

Apple Service Technical Procedures Apple II Family

Volume One

PN: 072-0229

Apple IIc Plus

Technical Procedures

❏ TABLE OF CONTENTS

Section 1 – Basics	1.2	Product Description
	1.2	Specifications
	1.3	Interface Ports and Connectors
	1.5	Theory of Operation
	1.5	Introduction
	1.6	Logic Board
	1.7	Power Supply
	1.7	Disk Drive
	1.7	Keyboard
Section 2 – Take-Apart	2.2	Top Case
	2.4	Keyboard
	2.6	Disk Drive
	2.9	Eject Button
	2.11	Power Supply
	2.12	Logic Board
	2.15	Speaker
Section 3 – Diagnostics	3.2	Introduction
	3.2	Things to Remember
	3.2	Before You Begin
	3.2	Setting Up
	3.3	While Testing
	3.4	Built-In Diagnostic
	3.4	Running the Diagnostic
	3.4	Results
	3.5	Apple IIc Plus Diagnostic
	3.5	Main Menu
	3.6	Choose Tests
	3.8	Options
	3.9	Special
3.9	Running the Diagnostics	
	3.13	Test Failures

**Section 4 –
Troubleshooting**

- 4.2 Introduction
- 4.2 General Information
- 4.2 How to Use the Symptom Charts
- 4.3 Symptom Charts
- 4.3 Video Problems
- 4.3 Drive Problems
- 4.4 Peripheral Problems
- 4.4 Miscellaneous Problems

**Illustrated
Parts List**

- IPL.3 Finished-Goods Assembly (Figure 1)

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Apple IIc Plus

Section 1 – Basics

□ CONTENTS

1.2	Product Description
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1.3	Interface Ports and Connectors
1.5	Theory of Operation
1.5	Introduction
1.6	Logic Board
1.7	Power Supply
1.7	Disk Drive
1.7	Keyboard

□ PRODUCT DESCRIPTION

The newest member of the Apple IIc family, the IIc Plus, sports a 3.5-inch 800K internal disk drive replacing the original 5.25-inch 140K drive, and a faster 65C02 microprocessor operating at up to 4 MHz. The keyboard has also been changed to match the keyboard of the Apple IIgs.

Specifications

The specifications that follow are identical to those for the original Apple IIc in many respects. Any items that are different are printed in *italics*.

Central Processing Unit (CPU)

- *65C02 operating at up to 4 MHz*
- 8-bit data bus
- 16-bit address bus

Memory

- 128K RAM, expandable through the memory expansion connector

Note: The Apple IIc Memory Expansion Card is **not** compatible with the IIc Plus. Compatible memory cards can be purchased from third-party manufacturers.

- 32K ROM

Video

- 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 composite output
- Video expansion port supports an optional RF modulator or Flat Panel Display

Mass Storage

- *3.5-inch 800K internal disk drive*
- UniDisk™, Apple 5.25 Drive, UniDisk 3.5, Apple 3.5 Drive, or Disk IIc external drives (optional)

Input/Output

- Built-in speaker
- Hand Controller/Joystick/Mouse port
- 2 RS-232 serial ports
- External video port
- External disk drive port
- Composite video connector

Keyboard

- 63 keys
- 128-character ASCII set, including 32 control characters
- DVORAK or Sholes standard layout, switch selectable

Indicators

- Power
- Disk activity

Interface Ports and Connectors

Specific interface port pin-outs, signal descriptions, and connector information can be found in the *Peripheral Interface Guide*.

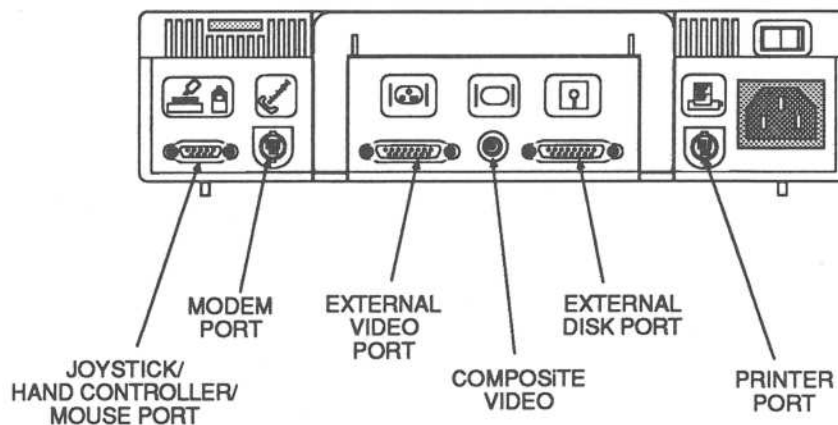


FIGURE 1

- **Joystick/Hand Controller/Mouse Port**
Supports Mouse IIc, Joystick IIc, Hand Controllers IIc
- **Modem Port**
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
Mini DIN-8 connector
- **External Video Port**
RF modulator support
Flat Panel Display (optional)
RGB output
- **Composite Video Connector**
NTSC composite—monochrome and color
- **External Disk Port**
Supports the UniDisk™, Apple 5.25 Drive, UniDisk 3.5, Apple 3.5 Drive, and Disk IIc
- **Printer Port**
Identical to modem port (see above)

□ THEORY OF OPERATION

Introduction

Troubleshooting can be approached in many different ways. Apple recommends two methods in particular:

- Logical troubleshooting
- Module swapping in a particular order for a particular symptom

Most troubleshooting charts in the *Apple Service Technical Procedures* 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 your search for the problem. This section will provide you with the information necessary to perform logical troubleshooting of the Apple IIc Plus. The information here includes a description of each module in the IIc Plus and the various functions it performs. (For definitions of basic terms refer to Simplified Overview of a Microcomputer System under the tab *You Oughta Know*.)

