Apple Technical Procedures

Macintosh IIci

Technical Procedures

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Illustrated Parts List

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Apple Technical Procedures

Macintosh IIci

Section 1 – Basics

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❑ PRODUCT DESCRIPTION

The Macintosh® IIci is a high-performance, open-architecture Macintosh computer with enhanced functionality. It is designed to run existing software while providing the power, flexibility, and expandability necessary for future applications.

New Features

The Macintosh IIci has the following features:

- Increased speed—25 MHz (true 32-bit support)
- Built-in video support
- Parity support (optional)
- 512K of ROM
- RAM cache connector

Macintosh IIci Configurations

The Macintosh IIci comes in a variety of configurations. Below are four configurations that are offered. These are not the only possible configurations. Because of the flexibility of this unit, you may see units with different amounts of RAM and with other SCSI 3.5-inch hard disk drives. Presented here are basic configurations and some of the limitations.

Floppy-Only Systems

The floppy-only system includes the following elements:

- 1 megabyte (MB) of RAM
- One Apple FDHD drive
  (Floppy Disk High Density, 1.4 MB Drive)

Hard Disk Systems

The hard disk systems include the following elements:

The 1 MB system with a 40 MB HDA:

- 1 MB of RAM
- One Apple FDHD drive
  (Floppy Disk High Density, 1.4 MB Drive)
- 40 MB SCSI internal hard disk

The 4 MB system with an 80 MB HDA:

- 4 MB of RAM
- One Apple FDHD drive
  (Floppy Disk High Density, 1.4 MB Drive)
- 80 MB SCSI internal hard disk

The 4 MB system with A/UX®:

- 4 MB of RAM
- One Apple FDHD drive
  (Floppy Disk High Density, 1.4 MB Drive)
- 80 MB SCSI + A/UX (Apple UNIX®) on a special internal hard disk

The 4 MB system with parity:

- 4 MB of RAM
- One Apple FDHD drive
  (Floppy Disk High Density, 1.4 MB Drive)
- 80 MB SCSI internal hard disk

Note: The limitation of the 1 MB system is that the built-in video uses 320K of memory to support a 640 x 480 screen at 8 bits/pixel (and 640 x 870 at 4 bits/pixel); therefore, the system will default to 1 bit/pixel. This leaves 680K of memory available for application use.

Note: The RAM cache slot is not compatible with the SE/30 direct slot.

Enhancements

The following enhancements can be added to any of the systems:

- 800K, 3.5-inch external disk drive or external 1.4 MB FDHD (the Macintosh IIci will not support the HD20, or any 400K drives)
- 1 to 8 MB of RAM (up to 128 MB when larger DRAMs become available)
- Any Apple 20, 40, or 80 MB (or larger, within limits) 3.5-inch internal SCSI hard disk drive
- Up to 6 external SCSI devices of any size or kind

IMPORTANT: *To maintain system functionality, A/UX customers planning to use the Macintosh IIci and/or Apple FDHD drive must upgrade A/UX software to at least version 1.0.1.*

❑ CONNECTOR IDENTIFICATION

Back Panel

The back panel of the Macintosh IIci has eight built-in ports and two connectors, as listed below. The number beside the item below corresponds to the numbered arrow in Figure 1.

1. Apple Desktop Bus™ 1 and 2
2. Stereo sound port
3. Serial port 2
4. Serial port 1
5. Video port
6. SCSI port
7. External disk drive connector
8. Locking power switch
9. AC power connector
10. Switched (courtesy) monitor connector

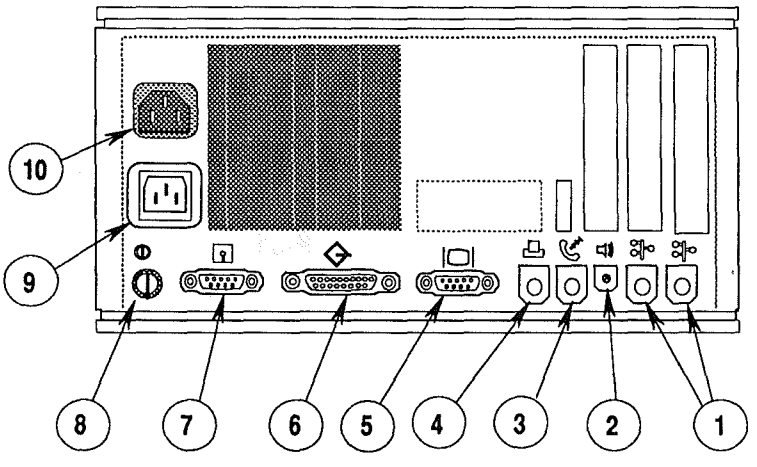


FIGURE 1

Internal Connectors

The Macintosh IIci logic board has nine connectors and one jumper. In the list below, the number beside the connector or jumper name corresponds to the numbered arrow in Figure 2.

1. Power supply connector for the logic board
2. Internal SCSI connector
3. Power connector for internal SCSI
4. Internal disk drive connector
5. RAM SIMM connectors
6. Speaker connector
7. ROM jumper
8. NuBus slots
9. ROM SIMM connector
10. Cache card connector

