	Display
1.2	CPU
1.2	Memory
1.2	Disk Drives
1.3	Input/Output
1.3	Keyboard
1.3	Indicators
1.4	Interface Ports
1.6	Other Information
1.6	Differences Between the Apple IIc's
1.7	Theory of Operation
1.7	Introduction
1.9	Logic Board
1.10	AC Power Pack
1.10	Internal Power Supply
1.11	Internal Disk Drive
1.11	Keyboard
1.12	Electrostatic Discharge (ESD) Precautions

□ PRODUCT DESCRIPTION

The latest addition to the Apple® IIc family incorporates an expansion connector that supports the addition of a Memory Expansion Card. System memory can now be expanded to 1.15 megabytes.

Display

The video display has the following capabilities:

- 40-column x 24-line text mode
- 80-column x 24-line text mode
- Low-resolution graphics (40 x 48)
- High-resolution graphics (80 x 192)
- Double high-resolution graphics (560 x 192)
- 96 ASCII characters including upper and lower case, 32 graphics characters (Mousetext)
- NTSC compatible output

CPU

The central processing unit has the following attributes:

- 65C02 at 1.02 MHz
- 8-bit data bus
- 16-bit address bus

Memory

The IIc has the following memory capabilities:

- 128K RAM, expandable to 1.15 Megabytes with a Memory Expansion Card
- 32K ROM

Disk Drives

Mass storage is available in the following configurations:

- 5.25" built-in
- 5.25" or 3.5" external drive (optional)

Input/Output

A variety of built-in I/O ports and devices are included:

- Built-in speaker
- Connector for using headphones
- Joystick/Mouse port
- 2 RS-232 Serial ports
- Video expansion port

Keyboard

The keyboard has the following features:

- 63 keys
- 128-character ASCII set including 32 control characters
- Upper and lower case
- DVORAK or Sholes standard layout

Indicators

The following indicators are present:

- Power
- Disk activity

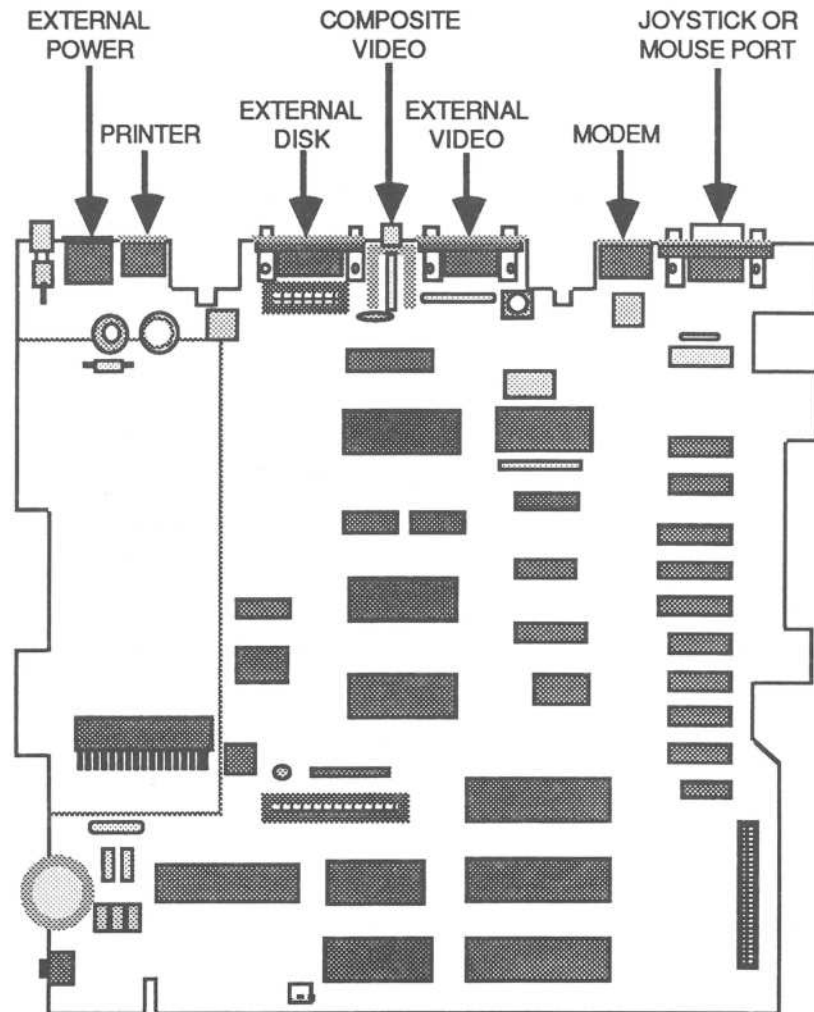


FIGURE 1

Interface Ports

The Apple IIc contains the following interface ports (Figure 1):

- **Joystick/Mouse**
 - Support for Mouse IIc
 - Support for Joystick IIc
- **Modem**
 - RS-232 serial
 - 50 to 19.2K baud
 - 5, 6, 7, or 8 data bits
 - 1 or 2 stop bits
 - Odd, even, or no parity
 - DIN-5 connector

- **External Video**
- RF modulator support
- Flat Panel Display
- RGB output
- **Composite Video**
- NTSC composite monochrome and color
- **External Disk**
- Supports the Disk IIc®, Apple 5.25 Drive™, and UniDisk™ 3.5
- **Printer**
- Identical to Modem Port (see above).
- **External Power Connector**
- Connection to AC Power Pack

□ OTHER INFORMATION

Differences Between the Apple IIc's

This section describes the differences between the older Apple IIc (designated as model A2S4000) and the current IIc (designated as model A2S4100). The model number is found on the case bottom along with the serial number tag.

	A2S4000	A2S4100
Maximum Memory Configuration	128K	1.15 MB
Cosmetics	White case Beige highlights	White case Platinum highlights
Functional	Slot 4 - Mouse Port Slot 7 - Reserved	Slot 4 - Memory Expansion Card Slot 7 - Mouse Port

□ THEORY OF OPERATION

Introduction

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

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

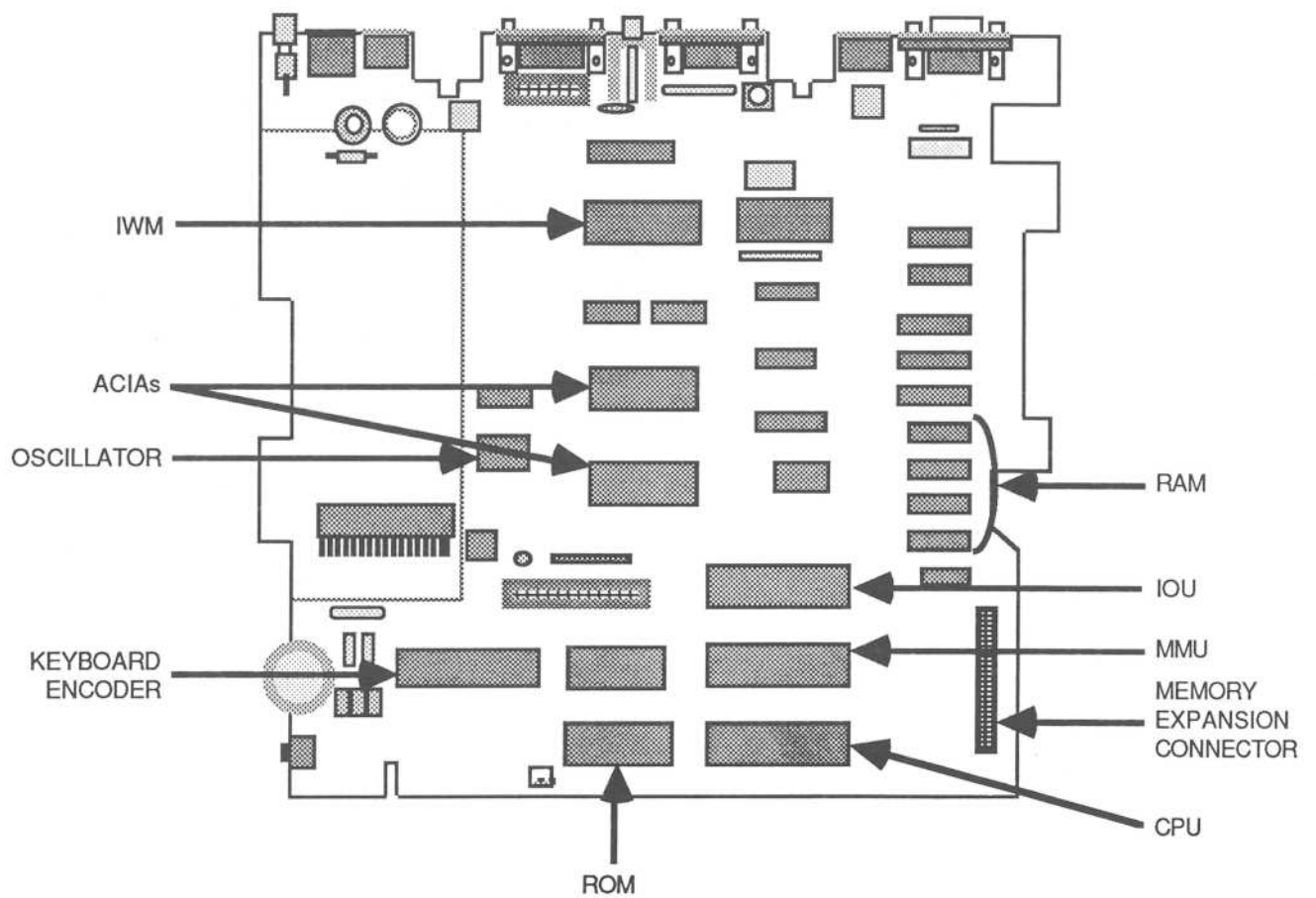


FIGURE 2

Logic Board

The Logic Board (Figure 2) is the heart of the system. It contains the components described below.

- The **CPU**, a 65C02 microprocessor, gets instructions from memory, translates them, and carries them out. It communicates with all components on the Logic Board.
- The **RAM** (read/write memory) is used to store, on a temporary basis, programs and data.
- The **ROM** (read-only memory) contains the Applesoft BASIC language, machine language Monitor, and the enhanced video firmware.
- The **Memory Management Unit** (MMU) contains most of the logic that controls memory addressing.
- The **Input/Output Unit** (IOU) contains most of the logic that controls the built-in input and output ports.
- The **Integrated Woz Machine** (IWM) is a self-contained disk controller card on a single integrated circuit. This IC supports both 3.5- and 5.25-inch disk drives.
- Two **6551 Asynchronous Communication Interface Adapters** (ACIA) handle the information to be sent and received through the two built-in serial ports.
- The **3600PRO Keyboard Encoder** interprets data sent from the keyboard when a key is pressed.
- The **Oscillator** (timing device) generates the master clock pulse. This master pulse is sent to two custom components, which break down the clock pulse and send it to various ICs on the logic board.
- A **Memory Expansion Connector** allows you to add a Memory Expansion Card containing up to 1 Megabyte of RAM. This brings total system memory to 1.15 Megabytes.

AC Power Pack

Power is supplied by the AC Power Pack (Figure 3-A), which converts AC voltage into 15 volts DC. The DC voltage is sent to a 7-pin DIN connector on the rear of the computer.

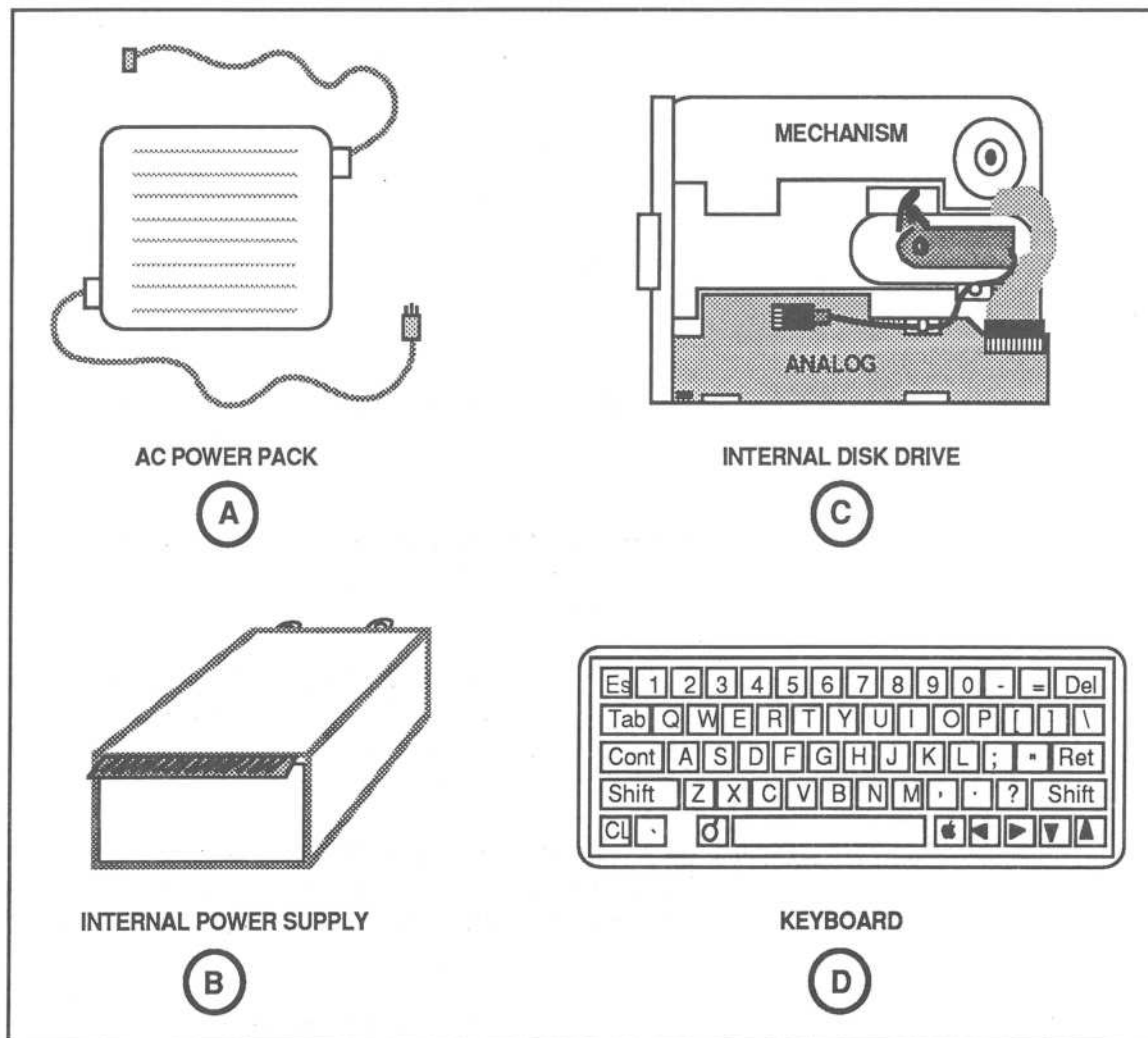


FIGURE 3

Internal Power Supply

The internal power supply (Figure 3-B) uses the 15 volts DC from the AC Power Pack to generate the DC voltages needed by the system.