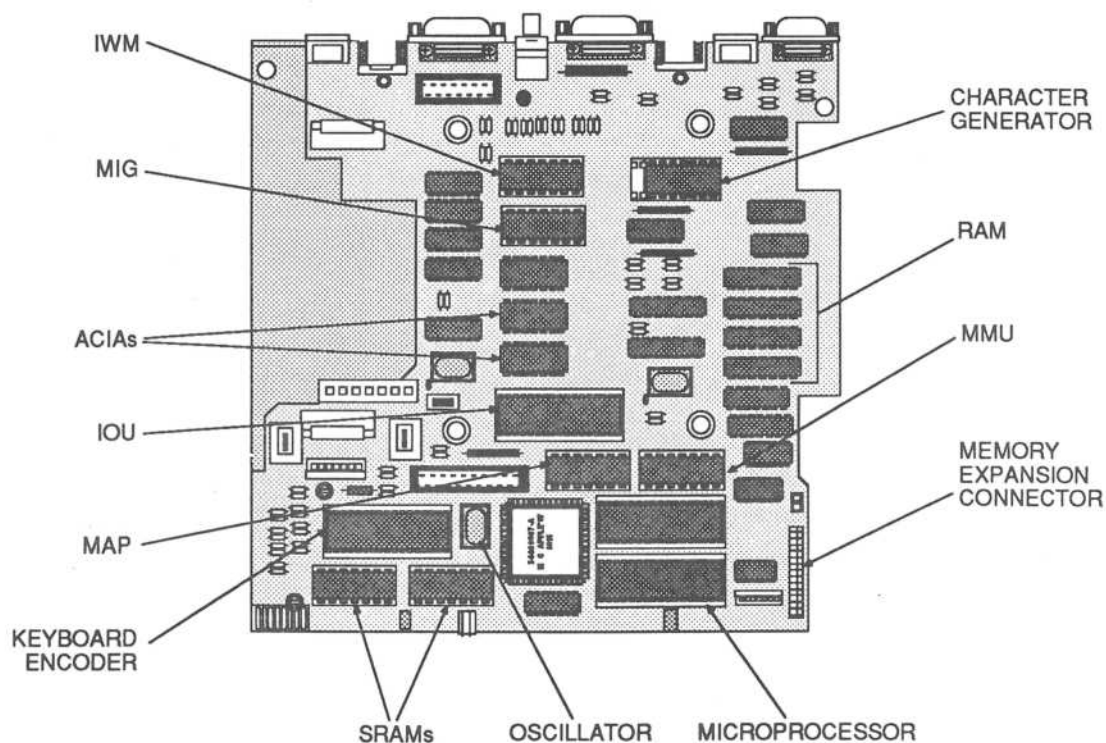


FIGURE 2

Logic Board

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

- The **Central Processing Unit (CPU)**, an enhanced 65C02 microprocessor, gets instructions from memory, translates them, and carries them out. The CPU communicates with all components on the logic board.
- An **Application-Specific Integrated Circuit (ASIC)** implements a custom accelerator circuit supporting both 1.024- and 4-MHz operation.
- Four **64K x 4-bit Dynamic RAMs (DRAMs)** provide 128K of read/write memory to store programs and data on a temporary basis.
- Two **8K x 8-bit Static RAMs (SRAMs)** provide a data cache for the accelerator circuit.
- **32K of Read-Only Memory (ROM)** 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 **Multidrive Interface Glue (MIG)** chip provides a RAM cache and hardware interface for the 3.5-inch disk drive.
- 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 **3600-PRO Keyboard Encoder** interprets data sent from the keyboard when a key is pressed.

- The **Oscillator** 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.
- The **Character Generator** provides the bit patterns for characters to be displayed.
- A **Memory Expansion Connector** allows you to add an optional third-party memory card.

Power Supply

The power supply generates the +5, +12, and -12 volts DC needed by the system.

Disk Drive

The disk drive provides 800K of permanent storage for the system. The drive connects to the logic board through a flat ribbon cable. The flow of data between the logic board and the disk drive is channeled through the IWM disk controller, which controls reading and writing operations.

Keyboard

The keyboard 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.

Apple IIc Plus

Section 2 – Take-Apart

❏ CONTENTS

2.2	Top Case
2.4	Keyboard
2.6	Disk Drive
2.9	Eject Button
2.11	Power Supply
2.12	Logic Board
2.15	Speaker

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

□ TOP CASE

Materials Required

#1 Phillips screwdriver

Remove

1. Turn off the computer and disconnect all cables from the back of the computer, if necessary.
2. **Carefully** place the computer upside-down on a **padded** work surface.

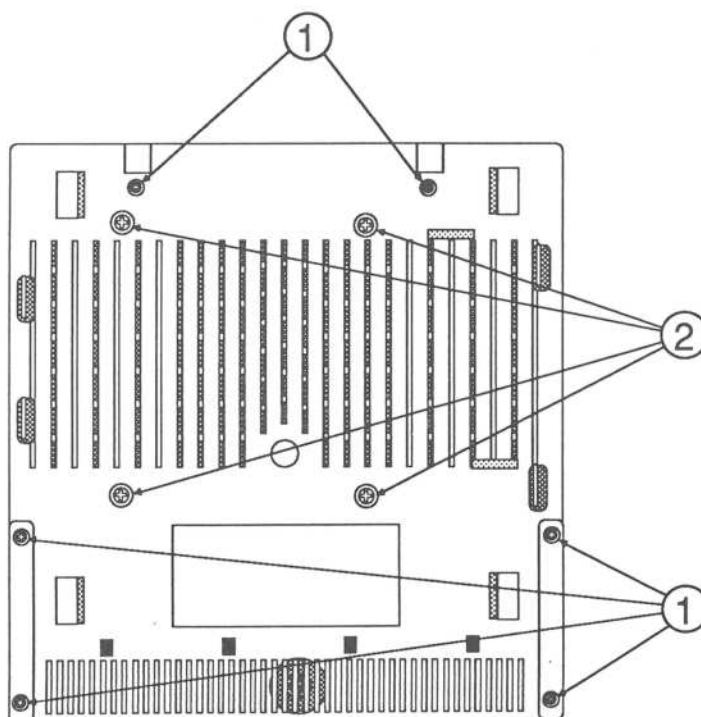


FIGURE 1

3. Remove the six Phillips screws (Figure 1, #1) that secure the top case to the bottom case.
4. **If you are replacing the disk drive, logic board, or eject button**, remove the four Phillips screws (Figure 1, #2) that secure the disk drive to the bottom case.
5. Turn the computer over and place it on the work surface.