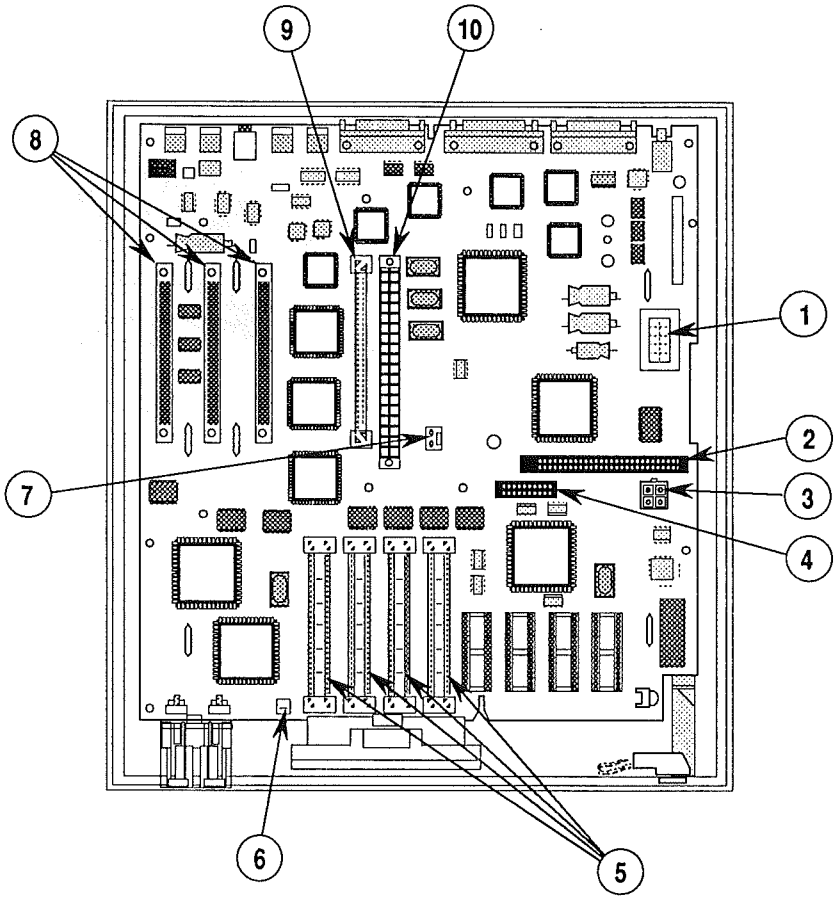


FIGURE 2

❑ MODULE IDENTIFICATION

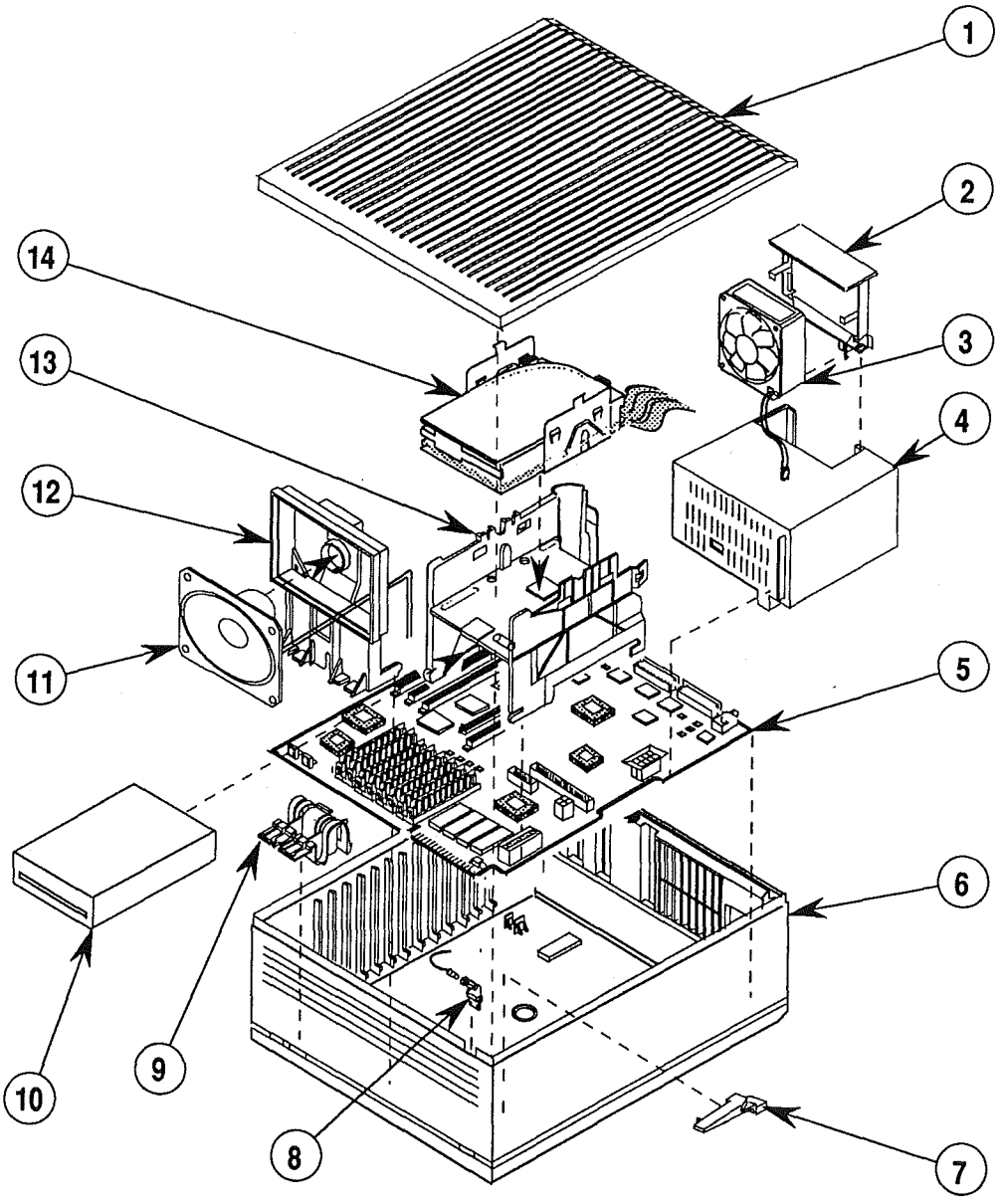


FIGURE 3
Module Components

1. Top lid
2. Fan bracket
3. Fan
4. Power supply
5. Logic board
6. Outer case
7. Power lamp lens
8. Diode light assembly
9. Programmer's switch
10. Floppy disk
11. Speaker
12. Speaker bracket
13. Disk carrier
14. Hard disk

❑ MACINTOSH IIci SYSTEM FEATURES

The Macintosh IIci is an enhanced-performance Macintosh IIcx that includes the following new or upgraded components:

- Motorola 68030 microprocessor running at 25 MHz
- 512K of ROM
- RBV (RAM-Based Video chip)
- MDU (Memory Decode Unit)
- Nu-Chip 30 (NuBus controller chip)
- NuBus Transceivers (NuBus support chips)
- Cache Card connector
- PGC (Parity-Generating Chip) (special orders)

Macintosh IIci Logic Board

At the heart of the Macintosh IIci is the Motorola 68030 microprocessor (Figure 4, #1). The 68030 is a true 32-bit microprocessor that is fully compatible with earlier 16- and 24-bit Macintosh microprocessors. This high-performance microprocessor runs at 25 MHz and is designed to handle paged memory management, thereby eliminating the HMMU (or PMMU). With this increased speed, and by taking advantage of the 68030 burst access capability (which enables the CPU to read groups of instructions or data in fewer clock cycles than in normal access mode), the Macintosh IIci delivers significantly higher performance than the existing Macintosh systems.