Internal Disk Drive

The internal disk drive (Figure 3-C) is composed of two exchangeable modules: the analog card and the mechanical assembly.

The **analog card** interprets the instructions from the logic board and lets the mechanical assembly know what to do. The **mechanical assembly** rotates the diskette and moves the read-write head over the proper area on the diskette for reading or writing.

Keyboard

The keyboard (Figure 3-D) is a matrix of keyswitches connected to the logic board via a ribbon (flat) cable. The 3600 PRO keyboard encoder IC on the logic board translates the information from the keyboard into signals that the logic board can use.

❑ ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

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

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

Grounds

Before working on any device containing a printed circuit, ground yourself and your equipment to an earth or building ground.

Use a grounded conductive workbench mat and a grounding wriststrap, and ground your equipment to the mat.

Bodies

Don't touch anybody who is working on integrated circuits.

If that person is properly grounded, your "zap" may not cause any damage, but just to be on the safe side, keep your own body charge away from other technicians.

Bags

Use antistatic bags for boards and chips during handling.

Whenever you are about to leave your bench and take a board to a storage place, first put the board in an antistatic bag. Leave all Apple service exchange components in their ESD-safe packaging until needed for use.

Leads

Handle all ICs by the body, not the leads.

Also, do not touch PCB edge connectors, exposed circuitry, or printed circuits. Handle ICs and PCBs by the edges, or use extractors.

Synthetics

Do not wear polyester clothing or bring plastic, vinyl, or styrofoam into the work environment.

The electrostatic field around these nonconductors cannot be removed.

Metals

Never place components on any metal surface.

Use antistatic or conductive mats or foam.

Atmosphere

If possible, keep the humidity in the service area between 70% and 90%, and use an ion generator.

Charge levels are reduced (but not eliminated) in high humidity environments and in areas where an ion generator is used routinely.

Apple IIc

Section 2 – Take-Apart

❏ CONTENTS

- 2.3 Electrostatic Discharge Precautions
- 2.4 Top Cover
- 2.6 Keyboard and Memory Expansion Card
- 2.8 Disk Drive
- 2.9 Analog Card
- 2.12 Mechanical Assembly
- 2.12 Bezel, Door, and Spring Assembly
- 2.14 Internal Power Supply
- 2.15 Speaker
- 2.17 Logic Board
- 2.18 Volume Control
- 2.19 Power Switch

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

❑ ELECTROSTATIC DISCHARGE PRECAUTIONS

Electrostatic discharge can be an important factor in causing board failures: even if the failures are not immediate and dramatic, static zaps can degrade chips in such a way that they fail weeks or months after exposure.

Be sure to follow the ESD prevention information located in Section 1, Basics, to avoid damage to any Apple II electronics.

□ TOP COVER

Materials Required

#2 Phillips screwdriver
Jeweler's screwdriver

Remove

1. Turn off the power and disconnect all cables from the back of the computer.
2. Move the handle into carrying position.
3. Turn the computer upside down.
4. Remove the six case screws (Figure 1, #1).
5. If you are replacing the disk drive, logic board, volume control, or power switch, also remove the disk drive mounting screws (Figure 1, #2).

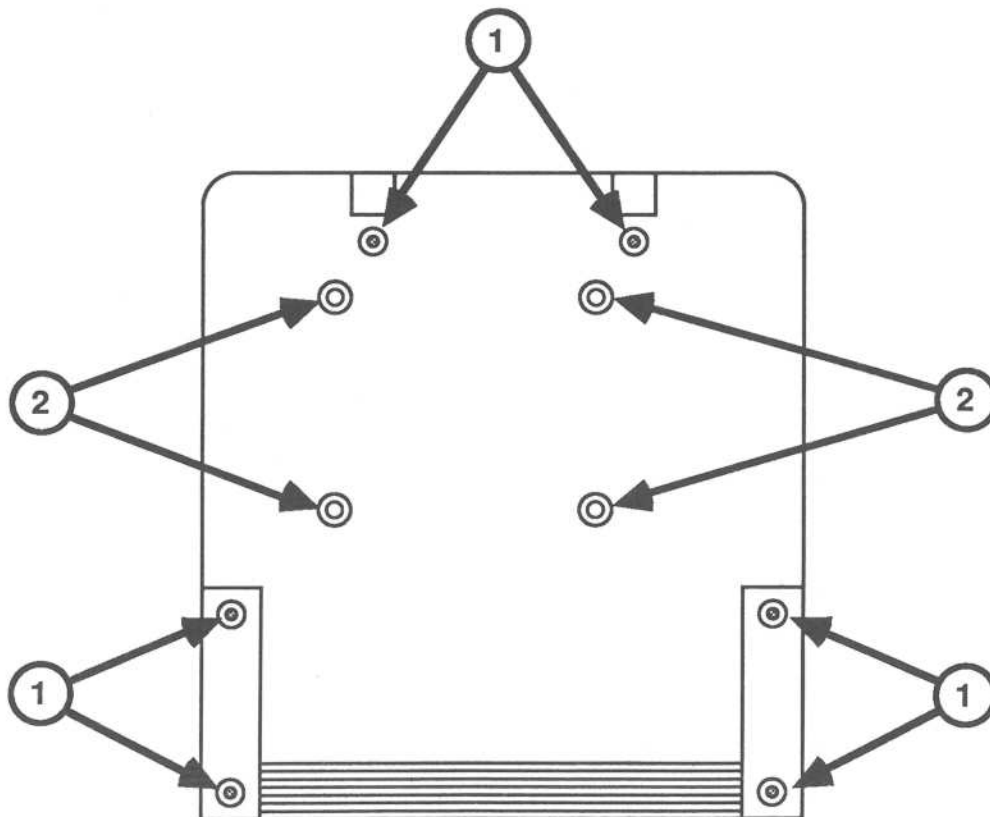


FIGURE 1

6. Hold the case together and turn it over (keyboard face up) with the keyboard toward you.
7. Grasp the sides of the IIc at the front so that your thumbs meet in the front center of the top cover.
8. Press back and up with your thumbs while gripping the sides of the case, so that the top cover flexes and the snaps come free.

If you have difficulty with this, insert the tip of the screwdriver in the front center of the case between the top cover and base. Then move the end of the screwdriver up. This will undo the snap at the front of the cover and allow you to lift the cover with your fingertips.

Note: In addition to the snap at the front center of the top cover, there is one snap on each side of the disk drive door. You will feel resistance from them, but don't worry: just pull the cover off.

9. Remove the handle and lay it aside.

Replace

1. If the handle is not already in place, snap it into the grooves in the back of the computer.
2. Make sure the keyboard is properly seated in the grooves in the side of the disk drive shield and within the plastic guides that surround it.
3. Fit the top cover onto the base. Make sure it snaps into place at the two back corners, on either side of the disk drive door, and at the center of the front edge.
4. Turn the computer over and replace the screws as follows:
 - a) The four large-head flat-nose screws attach the disk drive to the case.
 - b) The six small-head pointed-nose screws hold the case together.

□ KEYBOARD AND MEMORY EXPANSION CARD

Materials Required

Needlenose pliers

Remove

1. Remove the top cover.
2. Lift the front of the keyboard up and forward. Rest the keyboard upside-down on the disk drive.

If a Memory Expansion Card is **not** installed, skip to step 5.

3. Using the needlenose pliers, squeeze each of the four nylon clips securing the Memory Expansion Card to the stand-offs (see Figure 2, #1), and simultaneously lift the edge of the board nearest that stand-off. Start with the stand-off in the upper-left corner of the board and work counter-clockwise. To avoid causing damage to the printed circuit board, hold the pliers straight up.
4. Lift the Memory Expansion Card straight up and lay it aside.
5. Disconnect the keyboard cable connector from the logic board.

Replace

1. Rest the keyboard upside down on the disk drive.
2. Connect the cable from the keyboard to the logic board.

If a Memory Expansion Card is **not** installed, skip to step 5. If a Memory Expansion card **is** installed, continue with step 3.

3. Prior to installing a new keyboard in the computer, verify that four rubber feet have been installed on the solder side of the keyboard. If there are no rubber feet present, refer to "Memory Expansion Card Installation" in section 6, Additional Procedures, for placement information.

4. Place the Memory Expansion Card on the four nylon stand-offs, component side down and with the connector at the right side. **Gently** press down on the card starting at the connector side and then at each stand-off on the left side.
5. Slide the back edge of the keyboard into the slots in the side of the disk drive shield. Make sure the keyboard is seated inside the plastic guides that surround it.
6. Replace the top cover.

Note: Refer to *You Oughta Know* for replacement of individual keyswitches.

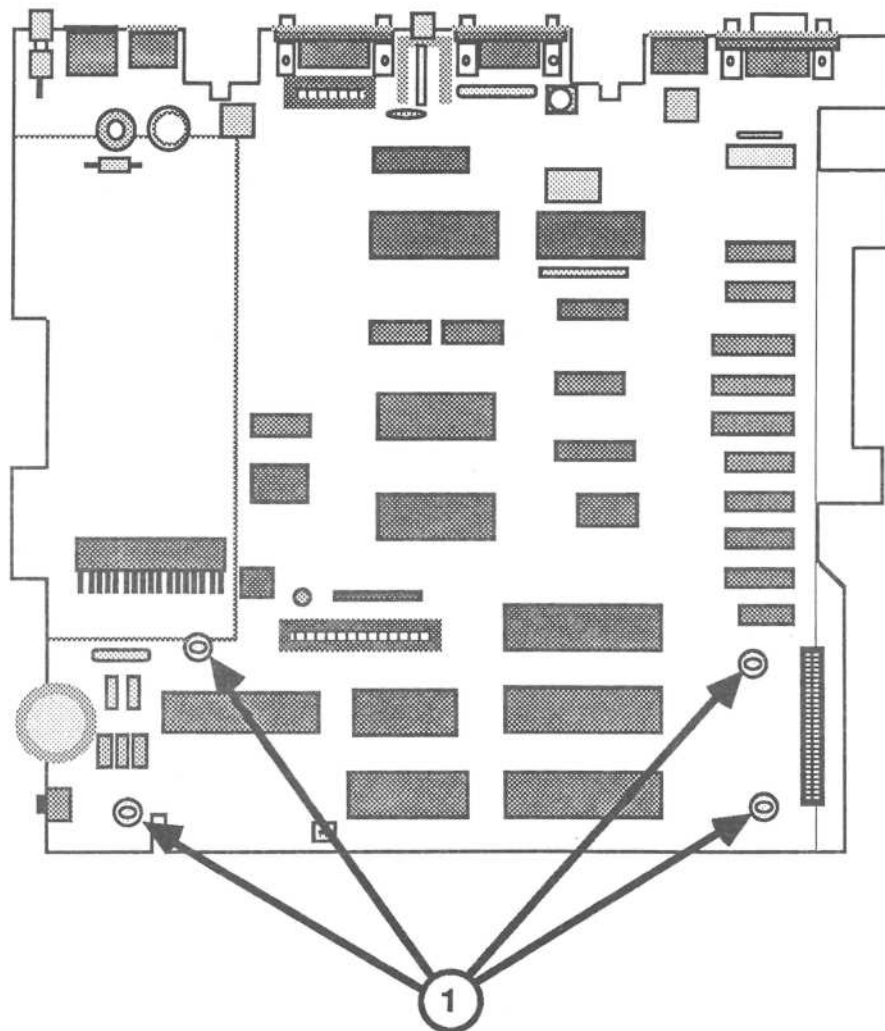


FIGURE 2

□ DISK DRIVE

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the top cover, including the four disk drive screws, and place the IIC on your work surface.
2. Lift the disk drive up and back. Place it upside down on the table behind the computer.
3. Disconnect the disk drive cable connector from the logic board.

Replace

1. Attach the disk drive cable connector to the logic board.
2. Place the disk drive in the case. Line up the disk drive door with the cutout in the case, the ground clip with the keyboard, and the tab on the keyboard with the slot in the disk drive shield.
3. Replace the top cover.

□ ANALOG CARD

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the disk drive.
2. Remove the cable from the disk drive (Figure 3, #1).
3. Remove the four Phillips screws, two from either side of the disk drive shield.
4. Pull up on the shield to remove it from the disk drive.
5. On the analog card, disconnect the cable from connector J2 (Figure 3, #2).