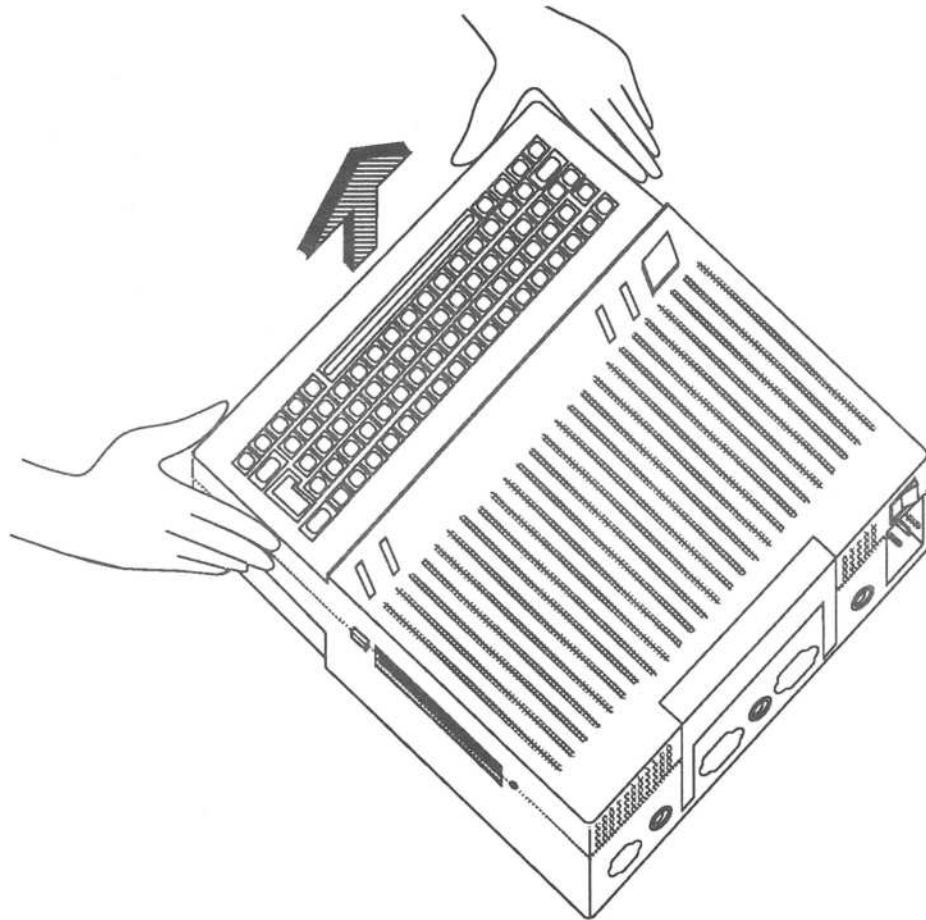


FIGURE 2

6. Place each thumb on the front of the top case (approximately one-third of the distance in from the edge) and your index fingers on the side of the bottom case near the upper-right and -left corners of the keyboard (Figure 2). Simultaneously press the top case back and up until the front of the top case comes loose.
7. Pivot the top case up and remove it toward the rear of the computer.
8. Remove the handle and lay it aside.

Replace

1. If the handle is not already in place in the top case, place the handle in its slots in the bottom case.
2. Place the top case in position so that the bottom edge of the rear panel mates with the rear edge of the bottom case.

3. Lower the front of the top case and press down until the case "clicks" into place. Carefully turn over the computer and place it on the work surface.
4. **If you removed the disk drive screws,** replace them.
5. Replace the six top case screws.

□ KEYBOARD

Materials Required

None

Remove

1. Remove the top case.

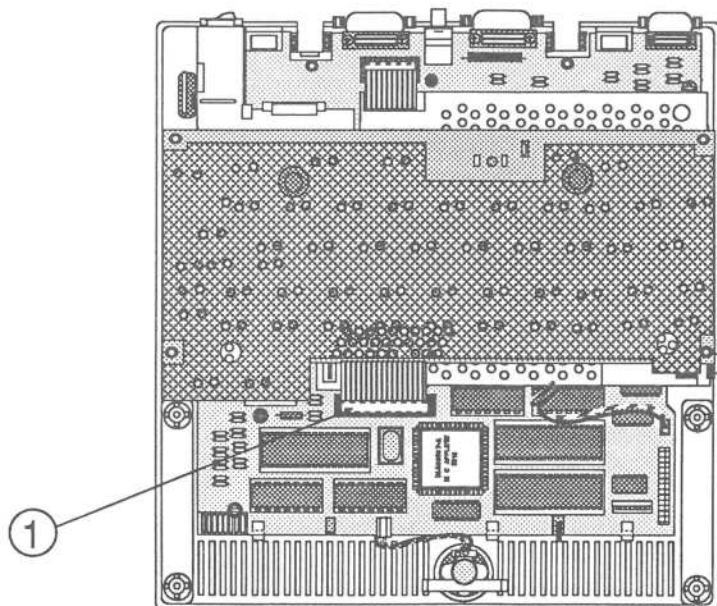


FIGURE 3

2. Lift the keyboard up and disconnect the keyboard cable from logic board connector J9 (Figure 3, #1).

Replace

1. Connect the keyboard cable to logic board connector J9.

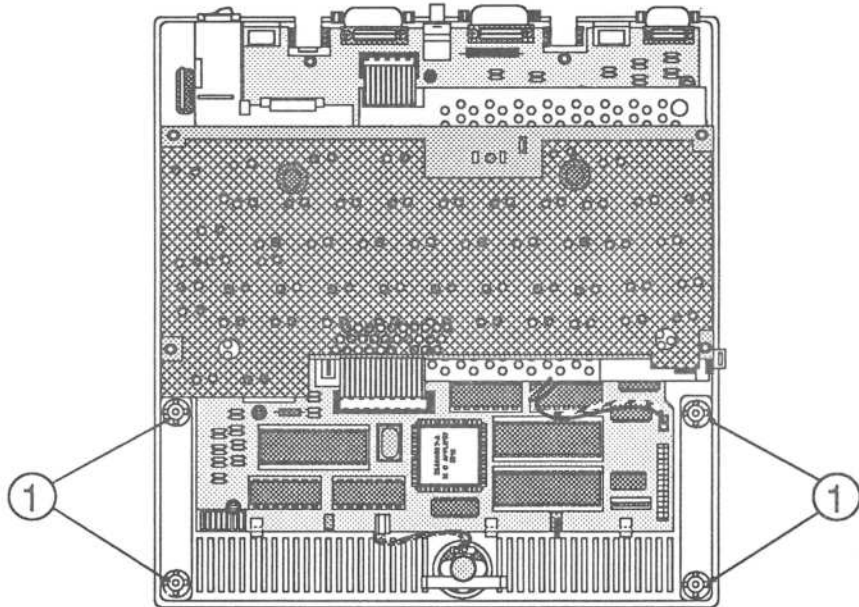


FIGURE 4

2. Place the keyboard in position on its four support posts (Figure 4, #1).
3. Replace the top case.

□ DISK DRIVE

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the top case, including the four disk drive screws.