The Macintosh IIci logic board includes four 128K x 8 bits in 32-pin DIP soldered-in 512K ROM (Figure 4, #2). It also contains a 64-pin SIMM (Single In-line Memory Module) socket (Figure 4, #3) that allows for future ROM upgrades to the Macintosh IIci without changing the main logic board. These ROM chips include code that supports the built-in video, parity, virtual memory (used on A/UX systems), and 32-bit QuickDraw™. The code supports future upgrades to the Macintosh Operating System.

Note: When a new ROM SIMM is installed, the existing DIP ROM will not have to be removed from the board. For the new ROM to be recognized, it will just be a matter of removing a jumper (Figure 4, #4) on the logic board.

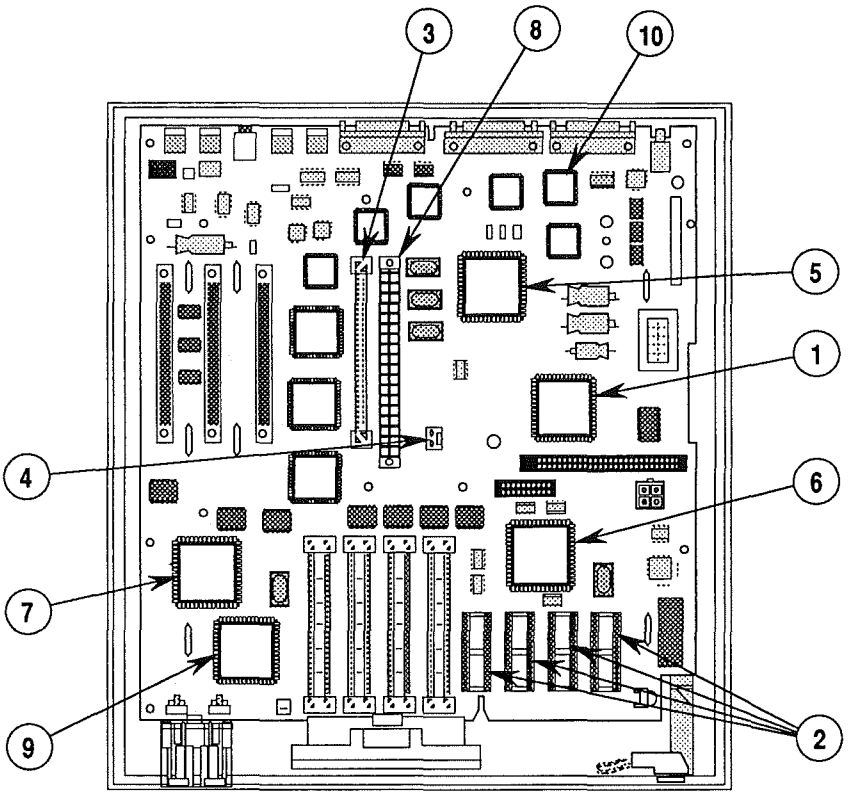


FIGURE 4

Having the RBV (RAM-Based Video) chip (Figure 4, #5) on the logic board enables the Macintosh IIci to drive a 640 x 480 screen at up to 8 bits/pixel and a 640 x 870 screen at up to 4 bits/pixel without the need for a video card. The chip uses a section of the RAM as a screen frame and retrieves the video data, which is then converted for display by a video DAC (digital-to-analog converter) and sent out through the DB-15 video port.

For decoding address space, a new chip called the MDU (Memory Decode Unit) has been added (Figure 4, #6). The chip decodes device selection for the physical address map, and addresses both banks of RAM memory. Unlike earlier Macintosh units, this allows larger amounts of memory to be installed in bank B.

The NuChip 30 chip (Figure 4, #7) is a new version of the NuBus chip (Macintosh IIcx). It is a controller chip that controls the NuBus transceivers through which data transfers to and from the NuBus slots.

The new cache connector (Figure 4, #8) allows the use of a cache card. The use of a cache card increases the effective speed of the main memory by providing the CPU with a copy of the most frequently used data more quickly than the memory that the cache supports. The cache stores the most recently accessed data and instructions in a small bank of high-speed memory, which the CPU can access faster.

***CAUTION:** The cache slot is not compatible with the SE/30 direct slot. Trying to use an SE/30 direct board in the cache slot will result in damage to the main logic board and the direct board.*

The last of the new features on the Macintosh IIci is the ability to have parity checking if the Macintosh IIci is a special-order unit. If the system has parity checking, it will have a PGC (Parity-Generating Chip—Figure 4, #9) installed on the logic board and will also have special 9-bit parity SIMMs installed in the RAM SIMM sockets. The PGC will generate an extra bit of information for each byte of information stored in memory so that the total number of "on" bits add to an ODD number. When the data is read from memory, the byte is checked to determine whether the data has been corrupted (does the byte still add to an odd number of "on bits"?). If so, the system is halted and a restart must be done.

The SWIM chip (Figure 4, #10) enables the Apple FDHD drive to read and write both GCR (Group-Coded Recording) and MFM (Modified Frequency Modulation) data formats.

Apple FDHD Drive

The Apple FDHD drive is a high-density (1.4 MB), 3.5-inch disk drive for the Macintosh IIci system. In addition to high-capacity data storage, the Apple FDHD drive provides data exchangeability between Apple (GCR data format) and MS-DOS (MFM data format) systems. The Apple FDHD drive is also fully backward-compatible with the current 400K and 800K disk formats.

Identification

The Apple FDHD drive cannot be distinguished from 400K and 800K format disk drives. However, since the Apple FDHD drive is the only drive supported internally, you should not have any problem. If you suspect that an 800K drive has been installed internally, you can tell by removing the top lid and locating the microswitches (Figure 5, #1) at the front of the drive. The Apple FDHD drive has three microswitches; the 800K drive has only two microswitches.

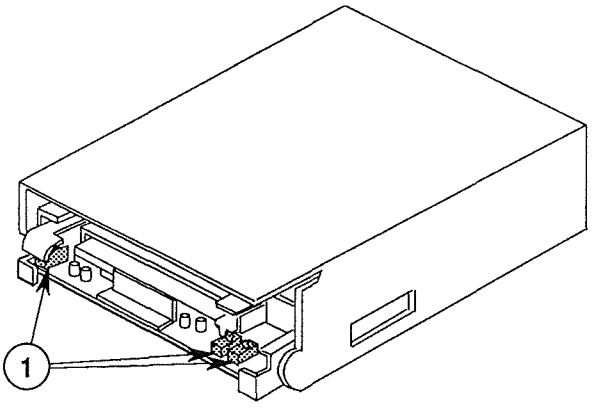


FIGURE 5

You can also identify an Apple FDHD drive by removing it from the Macintosh IIci and checking the manufacturer's label (Figure 6) on the bottom of the drive: all high-density drives have the note *2MB* on the label.