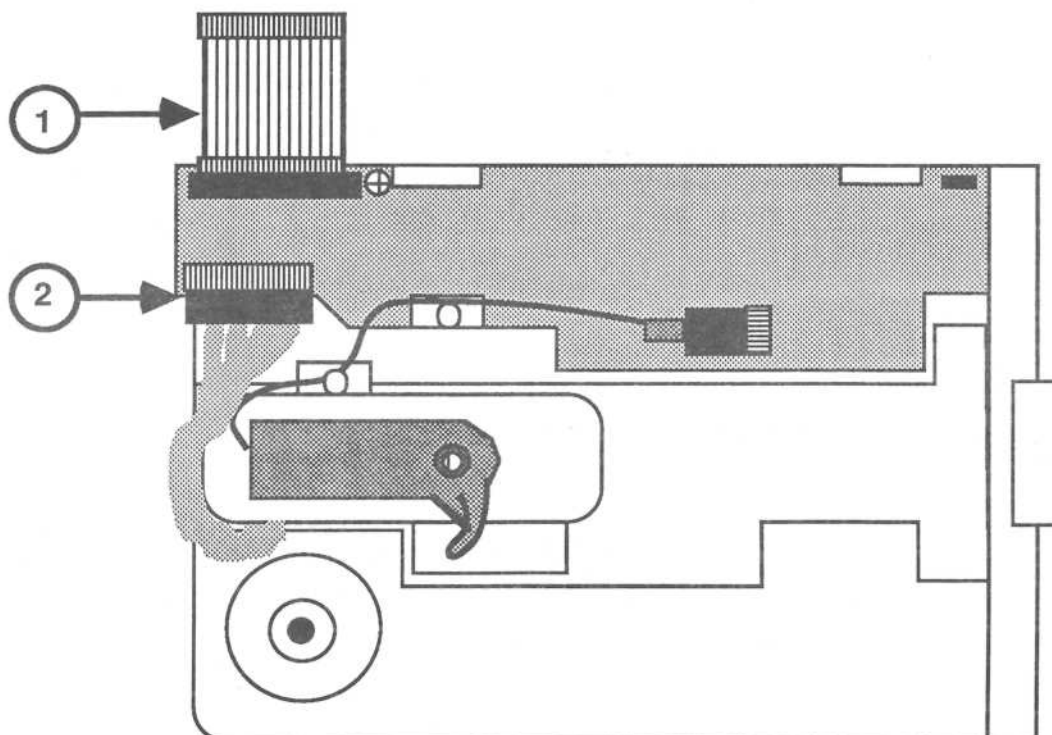


FIGURE 3

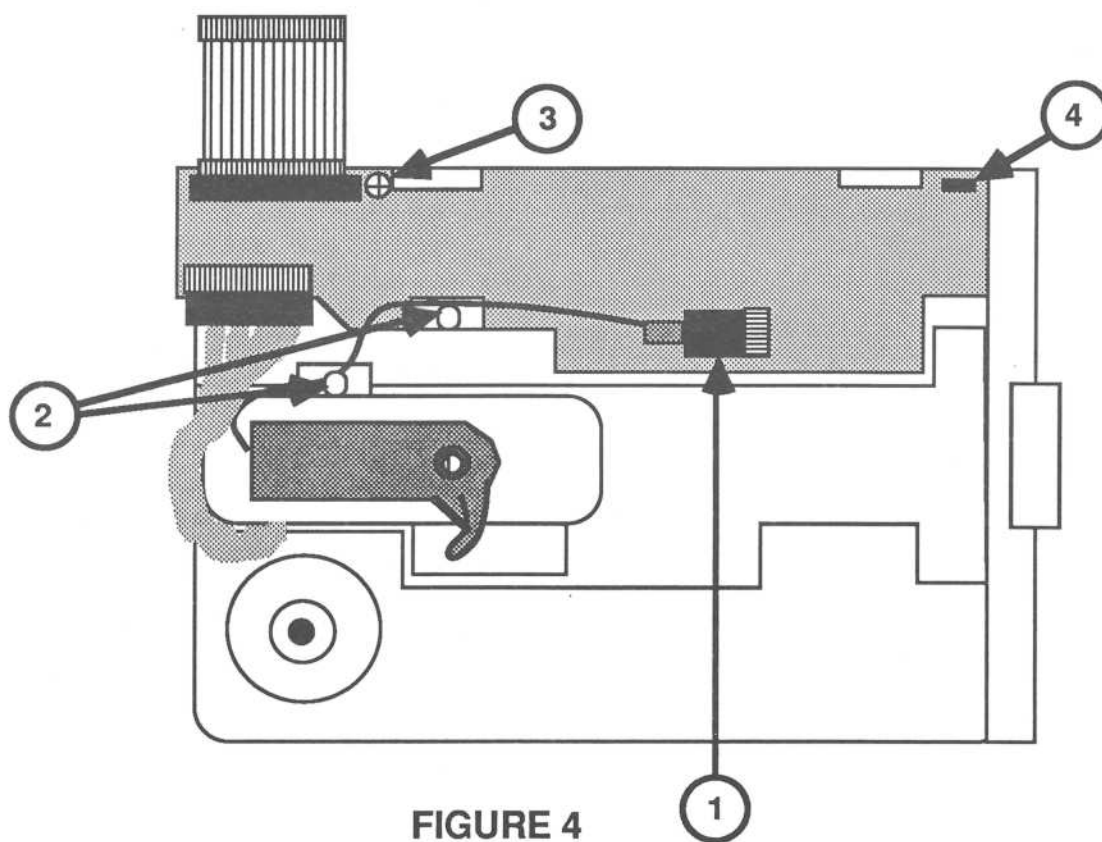


FIGURE 4

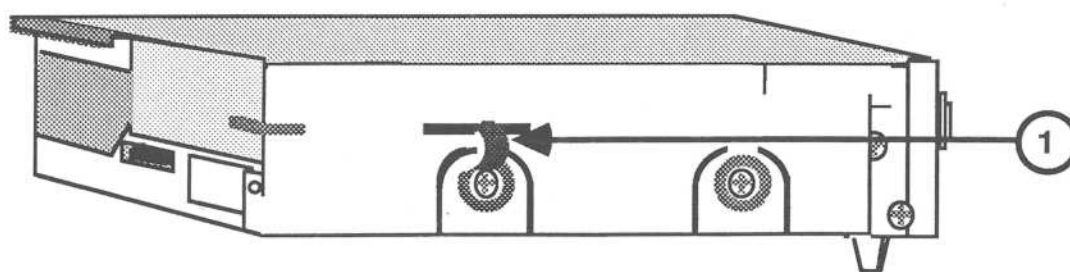


FIGURE 5

6. On the analog card, disconnect the cable from connector J3 (Figure 4, #1) and carefully remove the wire from the clips (Figure 4, #2).
7. Remove the Phillips screw that mounts the analog card to the disk drive chassis (Figure 4, #3).
8. Tilt the rear edge of the analog card slightly up, and slide the card away from the disk drive.

Replace

1. Slide the front edge of the card under the two plastic posts located on the inside of the disk drive bezel. Lay the card on the chassis so that the alignment tab (Figure 4, #4) protrudes through the hole.
2. Replace the Phillips mounting screw.
3. Look at the read/write head cable (Figure 4, #1) that attaches to connector J3, and note that only four wires are connected to the five-pin connector. Connect the read/write head cable, making sure that each wire makes contact with a pin on the header.
4. Position the wire and, if necessary, carefully bend the clips to hold it in place.
5. Connect the motor cable to connector J2. The cable should be oriented so that the end of the connector with the single wire is toward the rear of the disk drive.
6. Replace the shield and corresponding Phillips screws. Make sure the ground clip is installed at the left-front position (Figure 5, #1).
7. Replace the disk drive flat cable. Orient the cable so that the red stripe is at the rear of the disk drive.
8. Replace the disk drive.

□ MECHANICAL ASSEMBLY

Materials Required #2 Phillips screwdriver

Remove

1. Remove the analog card.
2. Replace the shield if returning the mechanical assembly to Apple for exchange.

Note: The disk drive shield must be installed on the mechanical assembly when the disk drive is sent to Apple for exchange. Also, be sure to remove the LED cable.

Replace

1. Remove the shield if present.
2. Replace the analog card.

□ BEZEL, DOOR, AND SPRING ASSEMBLY

Materials Required #2 Phillips screwdriver

Remove

1. Remove the disk drive.
2. Remove the flat cable from the disk drive.
3. Remove the four Phillips screws, two from either side of the disk drive shield.
4. Pull up on the shield to remove it from the disk drive.
5. Remove the four Phillips screws that attach the bezel to the disk drive (two screws on each side).
6. Open the disk drive door by pushing inward. As you pull the bezel from the disk drive, hold on to the spring. It is not firmly attached and may fall out.

7. To remove the door from the bezel, simultaneously push it forward and rotate the rear edge up. Now pull it backward out of the bezel.
8. Remove the spring from the door.

Replace

1. Put the door in the bezel (Figure 6, detail A).
2. Hold the door and bezel together. Slide the projecting part of the door partway into the grooves of the hub frame (Figure 6, detail B).

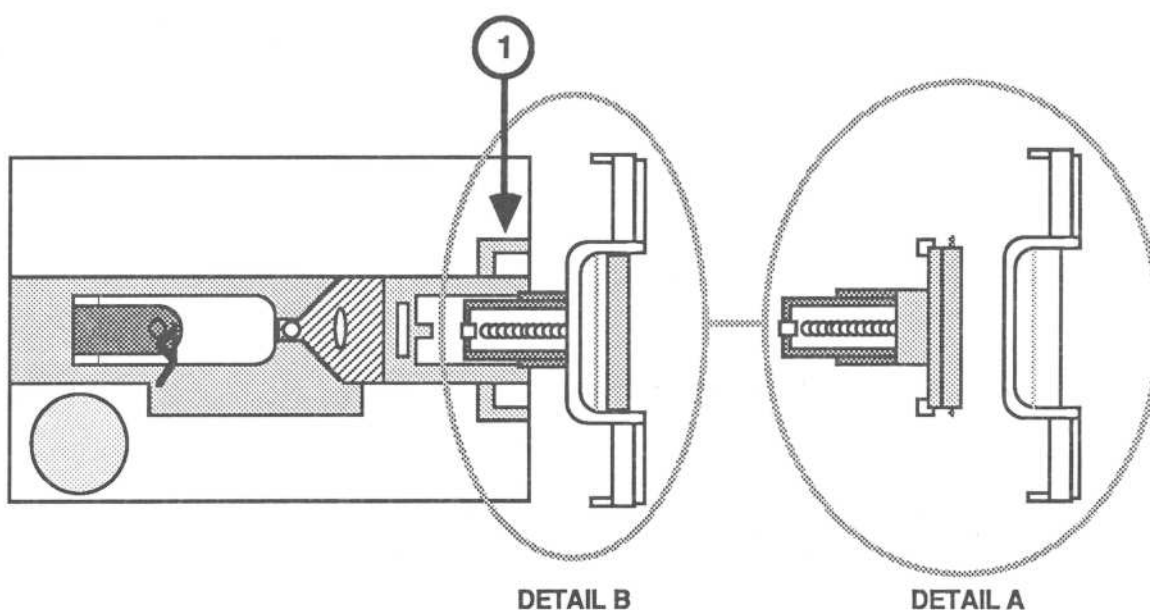


FIGURE 6

3. As you fit the bezel onto the disk drive:
 - a) Push down the hub frame so that its aluminum arms (Figure 6, #1) fit under the top edge of the bezel.
 - b) If the analog card is present, make sure that it is held in place under the two tiny posts on the inside of the bezel.
4. Install the spring. (Hint: Put one finger under the disk drive door to guide the spring.)

5. Close the disk drive door and put the bezel into place.
6. Replace the Phillips screws that attach the bezel to the disk drive.
7. Replace the shield and corresponding Phillips screws. Make sure the ground clip is installed at the left-front position.
8. Replace the flat cable. Orient the cable so that the red stripe is at the rear of the disk drive.
9. Replace the disk drive.

❑ INTERNAL POWER SUPPLY

Materials Required

#2 Phillips screwdriver

CAUTION: Make sure the power cord has been disconnected from the rear of the computer.

Remove

1. Remove the top cover.
2. Remove the two screws that mount the power supply to the case.
3. Tip the back of the power supply up a little and pull the power supply from the connector.

Replace

1. Slide the power supply into the connector.
2. Install the two screws that mount the power supply to the case.
3. Replace the top cover.

□ SPEAKER

Materials Required

#2 Phillips screwdriver
Jeweler's screwdriver
Sharp razor blade with handle

Remove

1. Remove the keyboard.
2. Use the razor to cut the glue securing the speaker to the case. Be careful not to damage the speaker, its wires, or the logic board.
3. Insert a small screwdriver under the rear lip of the speaker and pop it out of its plastic retaining clips.

Replace

1. Place the speaker so that the wires are toward the bottom of the IIC case and the top lip is under the top plastic clip on the case.
2. Press on the bottom lip until it pops under the two lower clips.
3. Replace the keyboard.

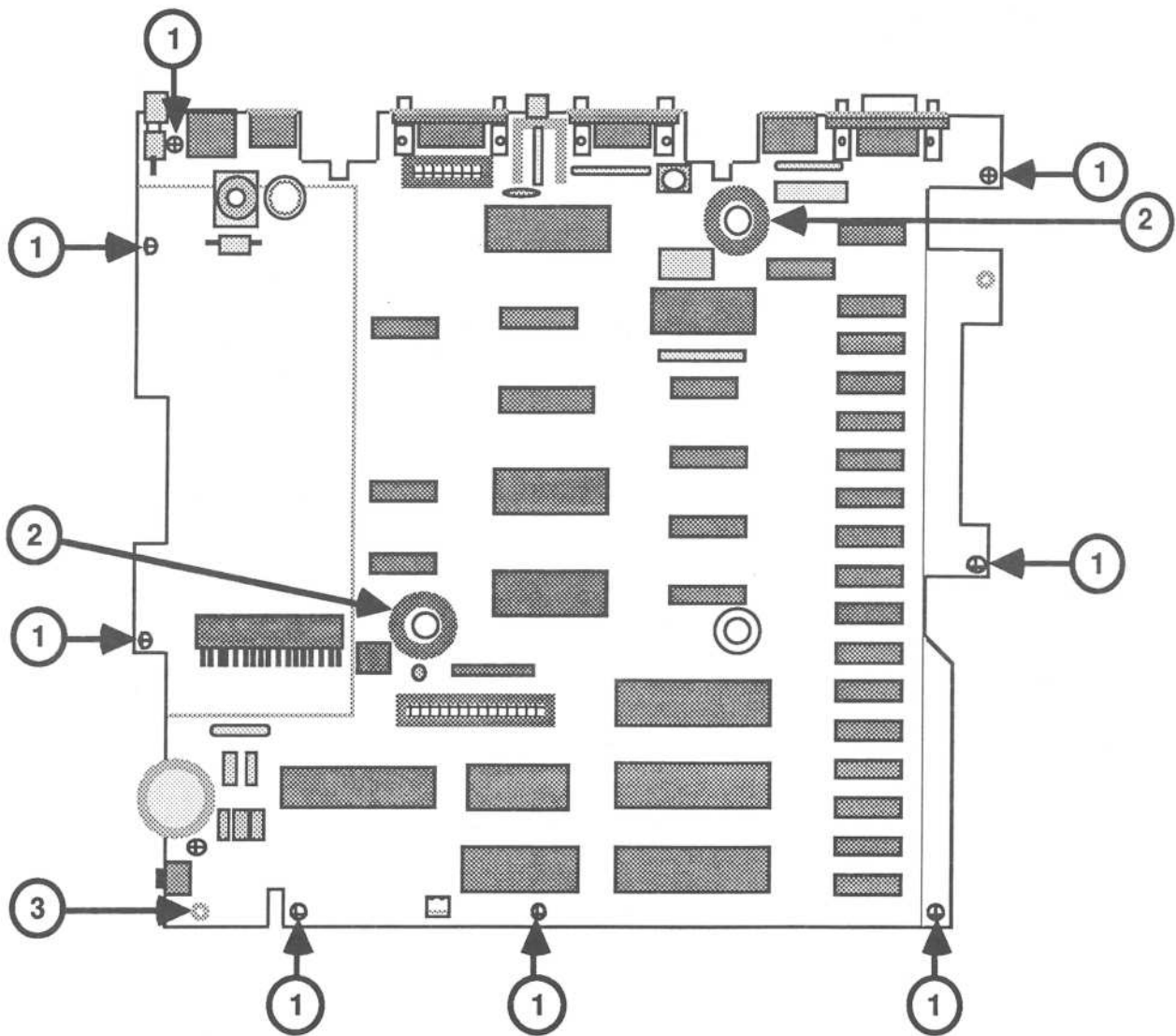


FIGURE 7

❑ LOGIC BOARD

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the top cover.
2. Remove the keyboard and Memory Expansion Card (if present).
3. Remove the disk drive.
4. Remove the internal power supply.
5. Disconnect the speaker cable.
6. Remove the screws that attach the logic board to the case (Figure 7, #1). Depending on the version of logic board installed, there will be either eight or nine screws.
7. Remove the two wire-mesh toroids (Figure 7, #2).
8. Carefully remove the logic board by lifting it off its posts and then pulling it out to the right. Be careful of the small post at the front, near the headphone connector (Figure 7, #3).