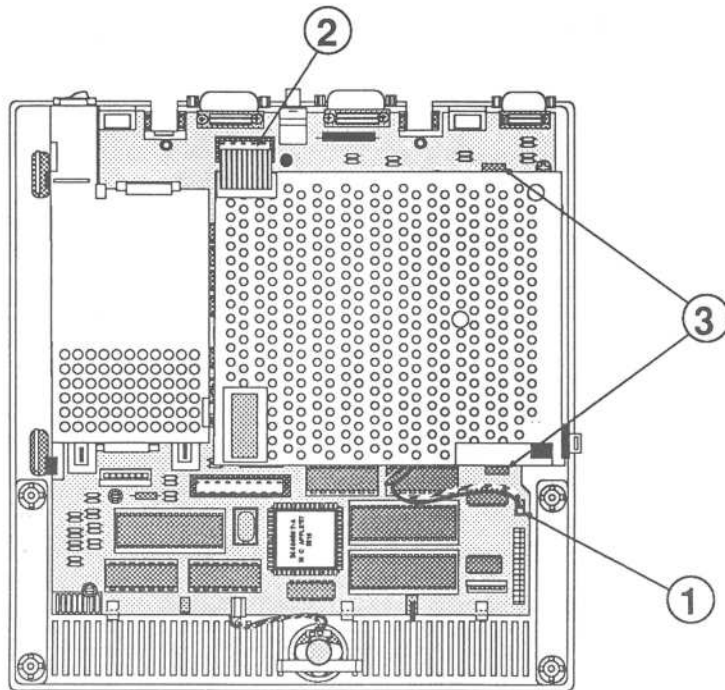


FIGURE 5

2. Lift the keyboard up and forward, and disconnect the eject button cable from logic board connector J7 (Figure 5, #1).
3. Disconnect the disk drive cable from logic board connector J8 (Figure 5, #2).
4. Lift the disk drive straight up and out of the computer.
5. Remove the two Phillips screws (Figure 5, #3), one on each side of the drive shield.
6. While simultaneously pulling each side of the upper drive shield away from the lower drive shield, lift the upper drive shield. You'll need to pull the sides away far enough to disengage the retaining pins (located next to the shield screws).

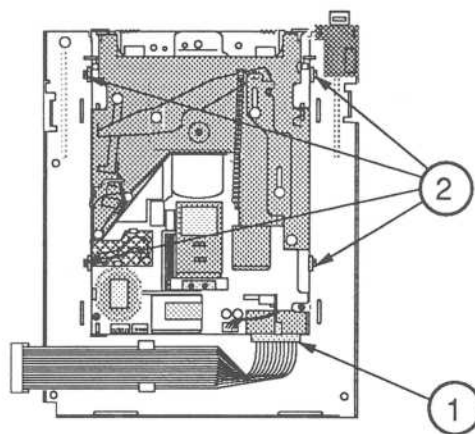


FIGURE 6

7. Disconnect the disk drive cable (Figure 6, #1) from the disk drive.
8. Remove the four Phillips screws (Figure 6, #2) holding the disk drive mechanism to the lower drive shield, and remove the disk drive.

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

Replace

1. Remove the shipping fixture and the plastic shipping disk from the replacement disk drive mechanism.
2. Place the disk drive mechanism in position in the lower drive shield, and replace the four Phillips screws.
3. Attach the disk drive cable to the disk drive.
4. Place the upper drive shield on the lower drive shield, making sure that the tabs at the rear of the upper shield engage in the slots in the lower shield. Press down the front of the upper shield until the retaining pins engage.
5. Replace the two Phillips screws holding the upper shield to the lower shield.

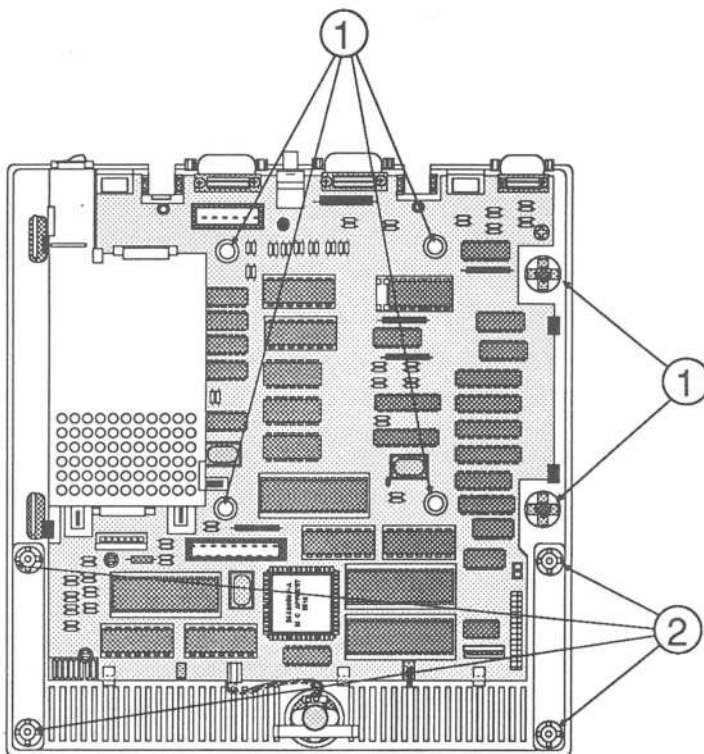


FIGURE 7

6. Place the disk drive in position on its six support posts (Figure 7, #1).
7. Connect the disk drive cable to logic board connector J8.
8. Connect the eject button cable to logic board connector J7.
9. Place the keyboard in position on its four support posts (Figure 7, #2).
10. Replace the top case.

□ EJECT BUTTON

Materials Required

#1 Phillips screwdriver

Remove

1. Remove the top cover and disk drive.

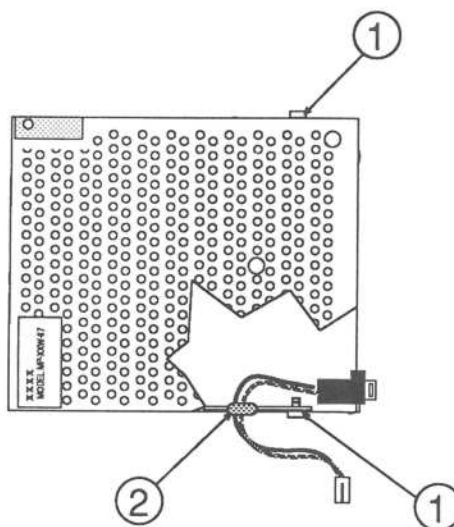


FIGURE 8

2. Remove the two Phillips screws (Figure 8, #1) that secure the disk drive top shield to the bottom shield.
3. Lift the front of the top shield and simultaneously pull the shield forward to disengage the tabs at the rear.
4. Remove the eject button wires and grommet (Figure 8, #2) from the bottom shield.
5. Remove the eject button by pulling the middle tab slightly forward and simultaneously lifting the switch from its post.