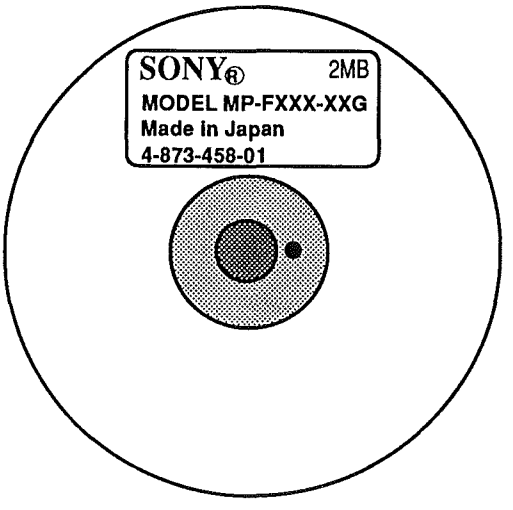


FIGURE 6

CAUTION: *High-density media are more likely to have problems than low-density media. To avoid media-related problems, use only known-good media or high-density media bearing the Apple label.*

High-Density

The Apple FDHD drive can read, write, and format 400K and 800K media data disks. However, special high-density, 3.5-inch disks that take full advantage of the increased capacity of the Apple FDHD drive are also available. To avoid media-related problems when using the Apple FDHD drive, Apple advises using high-density media bearing the Apple label.

As shown in the drive and media compatibility matrix (Figure 7), 400K drives can read, write, and format both single-sided media and double-sided media (in 400K format only). The 800K drives can also read, write, and format both single- and double-sided media. However, Apple does not recommend using high-density media in either 400K or 800K disk drives. Data saved to high-density media using 400K or 800K drives is unreliable and could be lost later. The Apple FDHD drives can read, write, and format single-sided, double-sided, and high-density media. In addition, Apple FDHD drives can read, write, and format 720K and 1.4 MB double-sided IBM (MFM) format media.

Drive	Media	FORMAT			
		400K (GCR)	800K (GCR)	720K (MFM)	1.4 MB (MFM)
400K	Single-Sided	R/W/F	X	X	X
400K	Double-Sided	R/W/F	X	X	X
400K	High-Density	NR	X	X	X
800K	Single-Sided	R/W/F	NR	X	X
800K	Double-Sided	R/W/F	R/W/F	X	X
800K	High-Density	NR	NR	X	X
FDHD	Single-Sided	R/W/F	NR	X	X
FDHD	Double-Sided	R/W/F	R/W/F	R/W/F	X
FDHD	High-Density	X	X	X	R/W/F

LEGEND: R = Read
W = Write
F = Format
X = Not Allowed
NR = Not Recommended

FIGURE 7

Note: To help understand drive and media format compatibility, think in terms of the drive/media of lowest capacity. For example, if your system has both an external 800K drive and an Apple FDHD drive, to ensure media format compatibility between the two drives you must use 800K media (the drive and media of lowest capacity).

❑ SPECIFICATIONS

Processor

MC68030 CPU, 32-bit architecture with bursting support

Clock Frequency

25.0 MHz

Addressing

32-bit internal registers
32-bit address bus
Supports paged memory management

Coprocessor

25 MHz MC68882 Floating-Point Unit (FPU)
Accepts optional coprocessor cards installed in NuBus expansion slots.

ROM

512K

RAM

1 MB expandable to 8 MB (expandable to 128 MB when SIMMs with higher-density DRAM chips become available); additional expandability through NuBus slots

Slot Expansion

Three NuBus expansion slots

Power available per slot

+ 5 V	12 Amps	10 Watts
+12 V	0.175 Amps	2.1 Watts
-12 V	0.150 Amps	1.8 Watts

One RAM cache slot

Power available

+5 V	1 Amp	5 Watts

Sound

Apple Sound Chip (ASC), including four-voice wave-table synthesis and stereo sampling generator capable of driving stereo mini phone jack headphones or stereo equipment

Disk Drives

Internal Apple FDHD drive
External 3.5-inch 800K disk drive

Hard Disk

SCSI hard disks (internal/optional external)

SCSI	One external SCSI port (DB-25)
Serial Ports	Two RS-422 (RS-232 compatible) serial ports, 230.4K baud maximum (Mini DIN-8)
Video Display	Built-in video support with external video port to support the Apple High-Resolution Monochrome Monitor, AppleColor High-Resolution RGB Monitor, and the Apple Portrait Display Will also support multiple external color and monochrome monitors connected through video cards in NuBus expansion slots
Keyboard	Apple Keyboard or Apple Extended Keyboard connected through Apple Desktop Bus ports (Mini DIN-4)
Mouse	Apple Desktop Bus mouse (Mini DIN-4)
Input Power	100 to 240 volts AC RMS automatically configured 50–60 Hz single phase 130 Watts maximum, not including monitor convenience power connector load
System Output Power	Output receptacle: 100-240 Volts AC, RMS (determined by actual input voltage) DC power: 90 watts maximum +5 Volt 12.0 Amps (60 Watts) +12 Volt 1.5 Amps (18 Watts) -12 Volt 1.0 Amps (12 Watts)
Clock/Calendar	CMOS custom chip with long-life lithium battery 256 bytes of parameter memory
Operating Temperature	10° C to 40° C 50° F to 104° F
Storage Temperature	-40° C to 47° C -40° F to 116.6° F

Relative Humidity	5% to 95% (noncondensing)
Altitude	0 to 3048 m (0 to 10,000 ft.)

❑ THEORY OF OPERATION

Introduction

The Macintosh IIci computer is made up of three basic modules: the logic board, the power supply, and the disk drives. The computer can have one internal floppy disk drive and can have one internal SCSI hard disk.

The information here will give you an understanding of how the Macintosh IIci computer works. This understanding, in turn, will assist you in performing logical troubleshooting on this system.

System Startup

When the computer is turned on, the system begins a carefully synchronized sequence of events. First, ROM is mapped by the MDU to physical $0000 0000. This enables the starting address, retrieved by the 68030 on reset, to be stored in ROM. After the first access to the true ROM address space, the normal memory map is imposed by the MDU. The only change from one map to the other is that the power-up map selects ROM for low addresses, whereas the normal map selects RAM for that address space.