Replace

Note: Prior to installing a new logic board in the computer, verify that three rubber feet have been installed on the solder side of the board. If there are no rubber feet present, refer to "Logic Board Rubber Feet Installation" in Section 6, Additional Procedures, for installation instructions.

1. Slide the logic board into place, left side first, making sure the headphone connector is properly seated and that the board is seated on all posts.
2. Connect the speaker cable.
3. Replace the two wire-mesh toroids on their posts.

Note: The toroids must be on the correct posts to ground the disk drive.

4. Install the screws that attach the logic board to the case. Start each screw before tightening them down
5. Replace the internal power supply.
6. Replace the disk drive.
7. Replace the keyboard and Memory Expansion Card (if applicable).
8. Replace the top cover.

❑ VOLUME CONTROL

Materials Required

#2 Phillips screwdriver
Soldering iron
60/40 Rosin core solder
Desoldering tool

CAUTION: *If you are not familiar with basic soldering skills, DO NOT attempt this procedure.*

Remove

1. Remove the logic board.
2. Locate the volume control on the logic board. Turn the logic board over and carefully desolder the three volume control leads.
3. Turn the logic board over again (component side up) and remove the volume control.

Replace

1. Insert the three leads of the volume control into their respective solder holes on the logic board.
2. Hold the knob in place as you turn the logic board over. Position the logic board so that the interface connectors and the two capacitors (near the power switch) hang over the edge of the desk. Allow the volume control to rest against the top of the work surface.
3. Solder the three volume control leads to the logic board.

3. Solder the three volume control leads to the logic board.
4. Check to see that there are no cold solder joints and that the body of the control is flush against the logic board.
5. Replace the logic board.

□ POWER SWITCH

Materials Required

#2 Phillips screwdriver
Soldering iron
60/40 Rosin core solder
Desoldering tool

CAUTION: *If you are not familiar with basic soldering skills, DO NOT attempt this procedure.*

Remove

1. Remove the logic board.
2. Orient the logic board so that the interface connectors are facing away from you.
3. Locate the power switch at the upper left corner of the board.
4. Turn the logic board over and desolder the five leads coming from the power switch.
5. Turn the board over again (component side up) and remove the switch. If the switch offers too much resistance, gently rock it back and forth until it is loose enough to be easily removed.

Replace

1. Insert the five leads from the power switch into their respective solder holes in the logic board.
2. Hold the switch against the logic board so that the body of the switch remains flush against the board. Turn the board over.
3. Solder the five leads to the logic board.
4. Check to see that there are no cold solder joints, and that the body of the switch is flush against the logic board.
5. Replace the logic board.

Apple IIc

Section 3 – Preventive Maintenance

❏ CONTENTS

- 3.2 Introduction
- 3.2 Disk Drive Read/Write Head
- 3.3 Disk Drive Head Load Button

□ INTRODUCTION

The preventive maintenance procedures for the IIc all relate to the internal and external disk drives. The read/write head should be cleaned any time the computer or disk drive is being serviced. The head load button should be replaced whenever it is worn or dirty.

□ DISK DRIVE READ/WRITE HEAD

Materials Required

Cotton swabs
Isopropyl Alcohol (80% alcohol/20% water)

Procedure

1. Remove the disk drive. (see Section 2, Take-Apart or, for the external drive, "Disk Drive" in *Disk IIc Technical Procedures*, Section 1, Take-Apart.)
2. Remove the four screws, two from either side of the disk drive shield.
3. Pull up on the shield to remove it.
4. Clean the guide rails with the isopropyl alcohol. **Do not** use grease.
5. Inspect the head for worn or dull spots in the ceramic. If you find any, replace the mechanical assembly. See Section 2, Take-Apart.
6. Clean the head with the isopropyl alcohol.
7. Inspect the motor drive belt for cracks, slippage, and elasticity. If the belt is dry or cracked, or if it slips, replace the mechanical assembly. See Section 2, Take-Apart.
8. Move the read/write head assembly back and forth along the full length of its travel. Check for any blockage or friction. If there is any, replace the mechanical assembly. See Section 2, Take-Apart.

□ DISK DRIVE HEAD LOAD BUTTON

Check the head load button for contamination and wear. If the button is worn or dirty, replace it.

Materials Required

Needlenose pliers
Head load button

Procedure

1. Remove the disk drive. See Section 2, Take-Apart.
2. Remove the four screws, two from either side of the disk drive shield.
3. Pull up on the shield to remove it.
4. Lift up the head load arm. If the head load button is worn or dirty, squeeze the top part of the load button with small needlenose pliers and let the button drop down.
5. Insert the new load button through the hole in the shield plate and into the head load arm. Press the button until it snaps into place.
6. Replace the drive shield, ground clip, and corresponding screws.
7. Replace the disk drive. See Section 2, Take-Apart.

Apple IIc

Section 4 – Diagnostics

□ CONTENTS

4.2	Introduction
4.3	Things to Remember
4.3	Before You Begin
4.3	Setting Up
4.4	While Testing
4.5	Built-In Diagnostic
4.5	Running the Diagnostic
4.5	Results
4.6	Apple IIc Diagnostic Diskette
4.6	Materials Required
4.6	Main Menu
4.7	Choose Tests
4.10	Options
4.10	Special
4.11	Running the Diagnostics
4.15	Test Failures

□ INTRODUCTION

This section describes general procedures for using the Apple IIc Diagnostic, either 5.25- or 3.5-inch, on the Apple IIc. This diagnostic allows you to select the tests you wish to run and the order in which you wish to run them. It also allows you to run a continuous test, which is valuable for pinpointing the causes of intermittent failures.

Note: The 3.5-inch diskette can also run on the Apple IIgs™ and the Apple IIe. The 5.25-inch diskette can run on the Apple IIe. Refer to the *Apple IIgs and Apple IIe Technical Procedures* for more information.

□ THINGS TO REMEMBER

Before You Begin

1. Make a backup diskette before beginning! When testing a defective Apple IIc, it is possible to erase and damage sections of the diskette. Use *System Utilities* (revision 2.1.1 or higher) to make the backup copy.
2. Before you boot the diskette-based diagnostics, run the built-in diagnostics.
3. The diagnostic can be run from either the internal 5.25-inch disk drive or an external UniDisk 3.5.
4. Make sure the keyboard switch is not depressed (Sholes layout). If it is, the keyboard diagnostic will not work correctly.

Setting Up

1. If you are going to select the **Serial External Test**, the loopback cable must be installed.
2. If you are going to select the **Apple IIc Memory Expansion Card Test**, the memory card must be installed and selected. Refer to Section 6, Additional Procedures, for more information.
3. To select a test, type the letter or use the arrow keys until the name of the test is highlighted; then press <Return>.
4. When chosen, each test displays a number (1, 2, 3, etc). This number indicates the order in which the test will be performed.

5. To deselect a test, type the letter or use the arrow key until the name of the test is highlighted; then press the <Delete> key. The test sequence numbers displayed will be corrected automatically. To deselect all tests, press <Open-Apple> and <Delete>.
6. To access the **Help** screen, hold down <Shift> and <Open-Apple> and press ?.

While Testing

1. Where input is required to start the next test (after video tests, for example), press <Space>.
2. To abort any test, press <Escape>. The testing will stop upon completion of the test in progress.
3. If you select the looping function and have selected a test that needs a loopback cable or card (Serial External Test, External Memory Card RAM Test) and the cable or card is not installed, you will receive an error code.
4. When running the Character Generator Test and using a ColorMonitor IIc or AppleColor™ Monitor IIc, the video display shifts left and right and toggles between color and monochrome. (This is the normal result of the method used to display the Character Set Test.)

To make the display easier to view, depress the White Only switch during the Character Generator Test, and release the switch during all other tests.

❑ BUILT-IN DIAGNOSTIC

Before you boot the diskette-based diagnostics, run the built-in diagnostic. This will verify that the RAM, ROM, MMU, and IOU are functioning correctly.

Running the Diagnostic

To run the built-in diagnostic, hold down the <Open-Apple> and <Closed-Apple> keys while turning on the power. (To run them when the power is already on, hold down the <Control><Open-Apple><Closed-Apple> and <Reset> keys. Release the <Reset> key first, then the other keys.)

The screen will display various patterns and colors for approximately one minute. The RAM, ROM, MMU, and IOU circuitry on the logic board are being tested.

Results

The results, shown in the center of the display, will be either **System OK** (accompanied by a high-toned beep) or the name of the failed component (with a low-toned beep).

Test Passed

If you can access the built-in diagnostics and you receive the message **System OK**, continue with this section.

Test Failed

If you cannot access the built-in diagnostics or you receive a message other than **System OK**, exchange the logic board and try again.

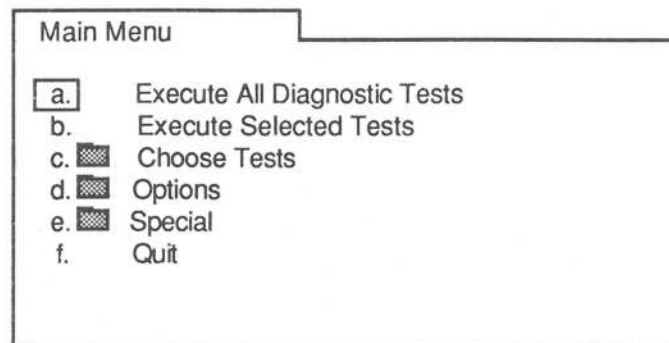
□ APPLE IIc DIAGNOSTIC DISKETTE

Materials Required

Apple IIc Diagnostic diskette
Video display and cable
Serial Loopback Cable (required for Serial External Test)
Apple IIc Memory Expansion Card (required for Memory Expansion Card Test)
AppleMouse™ IIc (Optional)
Hand Controllers II (Optional)
Joystick II (Optional)

Main Menu

The *Apple IIc Diagnostic* main menu is shown below.



The following is a list of each item in the main menu, along with a brief description of what it is used for.

Execute All Diagnostic Tests – Runs the standard tests for the Apple IIc.

Execute Selected Tests – Runs the tests selected in **Choose Tests**.

Choose Tests – Contains all the tests that can be selected for the Apple IIc. Used to select one or more tests for customized testing.

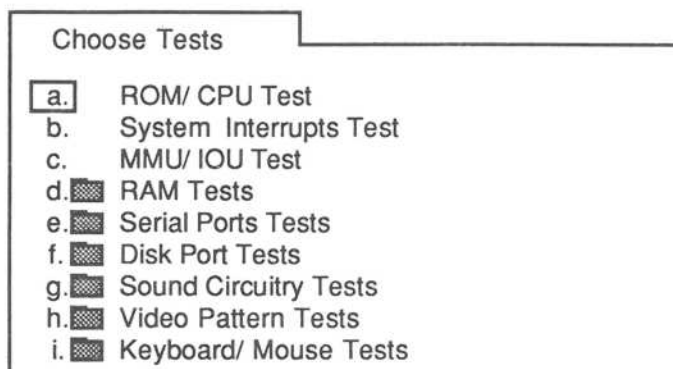
Options – Contains various selections that allow you to control how the tests are run.

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

Quit – Stops all testing and reboots the system.

Choose Tests

The **Choose Tests** folder is shown below.



The following is a list of each item in the **Choose Tests** folder, along with a brief description of each.

ROM/CPU Test – Checks the ROM and CPU.

System Interrupts Test – Checks that interrupts 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 128K on the logic board.
- Apple IIc Memory Expansion Card Test – Checks the RAM on an Apple IIc Memory Expansion Card (if installed). Testing takes approximately 45 seconds for each 256K. Refer to Section 6, Additional Procedures, for more information.

Serial Ports Folder

Serial Ports Tests – This folder contains the following:

- Serial Internal Test – Checks the logic board circuitry that handles the serial ports.
- Serial External Test (Loopback cable is required) – Checks the ports to be sure they are sending and receiving data correctly.

*Disk Port
Folder*

Disk Port Tests – 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 that are attached to the system. The diskette in the drive being tested must be ProDOS® formatted.

*Sound Circuitry
Folder*

Sound Circuitry Tests – This folder contains the following:

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

*Video
Pattern Folder*

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 full character set.

Note: When running the Character Generator Test and using a ColorMonitor IIc or Composite Monitor IIc, the video display shifts left and right and toggles between color and monochrome. (This is the normal result of the method used to display the Character Set Test.)

To make the display easier to view, depress the White Only switch during the Character Generator Test, and release the switch during all other tests.

- 80/40 Column Text Test – Displays 15 lines of characters. When the 40/80 column switch is depressed, 40 columns are displayed. When the switch is released, 80 columns are displayed.
- Low Resolution Graphics Test – Displays both pages (one and two) of low-resolution graphics with bars at the top of the screen.
- High Resolution Graphics Test – Displays both pages (one and two) of high-resolution graphics using 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.

Keyboard/Mouse Folder

Keyboard/Mouse Tests – This folder contains the following:

- Keyboard Test – Displays a keyboard layout. The instructions are given at the bottom of the screen.
- Languages – Displays a list of languages available for the keyboard tests. The default setting is U.S.A. English.
- Mouse Test – Displays a pointer that can be moved around the screen and a box that indicates whether the mouse button is pressed or not.
- Joystick/Paddle Test – Displays a pointer that can be moved around the screen and a box that indicates whether the joystick/paddle buttons are pressed or not. If testing paddles, verify that both reach the full range possible (0-FF).

Options

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

- Loop Tests Until ESC Is Pressed
- Continue On Error Until ESC

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 is a list of selections that appears when the **Special** folder is opened.

- Display Error Log – Displays the names of the tests that have failed since the last clearing of the error log (up to 255 names).
- Clear Error Log – Erases the error log from RAM.
- Clear Testing Status Line – Clears the iterations and failure counts displayed on the main menu.
- Display Current System Status – This indicates the type of system, the ROM version, the amount of memory available and whether a Memory Expansion Card is installed.
- Load Selected Test Sequence from Disk – This will load a previously saved test sequence. The sequence can then be executed.
- Save Selected Test Sequence to Disk – This will save a test sequence you have selected to the test diskette.

When any of these items is selected and <Return> 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 selection sequence that has been saved to the test diskette. Saved test sequences make it easier to test specific items that require non standard tests (see "Customized Tests," below).

Standard Test

1. Install the Serial Loopback Cable and the Memory Expansion Card, if available.

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

2. Insert the *Apple IIc Diagnostic* into either the internal or external disk drive. To run the diagnostic from the internal disk drive, turn on the computer. To run the diagnostic from the UniDisk 3.5, leave the internal drive door open.
3. Type the letter a or use the arrows to highlight **Execute All Diagnostic Tests**, and press <Return>.