Replace

1. Slide the eject button switch onto its post until you hear a click.
2. Slide the wire grommet into its slot in the lower shield.
3. Place the tabs at the rear of the top shield into their respective slots in the bottom shield.
4. Replace the two top shield screws.
5. Replace the disk drive and top cover.

□ POWER SUPPLY

Materials Required

None

Remove

1. Remove the top case and keyboard.

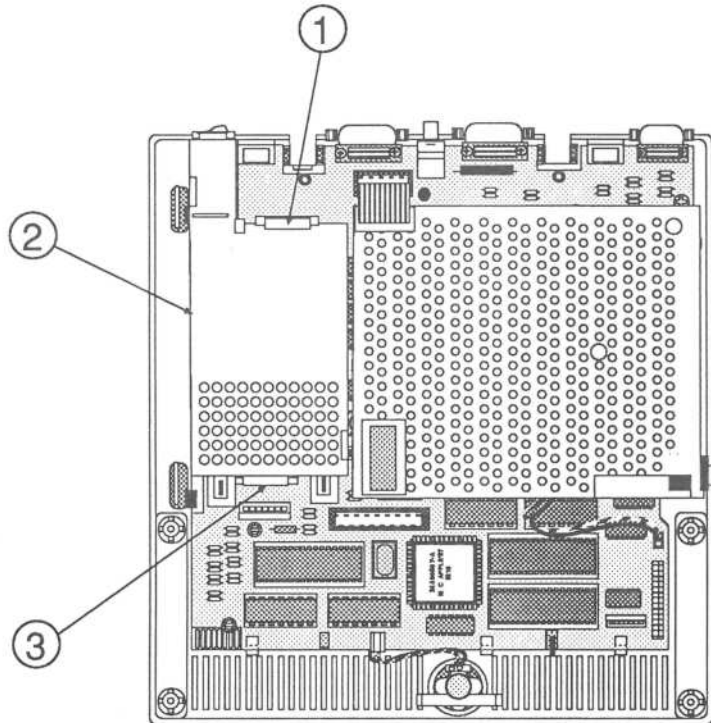


FIGURE 9

2. Simultaneously pull back on the rear power supply latch (Figure 9, #1) and lift the rear of the power supply (Figure 9, #2) far enough to disengage the latch.
3. While still holding up the rear of the power supply, simultaneously pull forward on the front power supply latch (Figure 9, #3) and lift the front of the power supply far enough to disengage logic board connector J1.

Replace

1. Place the power supply in position on logic board connector J1 and press down until the front and rear power supply latches engage in their respective openings in the power supply.

CAUTION: *Be careful when reinstalling the power supply, or you could damage the connector.*

2. Replace the keyboard and top case.

□ LOGIC BOARD

Materials Required

#1 Phillips screwdriver

Remove

1. Remove the top case, keyboard, disk drive, and power supply.

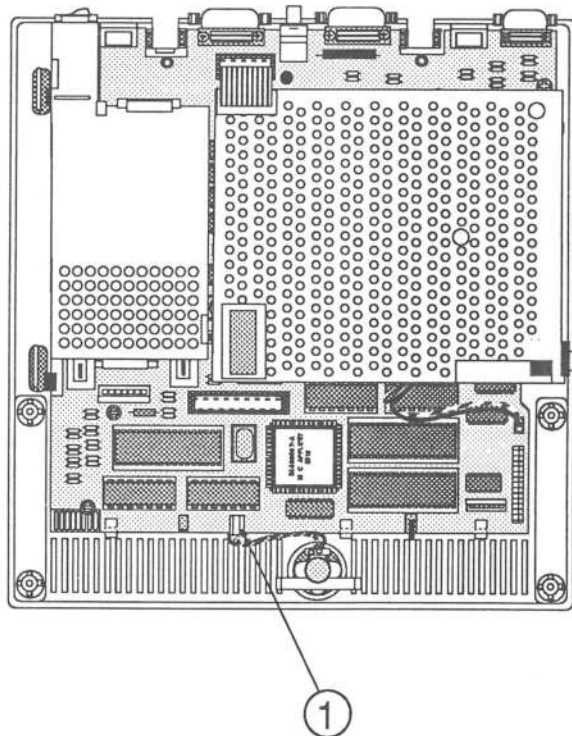


FIGURE 10

2. Disconnect the speaker cable from logic board connector J10 (Figure 10, #1).

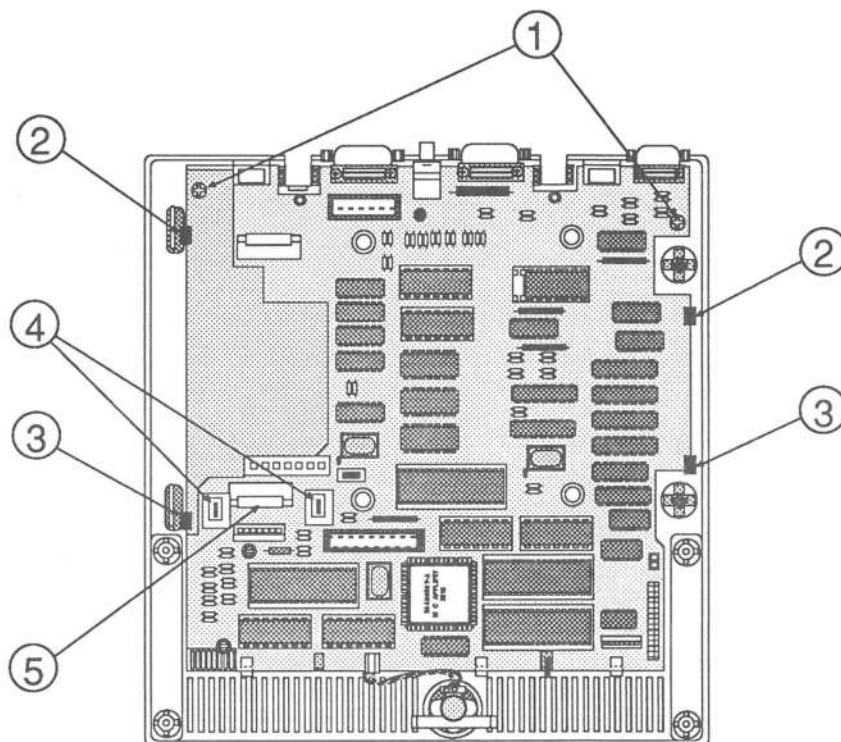


FIGURE 11

3. Remove the two Phillips screws (Figure 11, #1) that secure the logic board to the bottom case.
4. While **carefully** lifting the rear edge of the logic board, release the two rear logic board latches (Figure 11, #2).
5. Continue lifting the logic board and release the two front logic board latches (Figure 11, #3).
6. Continue to lift the rear of the logic board far enough for the logic board to clear the two power supply posts (Figure 11, #4) and the front latch (Figure 11, #5).