The software determines the memory size and compiles a table describing the current memory configuration. The MMU is then programmed, based on this table, to provide contiguous logical memory from the potentially noncontiguous physical segments in Bank A and B. The 24/32-bit memory map is designed to allow existing Macintosh software to use a 24-bit address mode while new software can use the full 32-bit address space. The mapping is implemented simply and directly.

At this point the disk startup process begins. The system looks for a readable disk in the available disk drives in the following order:

1) Internal floppy disk drive
2) External floppy disk drive
3) Setup device set in the control panel
4) SCSI devices in declining order of device ID (6 to 0)

Note: If the battery is removed or the contents of the parameter RAM is destroyed, the setup device defaults to the device with ID=0.

Once a readable disk is found, it is read and the disk startup process is completed.

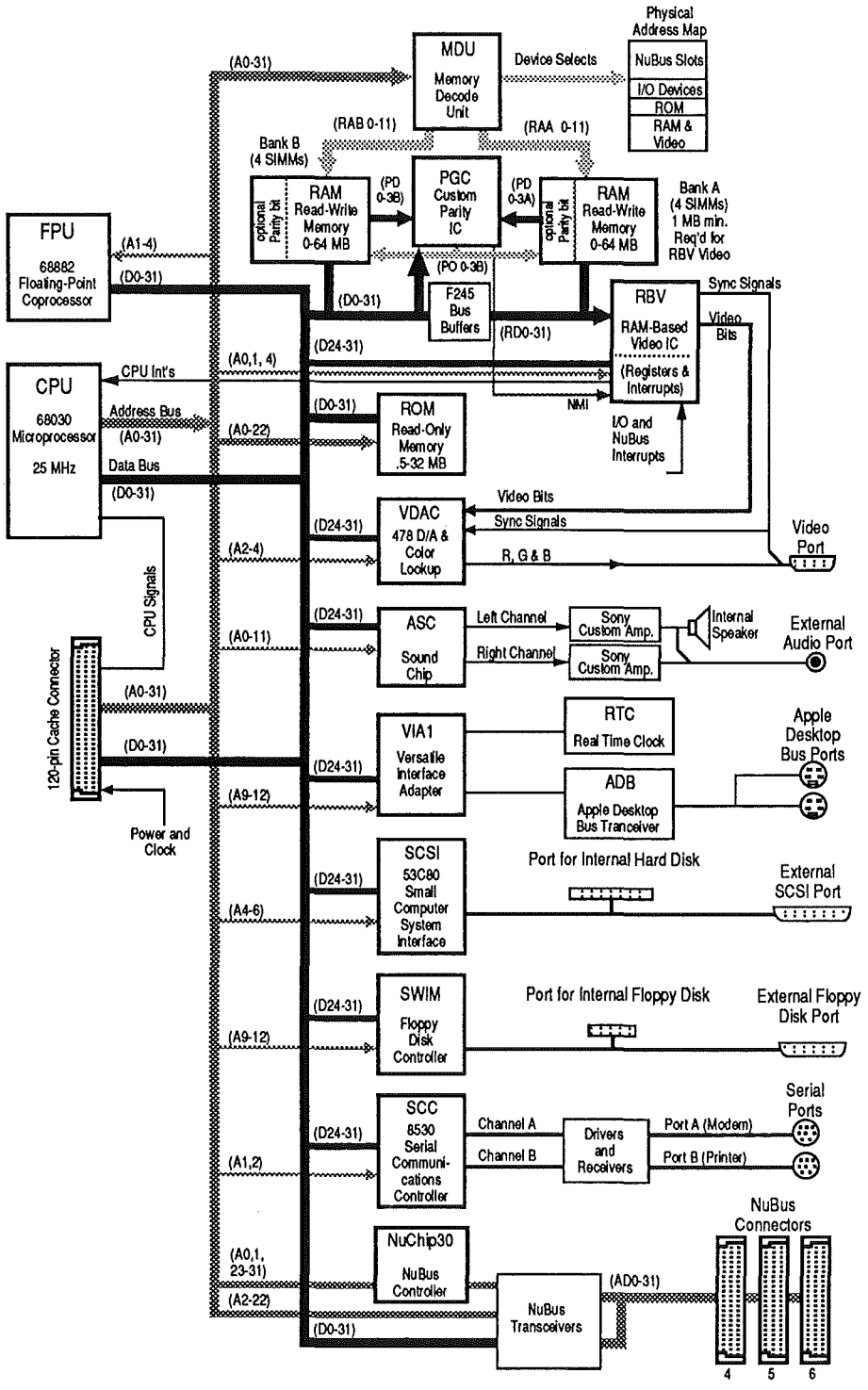


FIGURE 8

Logic Board

The logic board is the heart of the system, the place where all processing of information takes place. What follows is a list of the major components of the Macintosh IIci logic board and the functions they perform.

By using the block diagram in Figure 8 as you read through the various sections, you will get a clearer understanding of how the logic board works.

Microprocessors

The Macintosh IIci contains a 68030 microprocessor, which is a true 32-bit processor but also supports both 24- and 16-bit processing modes. It runs at 25 MHz for high performance. When running in the 24-bit addressing mode, the Macintosh IIci is compatible with the majority of existing Macintosh applications.

When working in A/UX (Apple UNIX), the 68030 microprocessor incorporates instruction sets for handling paged memory management, thereby eliminating the need for an HMMU or PMMU (as found in the Macintosh II). When data is sought from a memory location that isn't in the RAM, the 68030 swaps the page containing the data from the disk to the RAM.

Numeric Coprocessor

The MC68882 numeric coprocessor in the Macintosh IIci is a surface mount Quad-Flat-Pack that uses the coprocessor interface of the 68030 to perform numeric computations in parallel with 68030 program execution. It provides a high degree of precision and speed for Macintosh programs.

RAM

The Random-Access Memory (RAM) is provided in packages known as Single In-Line Memory Modules (SIMMs). Each SIMM consists of a small printed circuit board with various configurations of dynamic RAM (DRAM) chips. On one edge of each SIMM is a contact that fits into the SIMM sockets located on the logic board. The RAM interface requires 80-ns-RAS-access-time DRAMs with CAS before RAS refresh. The amount of RAM on the logic board can be changed by installing same-size SIMMs in Bank A or Bank B. The two banks of RAM do not occupy contiguous address space, as they do on the previous Macintosh products. The 68030 on-chip MMU (memory management unit) is used to join

the discontiguous blocks of physical memory to current contiguous logical memory for application software.