To continue after certain tests (for example, Speaker or Video Patterns), press <Space>.

If an error is encountered, the testing will stop and an error message will be displayed in an alert box. Refer to "Test Failures" at the end of this section for the appropriate actions to perform.

4. On completion, the message **Testing finished** will be displayed in the alert box.

Customized Test

1. If you are going to test the serial ports and the Memory Expansion Card, install the serial loopback cable and the memory card.
2. Insert the *Apple IIc Diagnostic* into either the internal or external disk drive. To run the diagnostic from the internal disk drive, turn on the computer. To run the diagnostic from the UniDisk 3.5, leave the internal drive door open.
3. Type the letter c or use the arrows to highlight **Choose Tests**, and press <Return>.
4. From this menu, use the letters or arrows to highlight the first three tests (if desired), and press <Return> to select them.

Use the letters or arrows to highlight the other test folders and press <Return> to display them. Use the letters or arrows to highlight the tests you wish to run from each folder and press <Return> to select them.

If you wish to deselect a test, use the letters or arrows to highlight the test and press the <Delete> key. To deselect all tests, press <Open-Apple> <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 the selected test sequence saved on the diskette. The sequence may be loaded using **Load Selected Test Sequence From Disk** at a later date when it is needed.

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

To continue after certain tests (for instance, speaker or video patterns), press <Space>.

If an error is encountered, the testing will stop and an error message will be displayed in an alert box. Refer to "Test Failures" at the end of this section for the appropriate actions to perform.

7. On completion, the message **Testing Finished** will be displayed in an alert box.

Continuous Test

A continuous test is possible with all but the Keyboard/Joystick 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 the diagnostic is configured, return to the main menu and select **Options**.

2. Select **Loop Tests Until Esc Is Pressed**

A check mark should appear indicating that it has been selected.

3. Selecting **Continue on Error until Esc** will cause the diagnostic to continue running regardless of an error until <Escape> is pressed. If you wish the diagnostic to stop on an error, make sure this option is not checked.

Errors will be logged to RAM.

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

The tests will run continuously (depending on your selection in step 3) until an error is encountered or <Escape> is pressed.

If you press <Escape> to stop the testing, you can then check for error codes by selecting **Special** followed by **Display Error Log**.

Highlight either the video display or the printer for a listing of the errors encountered.

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

❑ TEST FAILURES

When a test fails, a message will be displayed indicating which one failed. The following is a list of the tests along with the recommended remedial actions for each if it fails.

Failed Tests

Remedial Action

- | | |
|-------------------------------|--|
| • <i>Rom/CPU</i> | – Exchange logic board. |
| • <i>System Interrupts</i> | – Exchange logic board. |
| • <i>MMU/IOU</i> | – Exchange logic board. |
| • <i>Main Logic Board RAM</i> | – Exchange logic board. |
| • <i>Extended Memory</i> | <ol style="list-style-type: none">1. Refer to Section 6, Additional Procedures, for more information.2. Exchange logic board. |
| • <i>Serial Internal</i> | <ol style="list-style-type: none">1. Refer to Section 6, Additional Procedures, "Logic Board Rubber Feet Installation."2. Exchange logic board. |
| • <i>Serial External</i> | <ol style="list-style-type: none">1. Refer to Section 6, Additional Procedures, "Logic Board Rubber Feet Installation."2. Verify that the loopback cable is installed.3. Exchange loopback cable.4. Exchange logic board. |

Failed Tests

- *Disk Port*

1. Verify that the diskette is inserted and the drive door is closed.
2. Verify that the diskette is not write protected.
3. Exchange logic board.
4. Exchange disk drive.

- *Speaker Tone*

1. Check volume setting.
2. Check speaker connections.
3. Exchange logic board.
4. Exchange speaker.

- *Keyboard*

1. Rerun test to verify results.
2. Check keyboard switch position.
3. Exchange keyboard.
4. Exchange logic board.

- *Mouse*

1. Check mouse connections.
2. Exchange mouse.
3. Exchange logic board.

- *Joystick/Paddle*

1. Check joystick/paddle connections.
2. Exchange joystick/paddle.
3. Exchange logic board.

Apple IIc

Section 5 – Troubleshooting

❏ CONTENTS

5.2	Introduction
5.2	General Information
5.2	Before You Start
5.2	How to Use the Symptom Charts
5.3	Things To Remember
5.3	Symptom Chart
5.3	Video Problems
5.3	Drive Problems
5.3	Peripheral Problems
5.4	Miscellaneous Problems
5.5	Special Problem Symptom Chart

□ INTRODUCTION

General Information

These procedures provide guidelines for troubleshooting the Apple IIc personal computer using the following tools:

- Apple II Diagnostic Diskette
- Symptom/Corrective Action Charts

Before You Start

Read the section entitled "Things to Remember" before you begin troubleshooting. There are a number of things you should know about the Apple IIc to troubleshoot the system effectively.

How to Use the Symptom Charts

The *Symptom Chart* describes symptoms and appropriate steps to take to correct the failure. The *Special Problem Symptom Chart* describes unusual symptoms that may appear on older model Apple IIc computers (those with model number A2S4000).

When swapping out modules, remove the suspected faulty module and replace it with a known-good spare module from your service stock. If the problem still occurs, remove the replacement module, re-install the original module in the IIc, and try swapping out the next module on the list. Repeat the procedure until the problem no longer occurs. The module you replaced just before the problem disappeared is the faulty one. As a final check of the system, run the Apple II Diagnostic Diskette.

□ THINGS TO REMEMBER

1. Follow the basic ESD precautions when troubleshooting. (Refer to Section 1, Basics, for more information.)
2. Be sure the power is off before installing or removing any modules or components, or before connecting or disconnecting any peripheral devices.

□ SYMPTOM CHART

Video Problems

- | | |
|---------------------------------|---|
| • <i>No video</i> | - Exchange logic board. |
| • <i>Random monitor display</i> | 1. Exchange logic board.
2. Exchange keyboard. |

Drive Problems

- | | |
|---------------------------------|---|
| • <i>Will not boot</i> | 1. Exchange disk drive.
2. Exchange logic board. |
| • <i>No disk access</i> | 1. Exchange logic board.
2. Exchange disk drive. |
| • <i>Continuous disk access</i> | 1. Exchange disk drive.
2. Exchange logic board. |

Peripheral Problems

- *Mouse problems*
 1. Exchange mouse.
 2. Exchange logic board.
- *Printer prints garbage*
 1. Verify configuration of printer port.
 2. Verify configuration of printer option switches.
 3. Is the correct cable being used?
 4. Refer to Section 6, "Logic Board Rubber Feet Installation."

Miscellaneous Problems

- *No power*
 1. Exchange AC power pack.
 2. Exchange internal power supply.
 3. Exchange logic board.
- *Applesoft BASIC errors*
 - Exchange logic board.
- *Stuck keys*
 - Exchange keyboard.
- *Programs run erratically, crash often*
 1. Exchange disk drive.
 2. Exchange logic board.

❑ SPECIAL PROBLEM SYMPTOM CHART

Certain failures that occur on older model (A2S4000) IIC's can be solved using the symptom chart below. The left column lists the nature of the failure. The right column refers to the procedure in Section 6 that can be used to correct the failure.

- | | |
|--|---|
| • <i>Flashing screen or wavy lines on a IIC monitor</i> | Section 6, AC Power Pack Upgrade |
| • <i>When using any serial printer or non-Apple modem:</i>
<i>a. lost characters</i>
<i>b. transmission errors</i>
<i>c. characters overrun each other.</i> | Section 6, Serial Port Upgrade |
| • <i>IIC repeatedly fails to boot, or has difficulty reading or writing.</i> | Section 6, Upper Head Shield Plate Installation |
| • <i>Power supply is turned "OFF" and the power supply turns back on by itself.</i> | Section 6, Internal Power Supply Upgrade |
| • <i>Can't access UniDisk 3.5 disk drive.</i> | Section 6, UniDisk 3.5 Compatibility |

Apple IIc

Section 6 – Additional Procedures

□ CONTENTS

- 6.2 Apple IIc - Model A2S4100
- 6.2 Memory Expansion Card Installation
- 6.6 Diagnostics and Troubleshooting
- 6.9 Logic Board Rubber Feet Installation
- 6.10 Apple IIc - Model A2S4000
- 6.10 UniDisk 3.5 Compatibility
- 6.10 Serial Port Upgrade
- 6.10 AC Power Pack Upgrade
- 6.11 Internal Power Supply Shield Retrofit
- 6.12 Upper Head Shield Plate Installation
- 6.16 Internal Power Supply Upgrade
- 6.17 Expandable Logic Board Installation
- 6.20 Expandable Logic Board ROM Upgrade

Note: If a step is underlined, detailed instructions for that step can be found in Section 2, Take-Apart.

□ APPLE IIc - MODEL A2S4100

Memory Expansion Card Installation

The Apple IIc Memory Expansion Card can be used with any Apple IIc that has a logic board containing the memory expansion connector (see Section 1, Basics, "Theory of Operation"). This card supports the addition of RAM memory in increments of 256K, to a maximum of 1,024K (1 megabyte) with 256K as the minimum configuration available. (For further information on the features of the Memory Expansion Card, refer to the *Apple IIc Memory Expansion Card Owner's Manual*, which accompanies the card.)

Things to Remember

1. The Memory Expansion Card has ICs that are **highly susceptible to damage from electrostatic discharge**. Ground yourself by touching the internal power supply case before you pick up or install the Memory Expansion Card. To further prevent any damage from electrostatic discharge, place the board in an antistatic bag before carrying it anywhere.
2. The Memory Expansion Card exchange module is shipped configured with 256K of RAM. Any additional RAM is considered a replaceable part. 256K RAM chips are **highly susceptible to damage from electrostatic discharge**. Touch the internal power supply case before handling, removing, or installing the RAM chips. **Remember to remove any additional RAM from the board you are sending to Apple. Additional or defective RAM should not be sent in on the card.**

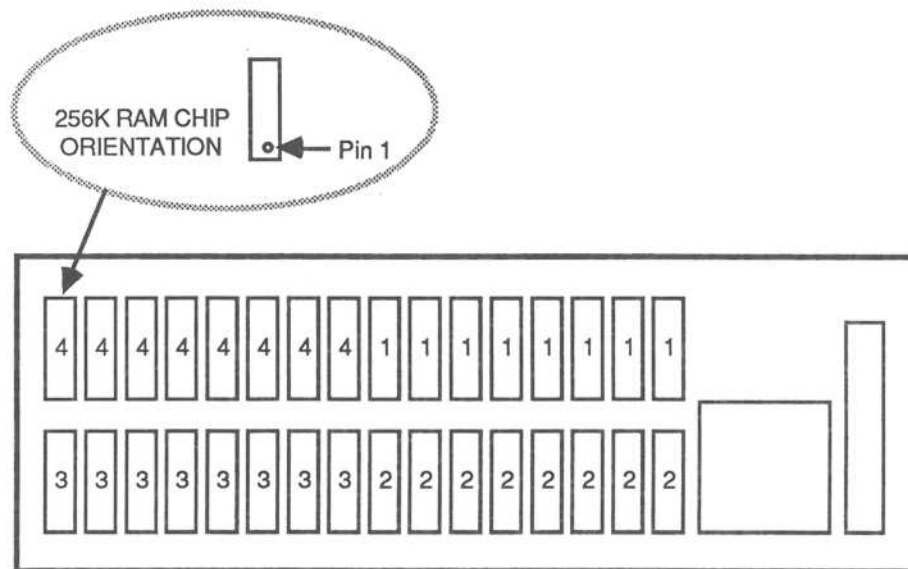
Configure the Memory Expansion Card

The Memory Expansion Card is shipped from Apple with 256K of RAM installed. To increase to 512K, 768K, or 1,024K, an appropriate number of *Apple II 256K Memory Expansion Kits* must be purchased and installed.

The RAM must be inserted in the correct sockets for the desired configuration. Remember to place the dot or indentation on the chip in the correct orientation for pin 1.

Only Apple RAM chips should be used. (Apple RAM has the letter *A* near pin 1.)

Install the RAM chips at their appropriate locations on the Memory Expansion Card. Refer to the Memory Configuration Chart for location information (Figure 1).



CARD SIZE	FILL BLOCK
256K	1
512K	1,2
768K	1,2,3
1024K	1,2,3,4

MEMORY CONFIGURATION CHART

FIGURE 1

Installation

Note: Apple IIc computers with model number A2S4100 have the connector and circuitry needed to install a Memory Expansion Card. Apple IIc computers with model number A2S4000 require a logic board upgrade **before** you install a Memory Expansion Card (see Section 6, Expandable Logic Board Installation).

1. Turn off the power and disconnect all cables from the back of the computer.
2. Remove the top cover.
3. Lift the front of the keyboard up and forward. Rest the keyboard upside down on the disk drive.
4. Insert the flared end of each stand-off into one of the four holes in the logic board, and press until it clicks into place. Repeat this for each of the three remaining stand-offs. Refer to Figure 2, #1 for stand-off locations.