CAUTION: *Don't lift the logic board too far, or you could break the bottom case clips.*

7. Remove the logic board.

Replace

1. Place the logic board in position in the bottom case. Make sure the front of the logic board is under the three clips (Figure 12, #1) in the bottom case. The tab in the bottom case should also be in the slot (Figure 12, #2) cut in the logic board.

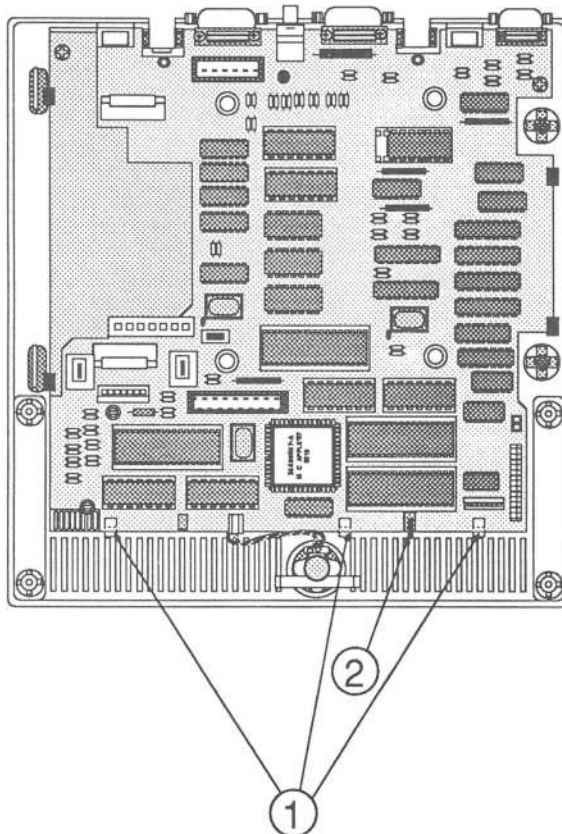


FIGURE 12

2. Lower the logic board into the bottom case and press the board down near each latch.
3. Replace the two logic board screws.
4. Connect the speaker cable to logic board connector J10.
5. Replace the power supply, disk drive, keyboard, and top case.

□ SPEAKER

Materials Required

None

Remove

1. Remove the top case.
2. Lift the keyboard and **gently** place it upside-down on the disk drive and power supply.

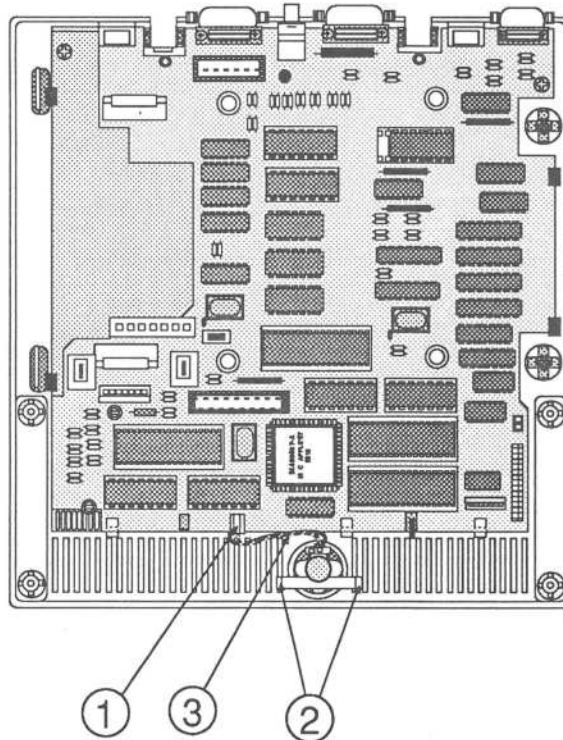


FIGURE 13

3. Disconnect the speaker cable from logic board connector J10 (Figure 13, #1).
4. Press in on the two tabs of the speaker snap (Figure 13, #2). Remove the snap.
5. Remove the speaker.

Replace

1. Place the speaker in position in the bottom case. The speaker wires should be coming from the bottom of the speaker (as shown in Figure 13, #3).

2. Replace the speaker snap. The half-oval opening in the snap should be against the speaker.
3. Connect the speaker cable to logic board connector J10.
4. Place the keyboard in position on its four support posts.
5. Replace the top case.

Apple IIc Plus

Section 3 – Diagnostics

□ CONTENTS

3.2	Introduction
3.2	Things to Remember
3.2	Before You Begin
3.2	Setting Up
3.3	While Testing
3.4	Built-In Diagnostic
3.4	Running the Diagnostic
3.4	Results
3.5	Apple IIc Plus Diagnostic
3.5	Main Menu
3.6	Choose Tests
3.8	Options
3.9	Special
3.9	Running the Diagnostics
3.13	Test Failures

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

□ INTRODUCTION

This section describes general procedures for using the *Apple IIc Plus Diagnostic*. 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.

□ THINGS TO REMEMBER

Before You Begin

1. **Make a backup diskette before beginning!** When testing a defective Apple IIc Plus, 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 disk drive or an external UniDisk 3.5 or Apple 3.5 Drive.

Setting Up

1. If you are going to select the **Serial External Test**, the loopback cable must be installed.
2. To select a test, type the letter or use the arrow keys until the name of the test is highlighted; then press <Return>.
3. When chosen, each test displays a number (1, 2, 3, etc.). This number indicates the order in which the tests will be performed.

4. 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>.
5. To access the **Help** screen, hold down <Shift> and <Open-Apple> and press 2.

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 are performing the **Serial External Test** without the loopback cable installed, you will receive an error code.
4. When running the Character Generator Test and using a ColorMonitor IIC (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 while the RAM, ROM, MMU, and IOU circuitry on the logic board are 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**, replace the logic board and try again.