Note: If the built-in video feature is used, then you must have RAM in bank A. If a video card is used, and built-in video in not used, then bank A does not have to have RAM in it.

Various RAM configurations are possible, depending on the size of the DRAM chips and on how many SIMMs (installed in sets of four) are used.

Every time the Macintosh IIci is switched on, the system software performs a memory test to determine how much RAM is present in the machine.

When built-in video is being used, RAM must be installed in bank A because the frame buffer is maintained beginning at physical address $0000 0000. The RBV frame buffer is variable in size, depending on the currently selected bit depth and the size of the video monitor plugged into the video port. The RBV requires only enough memory to hold the contents of the screen. The operating system decides at startup how much of bank A to devote to video and how much may be mapped to the system/application RAM address space.

Video accesses affect only bank A memory access because the data bus between the RAM banks can be disconnected by a bus buffer. This allows the RBV to fetch data from bank A without interrupting CPU access to bank B or I/O devices. Each bank of RAM is accessed independently by the MDU, so it can decode addresses for the CPU and the RBV at the same time without interference.

If there is RAM in both bank A and bank B, the Macintosh IIci will operate more efficiently with the larger RAM SIMMs in bank B.

ROM

The ROMs are the system's nonvolatile Read-Only Memory. The Macintosh IIci presently contains four 128K x 8-bit ROM chips in 32-pin DIP packages (soldered), which form a 32-bit-wide data bus. This provides a total of 512K of ROM that contain the routines for built-in video, parity, VM (virtual memory; used with A/UX), 32-bit Quickdraw, Toolbox, the

operating system, and other necessary system routines. The ROMs are also "32-bit clean" (have the ability to address 1.2 GB of addressable memory, which will allow support for future operating systems).

Also included on the logic board is a 64-pin ROM SIMM socket that will allow the Macintosh IIci to use new ROM SIMMs when available, thus providing a simple method to upgrade the machine.

Built-in Video
RBV Chip

The RBV (RAM-Based Video) consists of two functional parts, the video interface and the VIA2. The video portion of the RBV and bank A of RAM share a separated RAM data bus, which can be connected to or disconnected from the CPU data bus by bus buffers. Data stored in bank A of RAM is used by the RBV to feed a constant stream of video data to the display monitor during the live video portion of each horizontal screen line. The RBV asks the MDU (Memory Decode Unit) for data as it is needed. The MDU responds by disconnecting the bank A RAM data bus from the CPU data bus and performing an eight-long-word DMA burst read from bank A RAM while clocking the read data into the RBV.

If a video burst is in progress, CPU access to RAM bank A is delayed, effectively slowing the CPU. This effect is more pronounced for the larger monitors and for video configurations using more bits-per-pixel. Only accesses to RAM bank A are affected by video. The optional bank B of DRAM connects directly to the CPU data bus, and the CPU has full access to this bank at all times, as it does to ROM and the I/O devices.

The video signals that are generated by the RBV chip are driven through a CLUT/VDAC (Color Lookup Table/Video Digital-to-Analog Converter) chip. The lookup table has 256 three-byte entries (one byte each for red, green, and blue), and triple 8-bit video D/A converters.

When a monitor is connected to the built-in video ports, the monitor will ground certain pins on the connector which allows the RBV to identify the type of monitor connected. The RBV automatically selects the appropriate pixel clock and sync timing parameters. If an unknown monitor is plugged in or no monitor is plugged in, built-in video output is halted.

The built-in video will support monitors with screen sizes of 640 x 480, with up to 8 bits/pixel (12" B/W, 13" RGB) and 640 x 870, with up to 4 bits/pixel (15" full-page Portrait display).

The VIA2 portion contains eight 8-bit registers for miscellaneous inputs and outputs, video control, RBV chip-testing modes, and interrupt handling. The CPU communicates with these registers over an 8-bit bidirectional data bus that is separate from the 32-bit RAM data bus used by the video portion.

Input / Output Interface

The input/output interfaces of the system are the serial ports, controlled by the Serial Communications Controller (SCC) circuitry; the floppy disk, controlled by the SWIM circuitry; the SCSI devices, controlled by the Small Computer Standard Interface circuitry; the stereo sound port, controlled by Apple Sound Chip circuitry, and the ADB controlled by the ADB circuitry. The numeric coprocessor, the VIA chip, the VIA2 (which is part of the RBV chip), and associated circuitry are, to some extent, considered input/output devices; however, it should be recognized that they provide input/output to the processor. They do not have external ports as the system-level input/output circuitry does. Each of these interfaces is designed to be backwards compatible, when possible, with existing Macintosh systems.

Versatile Interface Adapters

The VIA1 and VIA2 provide maximum compatibility with existing Macintosh software. VIA1 has several CPU ID bits redefined to allow the ROM to distinguish between different computers. ROM overlay is performed automatically by the MDU so the overlay bit was eliminated. Two bits were redefined for parity, in addition to one bit in the VIA2 data register. The function of VIA2's is now provided by the RBV. Memory mapping is now supplied by the 68030 on-board MMU, so the RAM-size bits are no longer needed.

VIA1, which is a 6523 chip, provides the system with most of the signals from the 68000-based Macintosh configuration. VIA1 also provides access to features, including an Apple Desktop Bus interrupt and a synchronous modem signal. The VIA1 is configured to appear to the software as the VIA chip in 68000-based Macintoshes.

The VIA2 functions accommodate control of the new features that the Macintosh II design contains. VIA2 function is provided by the RBV and provides decoding of the NuBus slot interrupts, two SCSI interrupts, the Apple Sound Chip interrupt, detection of the external speaker or amplifier, testing of the parity circuit, flushing and disabling of a cache card, powering the unit off, blocking NuBus accesses to RAM, and decoding what error occurred in a NuBus transaction.

SWIM Chip

The SWIM chip in the Macintosh IIci replaces the IWM chip in the Macintosh II. The SWIM incorporates the functionality of the IWM and provides the capability to read, write, and format in both GCR (Apple) and MFM (MS-DOS and Apple high-density) data formats. The SWIM chip controls the one floppy disk drive internal to the unit and the one external floppy drive. In the Macintosh IIci the SWIM uses a 15.667-MHz clock when accessing the Apple FDHD drive and uses a divide-by-two circuit when accessing an 800K drive.