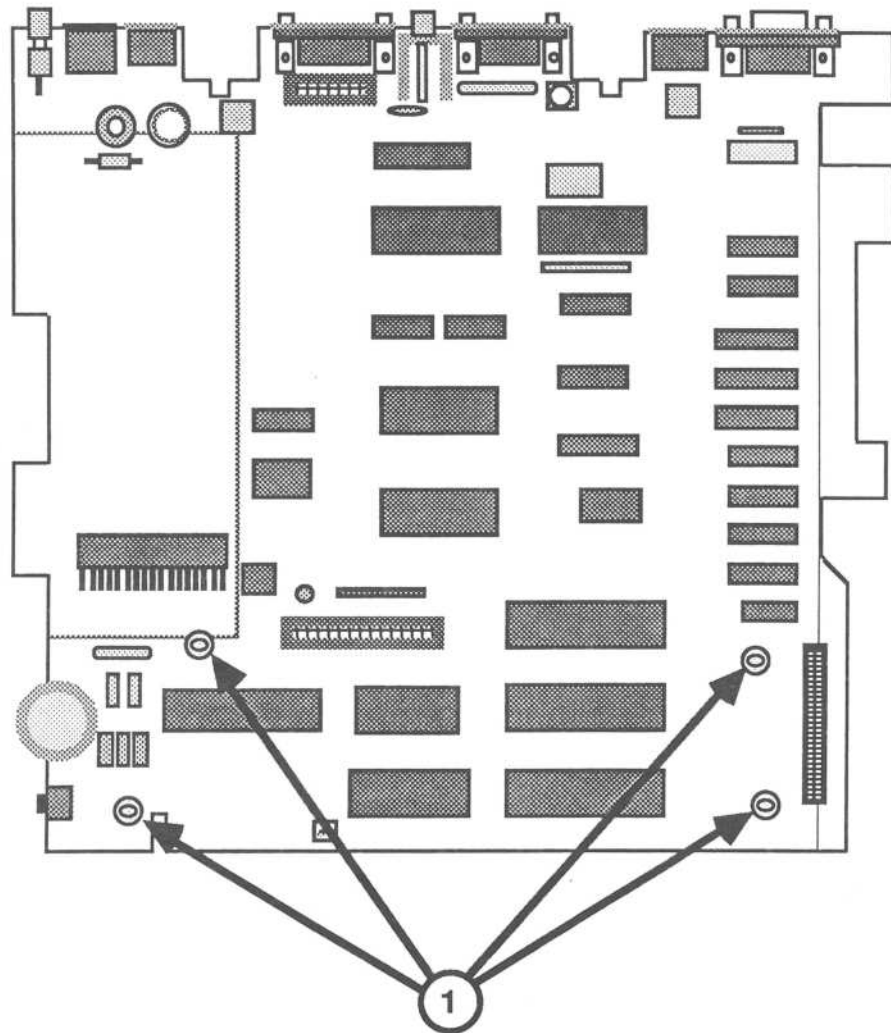


FIGURE 2

5. Install the four rubber feet supplied with the Memory Expansion Card using Figure A as a placement guide.

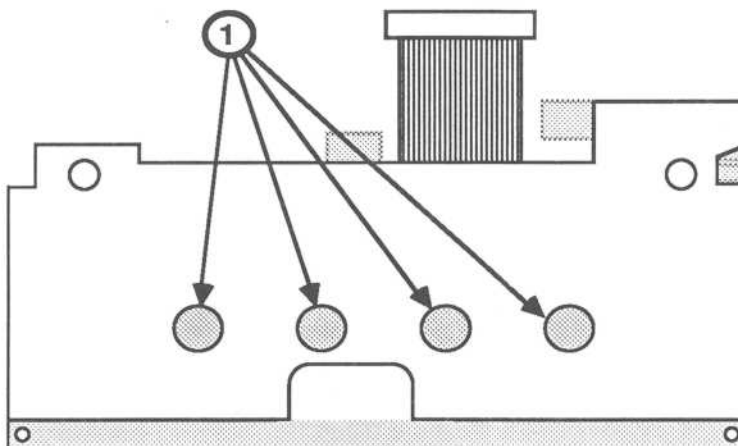


FIGURE A

6. Place the Memory Expansion Card on the four nylon standoffs, component side down and with the connector on the right side. **Gently** press down on the board starting at the connector side and then at each stand-off on the left side.
7. Replace the keyboard.
8. Run the *Apple II Diagnostic Diskette* to verify the correct operation of the card. (See "Diagnostics and Troubleshooting" later in this procedure.)
9. Replace the top cover.
10. Affix the appropriate memory ID sticker (Table 1) to the IIc case between the <OPEN APPLE> and accent mark keys.

<u>Memory Expansion Card Size</u>	<u>Memory ID Sticker</u>
256K	384K
512K	640K
768K	896K
1024K	1.15MB

Table 1

11. Return the IIC to the customer. Include the *Apple IIC Memory Expansion Card Instruction Manual*, "Tell Apple" and Warranty cards, *Apple II Utilities Guide*, and *ProDOS System Utilities Diskette*. **Do not give the Dealer's Installation Instructions or Packing List to the customer.**

Diagnostics and Troubleshooting

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

Materials Required

Known-good Apple IIC and Internal Drive
Known-good RAM chips
Apple IIC Memory Expansion Card
Apple II Diagnostic Diskette

Testing the RAM

1. Install the Apple IIC Memory Card into the memory slot.
2. Start up the *Apple II Diagnostic Diskette*. Select the **Apple IIC Memory Expansion Card Test** and run the test.

Note: The ROM on the logic board is verified before the card is tested. If the ROM on the logic board is bad an alert box will appear telling you to test the logic board ROM before continuing. Refer to Section 3, Diagnostics.

...Continued on next page

3. Two types of failures are possible on the Apple IIc Memory Expansion Card:

- a) If a RAM chip fails, a numbered location on the board will be indicated on the screen (Figure 3).

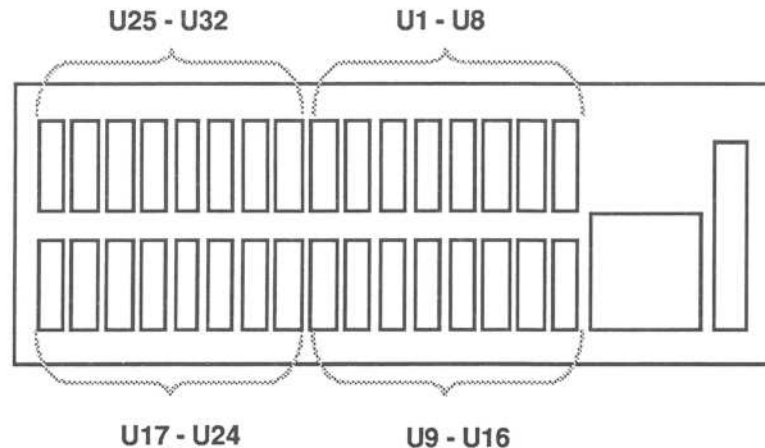


FIGURE 3

- 1) Locate the RAM and replace it with a known-good RAM chip.
 - 2) Retest the card.
 - 3) Repeat steps 1) and 2) until the card passes.
- b) If the problem cannot be corrected by replacing a RAM chip, the screen will tell you to exchange the entire card.
- 1) Remove all the RAM from the customer's card.
 - 2) Test the module being used for exchange.
 - 3) Install the customer's RAM onto the new module.
 - 4) Run the Apple IIGS Memory Expansion Card Test.
 - 5) Return to the beginning of this step until the card passes.

Logic Board Rubber Feet Installation

1. If the logic board is presently installed in the computer, remove the logic board.
2. Cut a piece of polyester tape about one inch long.

Note: A roll of this tape can be ordered from Apple Service. See your *Service Programs Manual* for ordering information.

3. Place the tape over the metal shield at the location shown in Figure B, #1. It is important that the tape **completely** cover the circular area of the shield.
4. Place the three rubber feet at the locations shown in Figure B, #2.

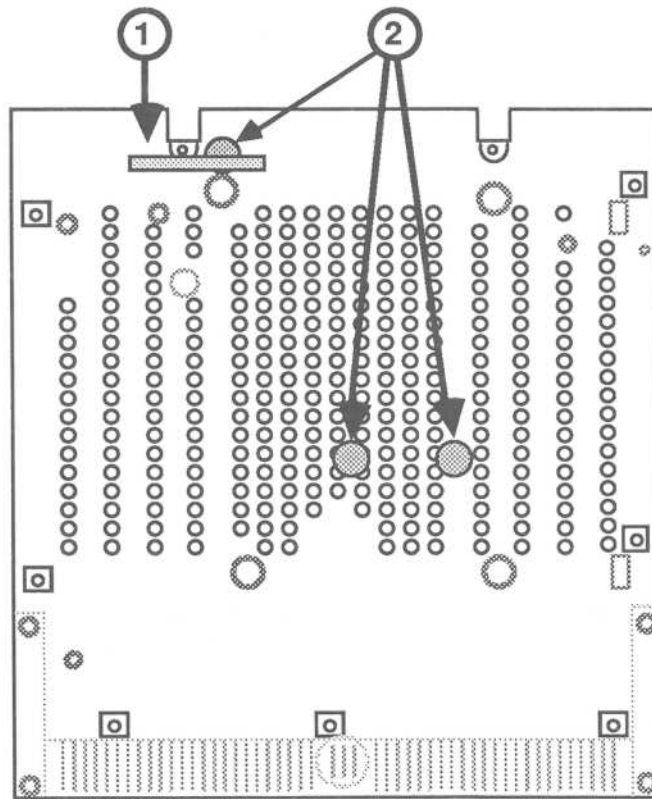


FIGURE B

□ APPLE IIc – MODEL A2S4000

UniDisk 3.5 Compatibility

To utilize a UniDisk 3.5 with an Apple IIc, a new monitor ROM is required. All new Apple IIc's (model A2S4100) have the ROM included. Apple IIc's, model A2S4000, with a serial number greater than F6051GFA, also contain the new monitor ROM.

Customers with a UniDisk 3.5 who purchased an Apple IIc system with a serial number less than F6051GFA will need a ROM upgrade. Exchange the customer's logic board with an upgraded board free of charge. Refer to "Apple IIc Product Notices" in your *Apple Service Programs* manual for additional information.

Serial Port Upgrade

If a customer has problems with devices connected to either of the Apple IIc serial ports, here's what to do:

1. Connect the serial device (printer or modem) to either a known-good Apple IIc or an Apple IIe with a Super Serial Card.
2. Try to transmit to the serial device.

If the device works, swap the logic board of the Apple IIc in question. Refer to your *Apple Service Programs* manual for exchange information.

If the device does not work with the known-good IIc or IIe, the device, cabling, or configuration is faulty.

AC Power Pack Upgrade

If you encounter a flashing screen or wavy lines on a Monitor IIc, check the date code on the AC power pack. The date code is printed in black on the bottom of the AC power pack. The first two digits in the date code indicate the week and the last two digits indicate the year of manufacture.

If the date code is earlier than **45 84**, replace the AC power pack. Check the Price Pages in the *Apple Service Programs* manual for the current price of the AC power pack.

Internal Power Supply Shield Retrofit

If the Apple IIc internal disk drive repeatedly has difficulty reading or writing a diskette, it might be because the IIc internal power supply is not properly shielded. Refer to Figure 4 to determine whether your power supply is shielded.

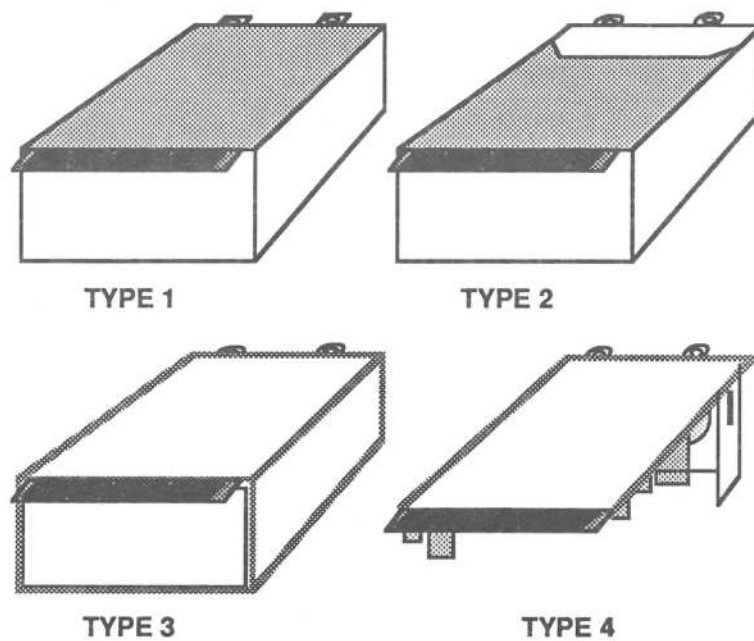


FIGURE 4

The power supply labeled *Type 1*, with the PC board totally exposed, is not shielded. *Type 2* is adequately shielded by the metal bracket across the back of the PC board. *Type 3* is shielded by being fully enclosed. *Type 4*, though completely open, is adequately shielded.

If you have a *Type 1* power supply, use the shield from the power supply in your IIc spares kit and order a new shield. If the drive continues to have reading/writing difficulty, the problem could be the disk drive.

Adding the Power Supply Shield

1. Remove the top cover.
2. Remove the internal power supply.
3. Turn the power supply so that the soldered side of the circuit board is facing up.
4. Slide the shield, hole side first, over the connector end of the power supply. When the shield is in position, you will be able to see **only** the circuit board, and no soldered areas, through the holes.
5. Replace the power supply.

After you put the shield on the customer's power supply, rerun the latest disk drive diagnostic to see if the problem has been fixed. If it has, replace the cover of the IIc.

If the problem has not been fixed, swap the disk drive. Rerun the disk drive diagnostic to verify that the problem has been fixed.

If the problem remains, replace the customer's power supply (without the shield) and disk drive, and send the unit to Apple.

Upper Head Shield Plate Installation

If the IIc repeatedly fails to boot or has difficulty reading or writing, the cause of the problem may be an unshielded disk drive read/write head assembly. To determine if the drive is shielded, lift the head load arm (Figure 5, #1), and compare it with Figures 6 and 7. Figure 6, with the metal plate installed on the head load arm, is completely shielded. Figure 7, without the metal plate installed, is unshielded.

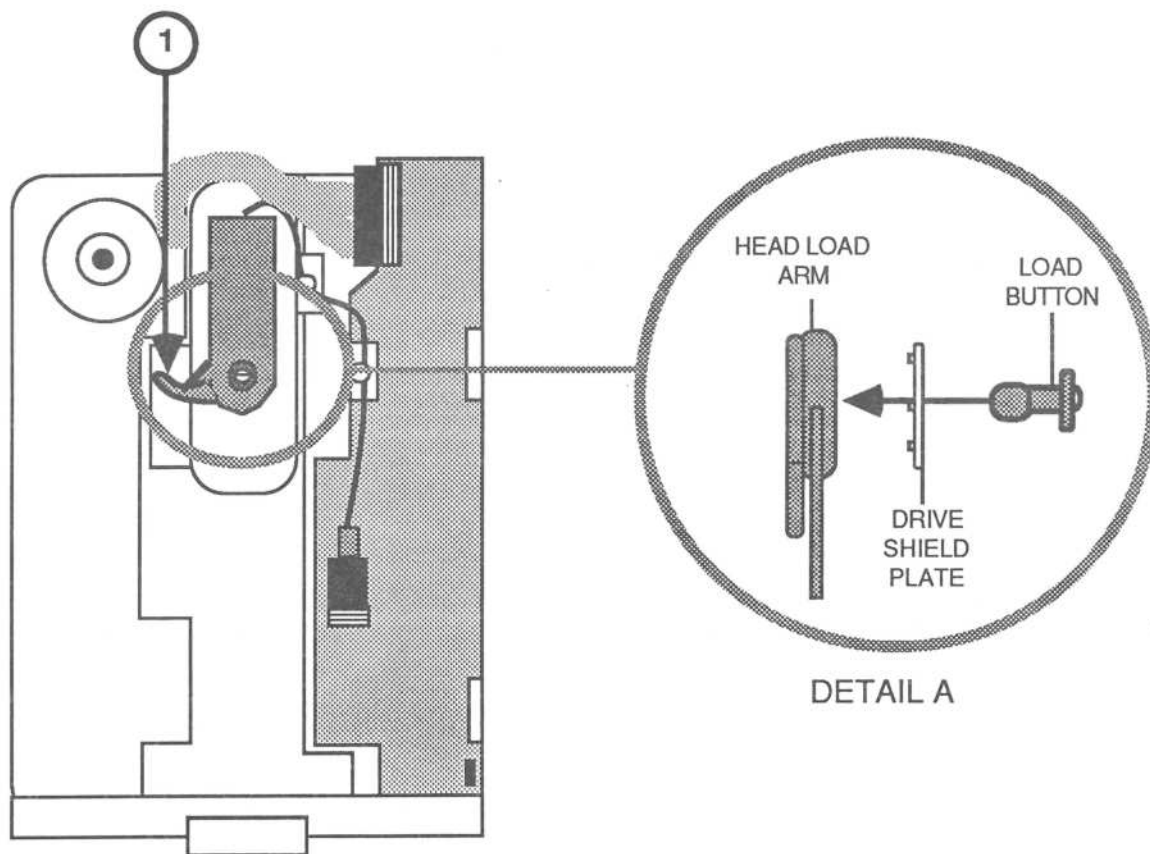


FIGURE 5

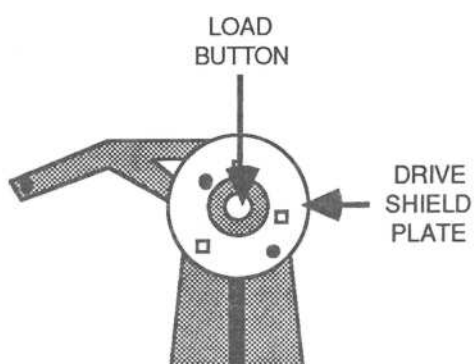


FIGURE 6

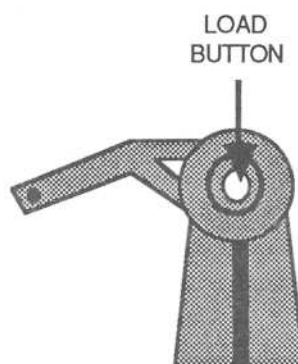


FIGURE 7

If your disk drive looks like Figure 7, install the upper head shield plate. If booting or read/write failures persist, replace the disk drive.