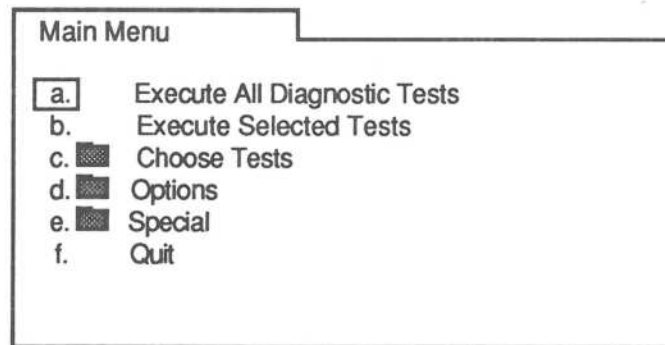
□ APPLE IIc PLUS DIAGNOSTIC

Materials Required

Apple IIc Plus Diagnostic diskette
Video display and cable
Serial loopback cable (required for Serial External Test)
AppleMouse™ IIc (optional)
Hand Controllers II (optional)
Joystick II (optional)

Main Menu

The *Apple IIc Plus Diagnostic* main menu is shown below. A brief description of each menu item follows.



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

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

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

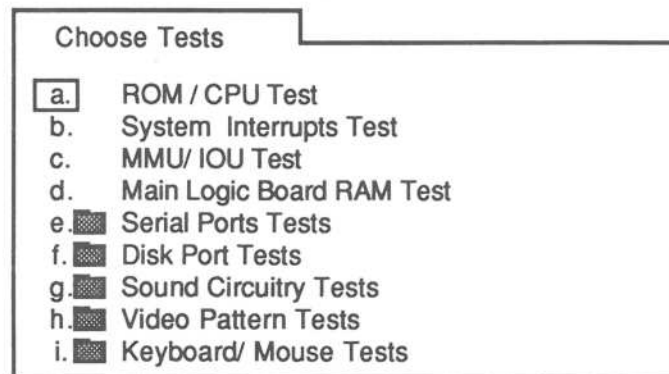
Options – Contains various selections that allow you to control how the tests are run.

Special – Contains selections 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. A brief description of each menu item follows.



ROM/CPU Test – Checks the firmware ROM and microprocessor chip.

System Interrupts Test – Checks that interrupts are functioning correctly.

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

Main Logic Board RAM Test – Checks the 128K of RAM on the logic board.

Serial Ports Tests:

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

Note: If the loopback cable is not installed when performing the Serial External Test in continuous mode, the diagnostic will not inquire whether the loopback cable is installed and will record a failure. **Before** replacing the logic board, connect a known-good loopback cable and rerun the test.

Disk Port Tests:

- **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 and the drives to be tested must be attached to the computer when the power is turned on.

Sound Circuitry Tests:

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

Video Pattern Tests:

- **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 (AppleColor Monitor IIc) the video display shifts left and right and toggles between color and monochrome. (This sequence 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. First, 80 columns are displayed. After pressing the space bar, 40 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.

...Continued on next page

- **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 Tests:

- **Keyboard Test** – Displays a keyboard layout. The instructions are given at the bottom of the screen.

Note: If you select the Keyboard Test under continuous mode, the diagnostic will flash the "Keyboard Test" message, increment the iterations counter, and never perform the keyboard test. You should not run the keyboard test in continuous mode.

- **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 selections appear 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 selections appear 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, and if so, how much memory it contains.
- **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 the tests you have selected under "Choose Tests" to the test diskette. It does not save selections made under "Options."

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 nonstandard tests (see "Customized Tests").

Standard Test

1. Install the serial loopback cable, if available. If the cable is not available, type **N** when the diagnostic asks you if it is installed. Testing will continue.
2. Insert the *Apple IIc Plus 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 an external drive, 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, install the serial loopback cable.
2. Insert the *Apple IIc Plus 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 an external drive, 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 four 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.

Saving and Loading Test Sequences

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>.

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 later using **Load Selected Test Sequence From Disk**.

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 what 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 test failed. The following is a list of the tests, along with the recommended solution for each test failure.

Failed Test

Solutions

- *ROM/CPU*
 - Replace logic board.
- *System Interrupts*
 - Replace logic board.
- *MMU/IOU*
 - Replace logic board.
- *Main Logic Board RAM*
 - Replace logic board.
- *Serial Internal*
 - Replace logic board.
- *Serial External*
 - 1. Verify that the loopback cable is installed and securely connected.
 - 2. Exchange loopback cable.
 - 3. Replace logic board.
- *Disk Port*
 - 1. Verify that the diskette is inserted and that the drive door is closed.
 - 2. Verify that the diskette is not write protected.
 - 3. Try a different diagnostic diskette.
 - 4. Replace disk drive.
 - 5. Replace logic board.
- *Speaker Tone*
 - 1. Check volume setting.
 - 2. Verify that the speaker connector is securely attached to logic board connector J10.
 - 3. Replace speaker.
 - 4. Replace logic board.

...Continued on next page

Failed Test

Solutions

- *Keyboard*
 1. Rerun test to verify results.
 2. Replace keyboard.
 3. Replace logic board.

- *Mouse*
 1. Check mouse connections.
 2. Exchange mouse.
 3. Replace logic board.

- *Joystick/Paddle*
 1. Check joystick/paddle connections.
 2. Exchange joystick/paddle.
 3. Replace logic board.

Apple IIc Plus

Section 4 – Troubleshooting

❏ CONTENTS

4.2	Introduction
4.2	General Information
4.2	How to Use the Symptom Charts
4.3	Symptom Charts
4.3	Video Problems
4.3	Drive Problems
4.4	Peripheral Problems
4.4	Miscellaneous Problems

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

□ INTRODUCTION

General Information

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

- *Apple IIc Plus Diagnostic*
- Symptom Charts

Remember to follow basic ESD precautions when troubleshooting.

How to Use the Symptom Charts

The *Symptom Charts* describe symptoms and appropriate steps to correct the failure.

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, reinstall the original module in the IIc Plus, 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 IIc Plus Diagnostic*.

□ SYMPTOM CHARTS

WARNING: Be sure the power is off before installing or removing any modules or components, or before connecting or disconnecting any peripheral devices. Failure to do so may result in damage to the computer, module, components, and/or peripheral.

Video Problems

Symptom

Solution

- *No video*
 1. Check contrast and brightness settings on the monitor.
 2. Check video cable connections.
 3. Replace video cable.
 4. Replace logic board.

- *Random monitor display*
 1. Replace logic board.
 2. Replace keyboard.

Drive Problems

Symptom

Solutions

- *Will not boot*
 1. Replace disk drive.
 2. Replace logic board.

- *No disk access*
 1. Replace logic board.
 2. Replace disk drive.