Small Computer Standard Interface

The Small Computer Standard Interface (SCSI) consists of an 53C80 chip (CMOS version), an internal 50-pin connector, and an external DB-25 connector. The chip is connected directly to both connectors, and it controls the high-speed parallel port for communicating with up to seven SCSI peripherals. This device supports arbitration of the SCSI bus, including reselection. The chip is controlled through a set of memory-mapped read-and-write registers.

The Macintosh IIci external SCSI port differs from the industry SCSI standard in two ways:

1. A DB-25 connector is used instead of the standard 50-pin connector. An adapter is available to convert the connector to the standard.

2. Power for termination resistors is provided. If the attached SCSI device does not have the required terminator resistor, an Apple-manufactured terminator block must be installed on the last device.

Serial Communications Controller

The two serial ports are controlled by the Serial Communications Controller (SCC), an 8-MHz Z8530 that has two independent ports for serial communication. Each port can be independently programmed for asynchronous, synchronous, and AppleTalk protocols. The serial ports conform to EIA standard RS422. These ports are used mainly for (though not limited to) connecting the Macintosh IIci to networks, printers, and modems.

The Macintosh IIci uses two Mini-DIN 8-pin connectors (Figure 9) for the two ports. Both connectors are interfaced through two 26LS30 and two 75175 chips to the SCC. Each signal pin passes through an RC filter network. The ports provide an output handshake but do not provide the +5 and +12 volts found on the Macintosh 128K, 512K, and 512K enhanced serial ports.

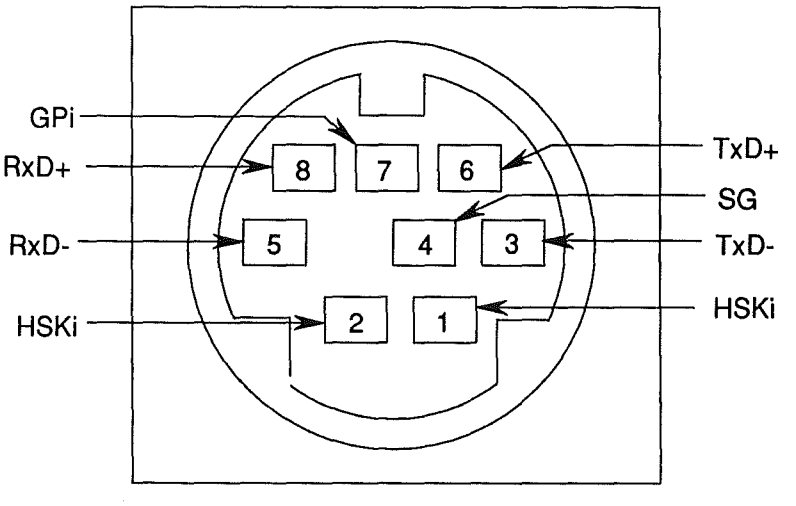


FIGURE 9

Apple Sound Chip

The Apple Sound Chip generates a stereo/audio signal. This signal is buffered by two additional chips that filter the Pulse Width Modulated (PWM) signal and drive the internal speaker or external stereo miniphone jack. If an external stereo mini-phone jack is not plugged into the IIci connector, then the internal speaker is driven from channel A sound output.

The sound generation system in the Macintosh IIci supports the previous Macintosh modes; it also offers a complete set of new ROM tools in the Software Sound Manager for performing sound generation.

Apple Desktop Bus

The Apple Desktop Bus (ADB) is a serial communication bus used to connect keyboards, mouse devices, graphic tablets, and other input devices to the system. It is a single-master, multiple-slave serial bus using an asynchronous protocol. The processor normally samples the state of each of the devices by using the control lines and shift register in VIA1 to read or write bytes over an internal serial link to the Apple DeskTop Bus modem chip. This is a 4-bit microprocessor that actually drives the external bus and reads the status of the selected device. The Mini-DIN 4-pin ADB connectors (Figure 10) connect the devices to the Macintosh IIci.

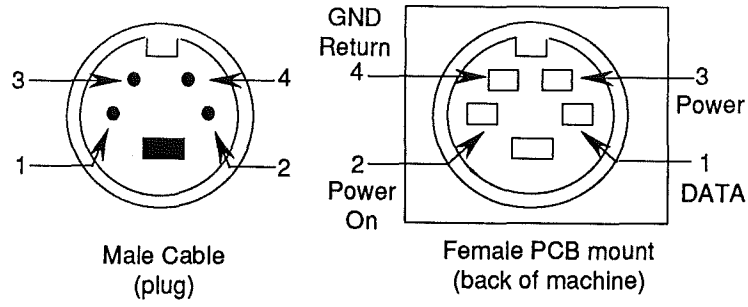


FIGURE 10

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

There are two Macintosh Apple ADB keyboards—the Apple Keyboard and the Apple Extended Keyboard. Both keyboards connect to the Apple Desktop Bus port on the rear of the Macintosh IIci. Both keyboards have their own microprocessors, which are called keyboard microcontrollers. The keyboards operate asynchronously, issuing commands on the ADB and transmitting and receiving data to and from the ADB devices.

Real-Time Clock

The Macintosh IIci real-time clock is a custom chip. It contains 256 bytes of RAM that are powered by a battery when external power is turned off. These RAM bytes are called parameter RAM. They store the configuration of ports, the clock setting, and other data that must be preserved even when the system power is not available.

NuBus Interface

The Macintosh IIci has three expansion slots to support Apple standard peripherals and increase RAM size. Each expansion slot is a 96-pin DIN connector that uses the NuBus interface to communicate with the system. The following are a few of the cards that will go into the NuBus slots:

- Video cards
- Extra RAM
- Ethernet™ (and other networks)
- Add-on SCSI port card

The NuBus interface supports the following features for the Macintosh IIci:

- **Geographic Addressing** Each of the three slots has a unique 4-bit value encoded into the slots, which eliminates the need for DIP switches or other means to uniquely address each card.

- **Distributed Arbitration** There is no central bus master or daisy chain to assign bus mastership. The bus mastership is performed with the geographic addresses, thus allowing a priority within a group of bus requesters but not an overriding control of the bus. In theory, all requesters will receive equal access to the bus over time.

- **Synchronous Transaction** All bus transactions are timed relative to a single asymmetric 10-MHz clock.

- **32-bit Address/Data** The NuBus supports 4 GB of address with justified 8-bit, 16-bit, and 32-bit data transactions. The 68030 supports all these data types through the use of dynamic bus sizing. This means word and long-word operations do not have to be aligned but instead cause multiple NuBus transactions to perform the proper alignment. The data bus from the 68030 to NuBus is byte reversed to allow sequential byte addresses to appear on the NuBus data ports in the same order as the NuBus address would imply.