During this procedure, check the head load button for contamination and wear. If the button is worn or dirty, replace it.

Installation

1. Remove the top cover.
2. Remove the disk drive.
3. Remove the four screws, two from either side of the disk drive shield.
4. Pull up on the shield to remove it.
5. Lift up the head load arm, squeeze the top part of the load button with small needlenose pliers, and let the button drop down.
6. Place the upper head shield plate against the head load arm. The raised ridges should face the arm, and the circular opening should line up with the opening in the arm (Figure 8).
7. Reinstall the button (or install a new one if necessary). Insert it through the hole in the shield plate and into the head load arm (Figure 9, detail A). Press the button until it snaps into place.
8. Replace the disk drive shield, ground clip, and corresponding screws.
9. Replace the disk drive.
10. Replace the top cover.

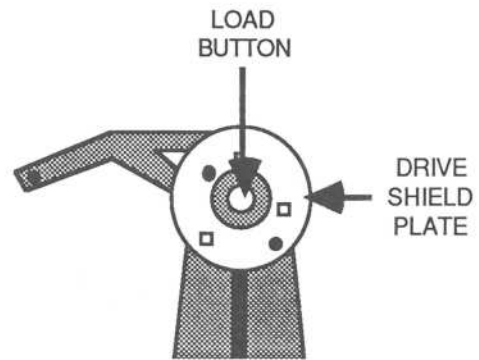


FIGURE 8

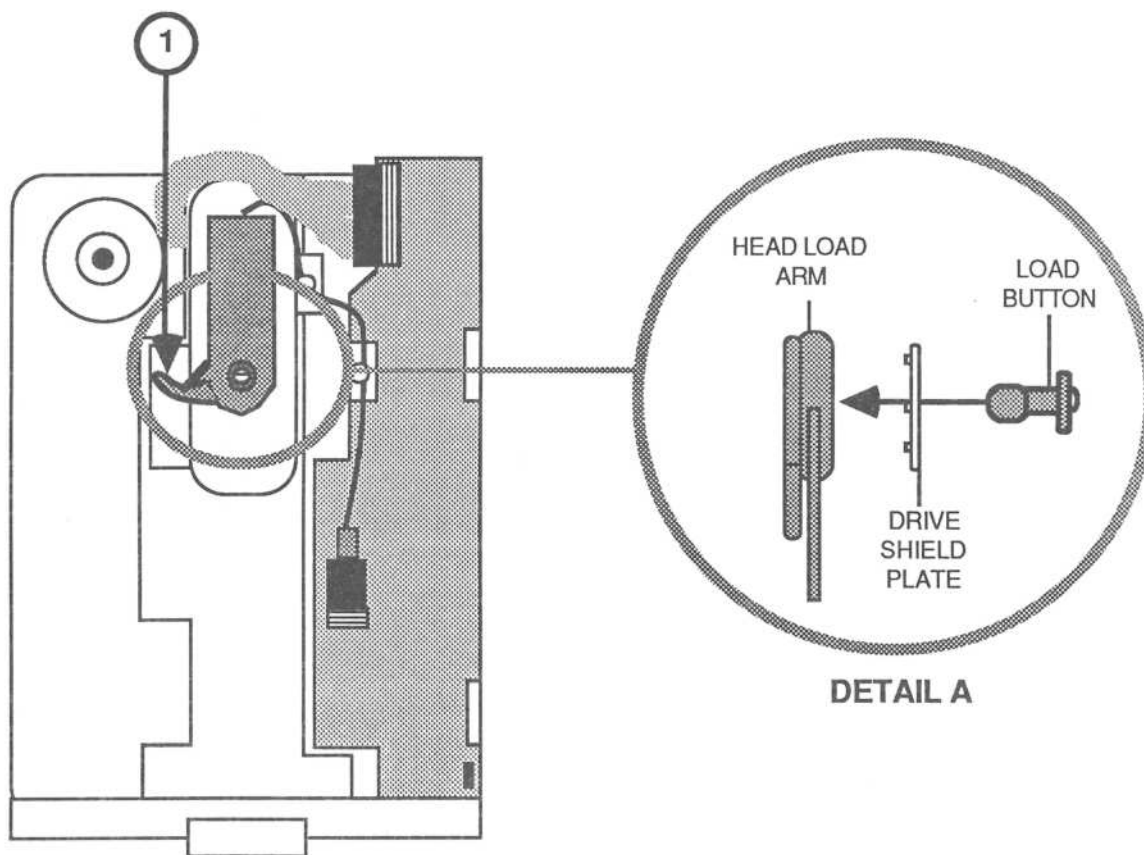


FIGURE 9

Internal Power Supply Upgrade

Check the customer's internal power supply for:

1. The marking "TDK" (Figure 10, #1).
2. A date code between 8501 and 8526 (Figure 10, #2).
These power supplies occasionally turn themselves back on spontaneously. When they do, all RAM on the logic board can be damaged.

Note: Black ink markings in either place indicated in Figure 10, #3, designates a reworked power supply that has had the problem corrected. These power supplies do not need to be exchanged.

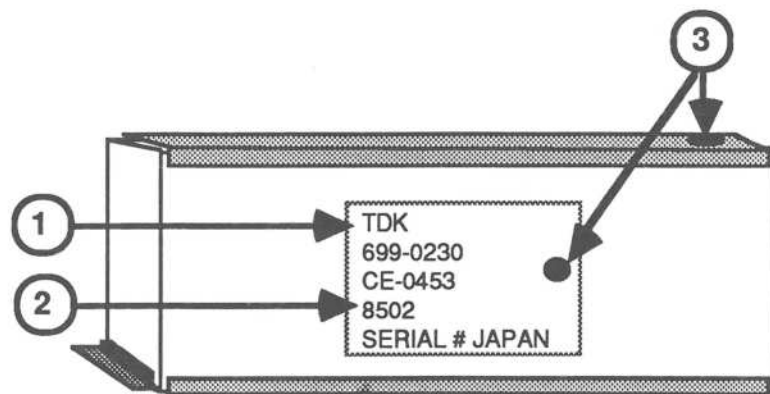


FIGURE 10

If the logic board is bad and the internal power supply meets the above criteria, exchange both modules.

If the logic board is good and the internal power supply meets the above criteria, exchange the internal power supply.

Expandable Logic Board Installation

The Apple IIc Logic Board Upgrade Kit contains an enhanced version of the original IIc logic board. The enhancement, an expansion connector, allows the addition of a Memory Expansion Card (see "Memory Expansion Card Installation" earlier in this section). This card yields a maximum memory configuration of 1.15 megabytes of RAM.

The Expandable Logic Board Upgrade Kit provides customers who own older versions of the Apple IIc with a cost-effective way to gain this memory expansion capability.

Note: This upgrade will also permit the use of a UniDisk 3.5 with the Apple IIc.

Return Information

The old IIc logic board **must** be returned in the Apple-approved packaging for credit. The shipping instructions must be followed **exactly** as stated on the *Apple IIc Logic Board Upgrade Kit Product Return* form.

The logic board **must** be placed in an anti-static bag. Failure to do so could lead to ESD (electrostatic discharge) damage to the board.

Installation

1. Turn off the power to the IIc, and disconnect the power cord and any attached peripherals.
2. Remove the logic board.
3. Install the new Apple IIc logic board.

Note: Some Apple IIc bottom cases contain an additional set of standoffs located underneath the internal power supply. If the IIc you are upgrading contains these standoffs, use a pair of diagonal cutters to cut them off **before** attempting to install the new logic board. (Do not confuse these extra standoffs with the two standoffs that the internal power supply is attached to.)

4. Replace the internal power supply.
5. Replace the disk drive.

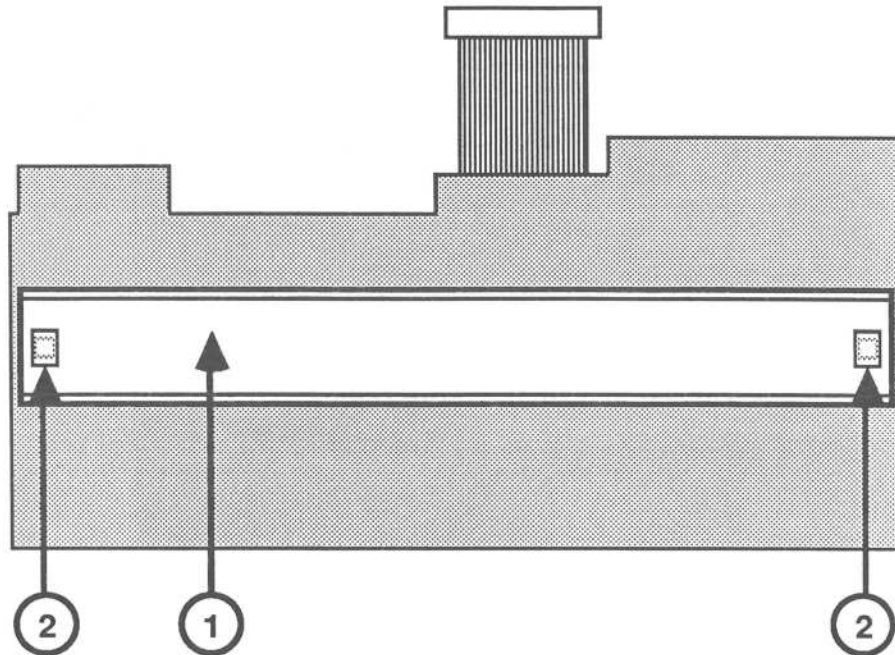


FIGURE 11

6. Some IIc keyboards have a plastic brace attached to the bottom (Figure 11, #1). Before reinstalling the keyboard, check to see if this brace is present. If it is, perform steps 6a through c, to replace the brace. If there is no brace, proceed to step 7.
 - a) Using a pair of needlenose pliers, squeeze the nylon mounting button holding the brace to the keyboard. At the same time, pull the brace away from the keyboard (Figure 11, #2). Repeat for the other mounting button, and remove the brace.
 - b) Insert the small end of the new mounting button through the hole at each end of the new brace.
 - c) Place the new brace on the back of the keyboard. Align the holes in the brace with the two mounting buttons. Press down on the brace until it clicks into place.
7. Replace the keyboard.
8. Plug the power cord into the power socket.

9. Run the *Apple II Dealer Diagnostics*, Part Number 077-0232, to make sure the computer operates correctly.

Note: Earlier versions of Dealer Diagnostics will not operate correctly on the enhanced IIc logic board and therefore will not test correctly.

10. Install the new FCC label on the bottom side of the IIc case. The label should cover the present label or engraving (Figure 12).

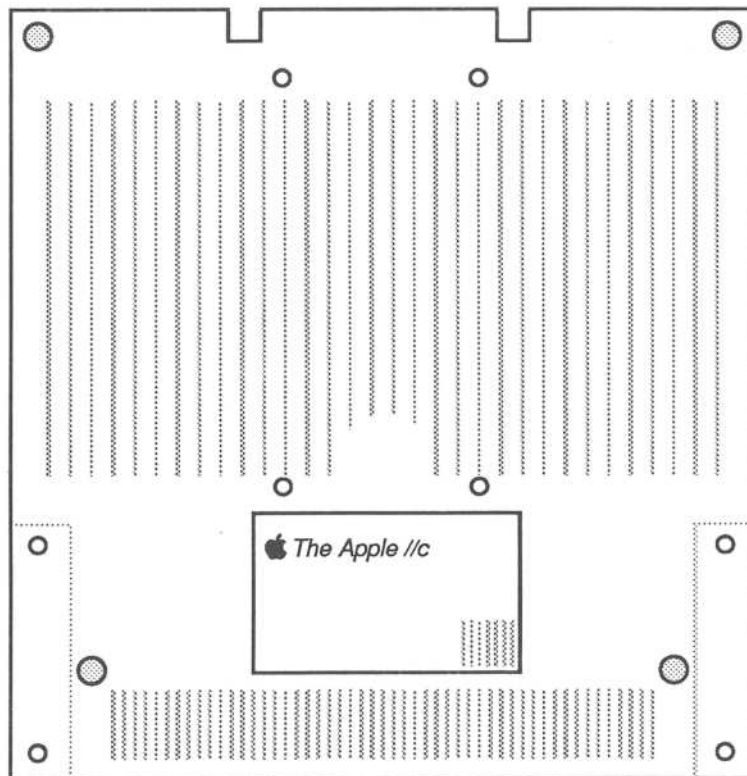


FIGURE 12

11. If you are installing a Memory Expansion Card, see the installation instructions earlier in this section, before you proceed to step 12.

12. Replace the top cover.
13. Return the IIc to the customer. Include the *New Features Update* and the Warranty card. **Do not give the dealer's installation instructions or packing list to the customer.**

Expandable Logic Board ROM Upgrade

There is a ROM upgrade available that corrects a minor bug when using terminal mode.