- *Continuous disk access*
 1. Replace disk drive.
 2. Replace logic board.

Peripheral Problems

Symptom	Solutions
• <i>Mouse problems</i>	1. Replace mouse. 2. <u>Replace logic board.</u>
• <i>Printer prints garbage</i>	1. Verify configuration of printer port. 2. Verify configuration of printer option switches. 3. Verify that the correct cable is being used. 4. <u>Replace logic board.</u>

Miscellaneous Problems

Symptom	Solutions
• <i>No power</i>	1. <u>Replace power supply.</u> 2. <u>Replace logic board.</u>
• <i>No audio</i>	1. Check volume setting. 2. Check speaker connection. 3. <u>Replace logic board.</u> 4. <u>Replace speaker.</u>
• <i>No beep or message; random characters on display; disk drive does not come on</i>	1. <u>Replace logic board.</u> 2. <u>Replace power supply.</u>
• <i>AppleSoft BASIC errors</i>	– <u>Replace logic board.</u>
• <i>Stuck keys</i>	– <u>Replace keyboard.</u>
• <i>Programs run erratically, crash often</i>	1. <u>Replace disk drive.</u> 2. <u>Replace logic board.</u>

Apple IIc Plus

Illustrated Parts List

❏ CONTENTS

IPL.3 Finished-Goods Assembly (Figure 1)

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

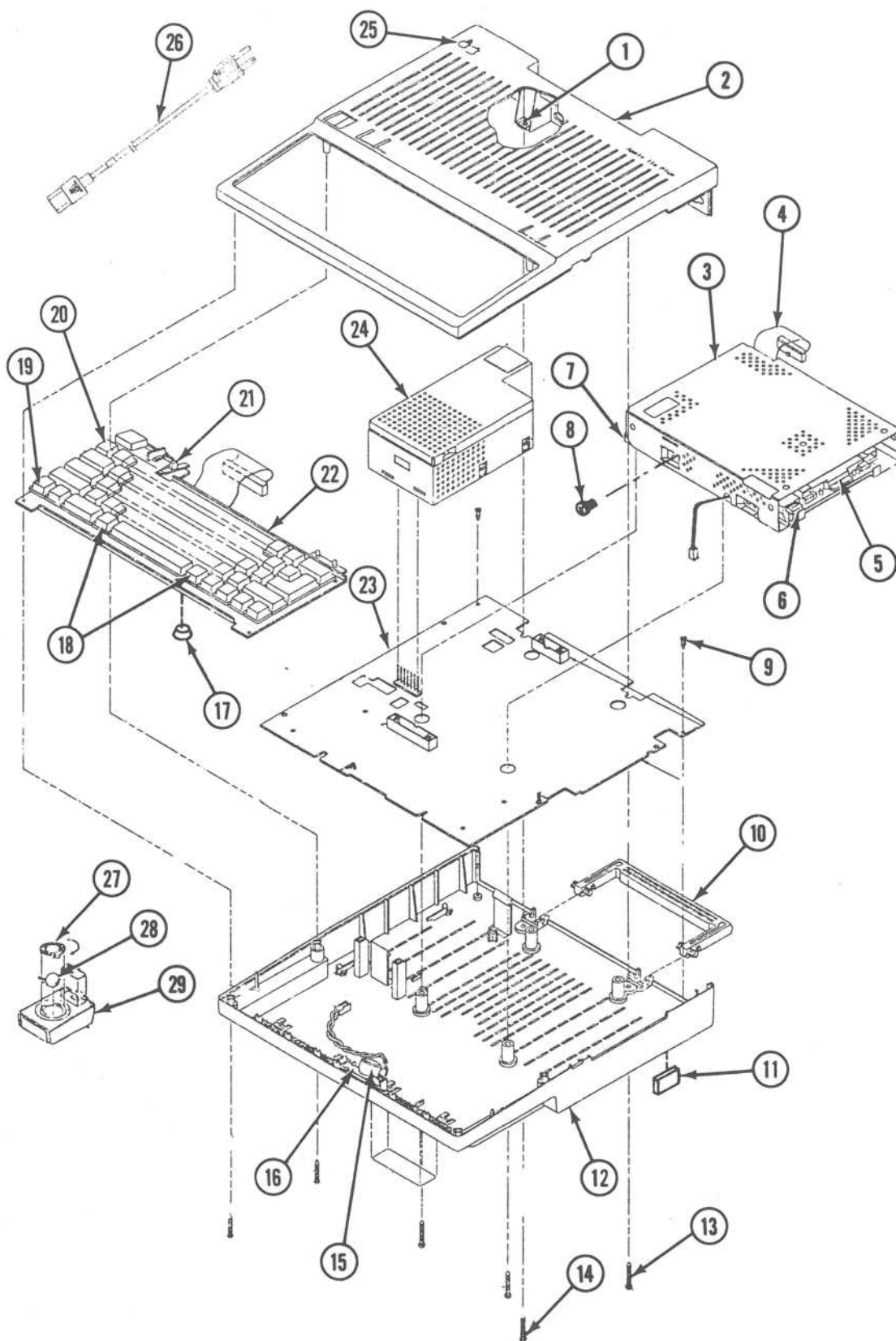


FIGURE 1

□ FINISHED-GOODS ASSEMBLY (Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	835-0176	U-Type Nut
2	612-5025	Top Case
3	805-0928	Shield, Disk Drive Top
4	590-0383	Cable, Internal Disk Drive
5	661-0345	800K Mechanism, Apple 3.5 Drive
6	865-0867	Eject Button Assembly
7	805-0927	Shield, Disk Drive Bottom
8	460-3400	Screw, Disk Drive Shield
9	430-1029	Screw, Tap 4-20 x .250
10	865-0055	Platinum Handle
11	865-0024	Platinum Foot
12	815-0948	Bottom Case
13	400-1612	Screw, 6-32 x 3/4
14	430-1030	Screw, Tap 4-14 x .750, PN CRS Rec. A
15	600-0349	Speaker
16	815-1084	Speaker Snap
17	865-0003	Rubber Feet (Total of 5)
18	076-0209	Low-Profile Keyswitch
19	970-1263	Locking Alps Keyswitch
20	658-7101	Keycap Set
21	937-0031	Volume Control Switch
	815-1085	Volume Control Knob
22	661-0419	Keyboard
23	661-0418	Logic Board
24	661-0420	Internal Power Supply
25	825-1256	Logo
26	590-0380	AC Power Cable
27	815-0409	Mouse Ball Retainer
28	699-8001	Rubber-Coated Mouse Ball
29	661-0400	Platinum Apple Mouse