The old ROM is P/N 342-0445-A; the new replacement ROM is P/N 342-0445-B.

Materials Required

ESD equipment
IC extractor
ROM P/N 342-0445-B

Procedure

1. Set up the ESD equipment (refer to the *You Oughta Know Technical Procedures*).
2. Remove the top cover.

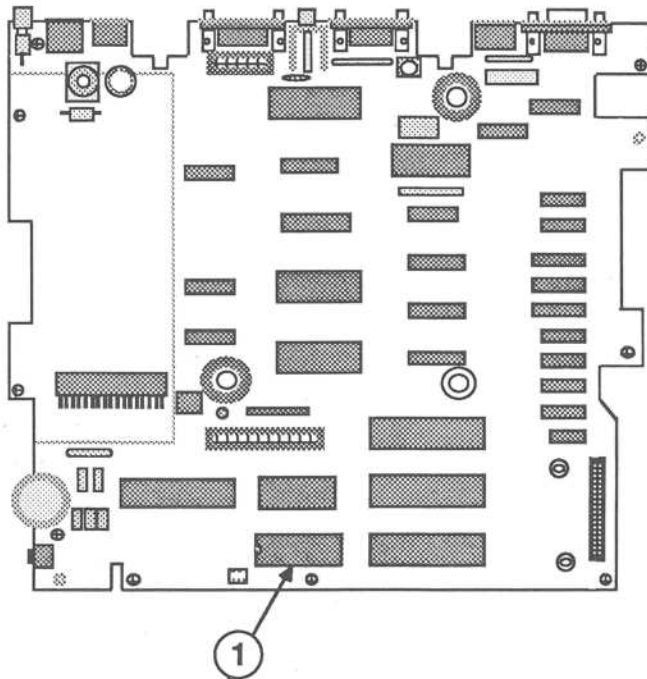


FIGURE 13

3. Remove the Memory Expansion Card, if present.
4. Locate the ROM at location D19 (Figure 13, #1) and verify that it is the old ROM (P/N 342-0445-A).
5. Using an IC extractor, remove the old ROM installed at location D19 (Figure 13, #1).
6. Install the new ROM in the same location, D19 (Figure 13, #1). There is a notch at one end of the ROM. This notch should line up with the white dot on the logic board.
7. Replace the Memory Expansion Card, if it was present.
8. Replace the top cover.
9. Run the diagnostics to verify that the machine is functioning correctly.

Apple IIc

Section 7 – Adjustments

□ CONTENTS

7.2 DSPEED

Note: If a step is underlined, detailed instructions for that step can be found in Section 2, Take-Apart.

□ DSPEED

This adjustment procedure was written to be used with the *Apple 5.25-Inch Disk Drive Diagnostic*—if the test indicates that you need to adjust the drive speed. All information on setting up and running the diagnostic is in the *Disk Drives Technical Procedures*, Section 1, 5.25-Inch Drive Diagnostic.

Materials Required

Apple 5.25-Inch Disk Drive Diagnostic diskette
Disk Drives Technical Procedures
Small (jeweler's) flatblade screwdriver
Apple IIc with video display

Making the Adjustment

To adjust the DSPEED (drive motor speed):

1. Start the DSPEED diagnostic running (see the *Disk Drives Technical Procedures*, Section 1, 5.25-Inch Drive Diagnostic).

2. Turn the Apple IIc upside down, and locate the DSPEED adjustment hole in the bottom of the case.

Note: When you make the DSPEED adjustment, keep the disk drive flat.

3. The adjustment is extremely sensitive, so turn the adjustment screw very slowly. The indicator on the screen will move back and forth, showing changes of the speed.
4. Adjust the speed so that the indicator is within the "good" range, as close to 0 as possible. Let the test run for 30 seconds.

5. Press <Escape> to return to the main menu; then repeat the test.

Does the DSPEED now stay within the "good" range?

- Yes—Press <Escape> to return to the main menu.
 - No—If the DSPEED cannot be properly adjusted, return the faulty mechanical assembly to Apple.
6. Remove the *Apple 5.25-Inch Disk Drive Diagnostic* diskette from the external drive.

Apple IIc

Illustrated Parts List

❏ CONTENTS

- IPL.3 Finished Goods Assembly (Figure 1)
- IPL.5 Memory Expansion Card (Figure 2)

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

Note: There are two replacement keyboards for the Apple IIc. When ordering them, you should be aware of the following differences:

- "Keycap Set, Beige" keyboards replace the original IIc keyboards, which rest on top of a black sheet of plastic.
- "Alps" keyboards replace other Alps keyboards, which do **not** rest on a plastic sheet.

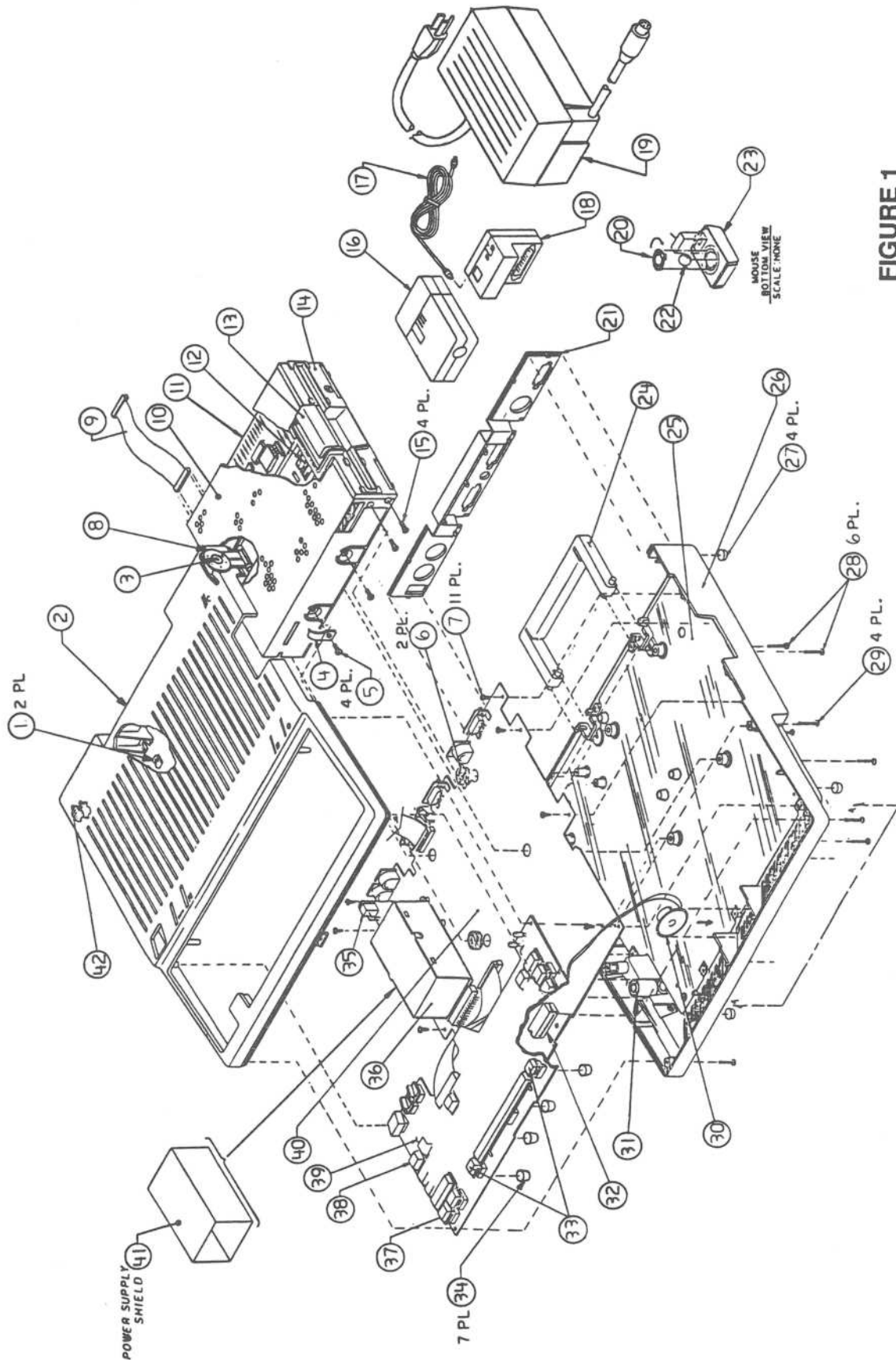


FIGURE 1

□ APPLE IIc - FINISHED GOODS ASSEMBLY (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	835-0174	U Type Nut
2	612-5029	Apple IIc Top Case with Back Panel
3	U815-0664	Load Button
4	805-0877	Ground Clip
5	400-1604	Screw, Disk Drive Shield
6	875-0049	Grounding Washer
7	430-1019	Tap Screw 4-24 x .250
8	805-5038	Upper Head Shield Plate
9	590-0181	Internal Disk Drive Cable
10	661-0264	Apple IIc Drive Mechanical Assembly
11	661-0265	Apple IIc Drive Analog Board
12	870-0023	Spring, Disk Door (Latch)
13	815-0811	Disk Drive Door (Latch), Beige
	815-0587	Disk Drive Door (Latch), Platinum
14	815-0810	Disk Drive Bezel
15	970-0473	Screw, Disk Drive Bezel
16	699-0242	RF Modulator Switch Box
17	699-0228	RF Modulator Cable
18	699-0220	RF Modulator
19	699-0424	AC Power Pack (110v)
20	815-0409	Mouse Ball Retainer
21	815-0813	Back Panel
22	699-8001	Rubber Coated Mouse Ball
23	661-0259	Apple II Mouse, Beige
	661-0400	AppleMouse, Platinum
24	865-0030	Handle, Beige
	865-0027	Handle, Platinum
25	725-0014	Bottom Shield Insulator
26	612-5030	Apple IIc Bottom Case
27	865-0021	Foot
28	400-1612	Screw, 6-32 x 3/4
29	430-1020	Tap Screw, 4-24 x .750, PN CRS Rec. A
30	600-0349	Speaker
31	109-0648	Volume Control Knob
32	342-0445	IC, ROM, Apple IIc Logic Board, Expandable
33	705-0040	Keyswitch, Low Profile (for original IIc keyboard)
	970-1262	Apple IIc Alps Keyswitch
34	865-0003	Rubber Foot
35	705-0041	On/Off Switch
36	661-71182	Apple IIc Power Supply (Internal)
37	705-0102	Keyswitch, Alternate
	970-1263	Alps Keyswitch, Locking
38	658-7055	Keycap Set, Beige (for original IIc keyboard)
	658-7083	Alps Keycap Set, Beige
	658-7096	Alps Keycap Set, Platinum
39	661-0294	Apple IIc Alps Keyboard, Beige
	661-0361	Apple IIc Alps Keyboard, Platinum
40	661-91177	Apple IIc Logic Board
	661-0359	Apple IIc Logic Board, Expandable
41	612-5004	RFI Shield Assembly, Power Supply
42	825-0907	Logo

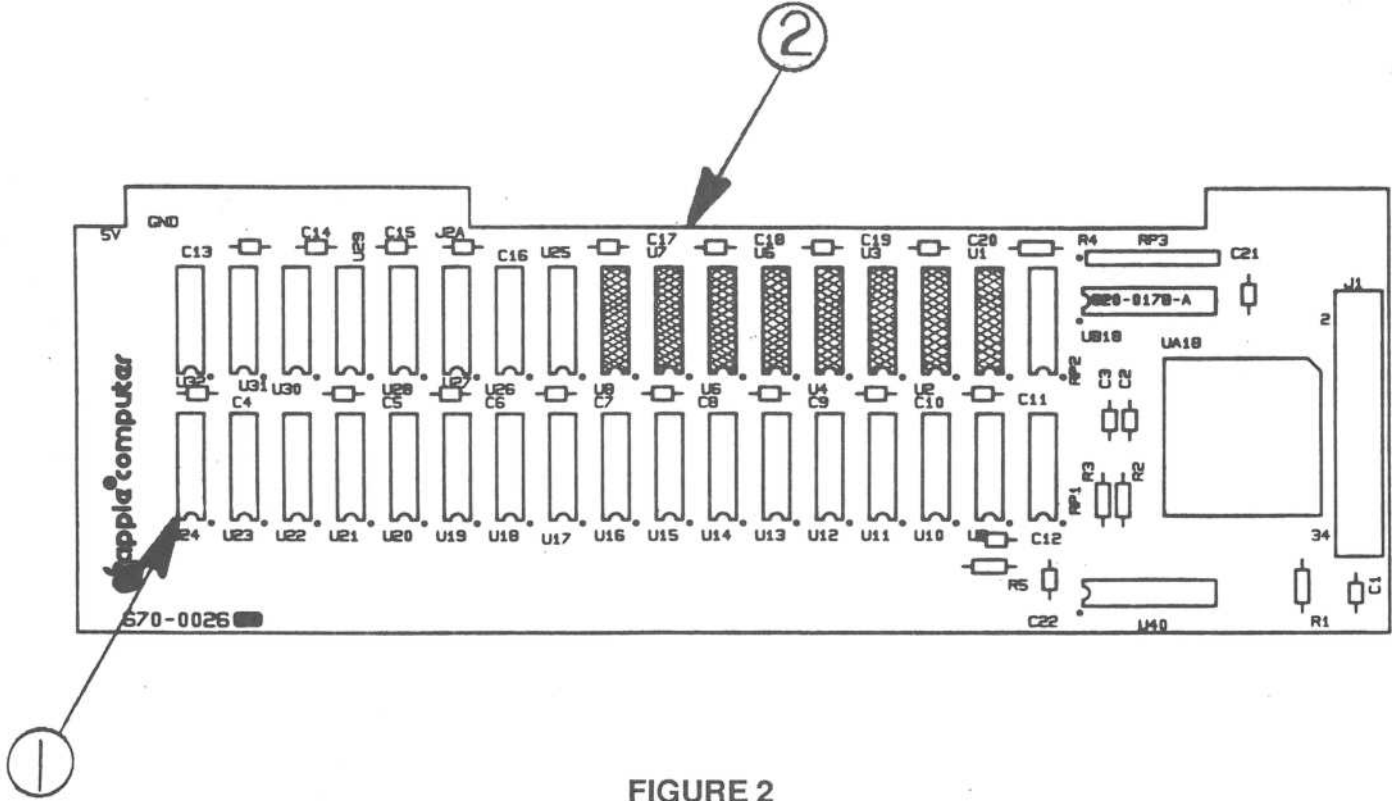


FIGURE 2

□ APPLE IIc – MEMORY EXPANSION CARD (Figure 2)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	334-0021	IC, RAM, 256K
2	661-0360	Apple IIc Memory Expansion Card

Note: The eight ICs that are shadowed in Figure 2 are soldered to the Memory Expansion Card. The 24 sockets on the card can be filled with 256K RAM ICs for memory expansion.