- **Bus Time-out** The absence of a card on the NuBus will not hang the bus by waiting for a reply. A system resource will error out any transaction taking longer than 25.6 µs.

- **Simple Interrupts** Each card has the ability to generate simple open-collector interrupts that allow inexpensive cards to gain system attention without having to become bus master.

The NuBus has three major states of communication with the Macintosh IIci system:

- Processor to NuBus, which is activated whenever the microprocessor generates a physical slot address. If a device responds, the data is transferred.

- NuBus to Processor Bus, which is for access to RAM, ROM, and I/O to and from NuBus. Two control functions are performed for this process. One tracks the changes on NuBus, and the other lets the 68020/68030 tell NuBus what to do next.

- NuBus time-out, which is required to prevent access to empty slots. Such access would hang the system.

The NuBus implemented in the IIci also allows communications directly from one NuBus card to a second NuBus card.

Every NuBus card should contain a ROM declaration that provides information to the operating system at startup. The ROM information ensures that drivers are properly installed and that the card is initialized and recognized by the system.

Cache Connector

The cache connector is a 120-pin EuroDIN connector that will enable installation of a cache card to boost the performance. The main idea of adding a cache card is to increase the effective speed of main memory by providing the CPU with a copy of the most frequently used data more quickly. The cache stores the most recently accessed data and instruction in a small (≤64K) bank of high-speed memory. This storage is especially useful in accessing looping routines. A cache card should operate transparently to the user programs.

The cache should be physically mapped, because it has no access to the 68030 chip's on-board MMU, so cache coherency should not be a problem.

***CAUTION:** Even though the cache connector is the same connector used in the SE/30, the SE/30 cards are not compatible with the cache connector. The pinouts are different. Using a SE/30 card in the cache connector will damage both the computer and the card.*

Parity

Parity is generated by the PGC (Parity Generator Chip). If the parity chip is installed, and parity checking is required, then the system must use 9-bit DRAM SIMMs. If parity checking is not needed, then 8-bit DRAMs can be used and parity checking will not take place. A warning message will be issued at boot time to indicate non-functioning parity.

If the PGC is present, the parity bit is always written. If the bit is not physically present (not using 9-bit DRAMs), it is simply ignored. If the correct DRAMs are being used when a read takes place in the RAM address space, the PGC generates an internal parity bit from each byte of the data bus, and compares it to the bit read from the SIMM's parity bit. If the two parity bits do not agree, and parity is enabled, the PGC generates two outputs: one that interrupts the processor and the other that indicates a parity error. At that point the system will have to be reset.

Power Control

The Macintosh IIci has a Hard-ON/Soft-OFF circuit to control the power supply. The circuit is designed to control the power supply through the Power Fail Warning signal on NuBus.

The circuit design attempts to turn on the power supply while the power switch is pressed (Hard-ON) and for 2–4 seconds after the power switch is pressed, depending on how many external SCSI devices are connected. The Apple Desktop Bus keyboard has a secondary power switch that can turn on the unit. When the power switch is pressed, a capacitor is discharged through a resistor to activate the power-on circuitry. The capacitor gets its charge through a soft-power circuit that is active even when the computer is turned off. As long as AC current is present (the unit is plugged in), the power supply will turn on the computer within 2–4 seconds.

This circuit works in conjunction with the new Locking Power Switch located on the rear of the unit. This switch can be locked in an ON position, which allows the unit to restart itself as soon as AC power is detected. In effect, if there is a power failure and the unit shuts off, the unit will start up as soon as the power is reinstated. If this switch is not in the ON position, the unit will not turn on until someone turns it on. This feature is most valuable when using the unit as a file server.

The power-off function is under software control (Soft-OFF) by using the menu command **Shut Down** from the Special menu of the Finder. This software control allows the computer to clean up any pending activity before switching off. The power-down switch generates a Hard-OFF that turns off the computer after 2 ms without going through software.

Power Supply

The power supply operates on standard line voltage and outputs +5V, +12V, and -12V DC voltages, which are used by the logic board, the internal devices, and the slots.

CAUTION: *It is extremely important that the ratings of the power supply not be exceeded. Exceeding the ratings will result in damage to the power supply and the logic board. See the specifications in this section for maximum ratings for the system.*

Fuses

There are three fuses on the logic board to protect the external connectors, SCSI, floppy disk drive, and ADB. These fuses are resettable polyfuses and require about four seconds to reset once blown by an overload.

Internal Floppy Disk Drives

The internal disk drive connects to the main logic board through an internally installed connector. The flow of data between the logic board and the disk drives is channeled through the SWIM disk controller. The SWIM controls reading and writing operations.

FDHD Drive

The SWIM disk controller enables the Apple FDHD drive to exchange data between Apple and MS-DOS systems. The SWIM chip interprets, converts, and outputs dual-disk (clock/time) and file (data) signals as appropriate for either GCR (Apple) or MFM (MS-DOS and Apple high-density) formats. This arrangement provides the capability to read, write, and format Apple 400K and 800K data disks (GCR), MS-DOS 720K data disks (MFM), and Apple or MS-DOS high-density (1.4 MB) data disks (MFM).

An application-specific translator within the Apple File Exchange utility program, or provided by third parties, must be used to translate the formatted data for use within an application program.

Internal Hard Disk SCSI

The hard disk connects to the logic board through the internal SCSI connector. Other SCSI devices may be daisy-chained to the external SCSI port.

Apple Technical Procedures

Macintosh IIci

Section 2 – Take-Apart

❑ CONTENTS

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

❑ ELECTROSTATIC DISCHARGE PREVENTION

The Macintosh IIci contains C-MOS components, and RAM memory is installed on small separate boards called SIMMs (Single In-line Memory Modules). Both the C-MOS components and the SIMM modules are very susceptible to damage from electrostatic discharge (ESD).

Preventive measures must be taken to avoid ESD damage. When you are unwrapping, installing, or replacing any modules, observe the appropriate ESD precautions.

For complete ESD prevention information, refer to *You Oughta Know Technical Procedures.*

If the proper ESD procedures are not available, then do the following:

Turn off the Macintosh IIci power switch and disconnect the power cord. After removing the lid and before going near the logic board, touch the metal of the power supply case.

❑ TOP LID

Materials Required

Phillips screwdriver

Remove

1. Remove the AC power cable.
2. Remove the Phillips screw (Figure 1, #1) at the top rear of the case.

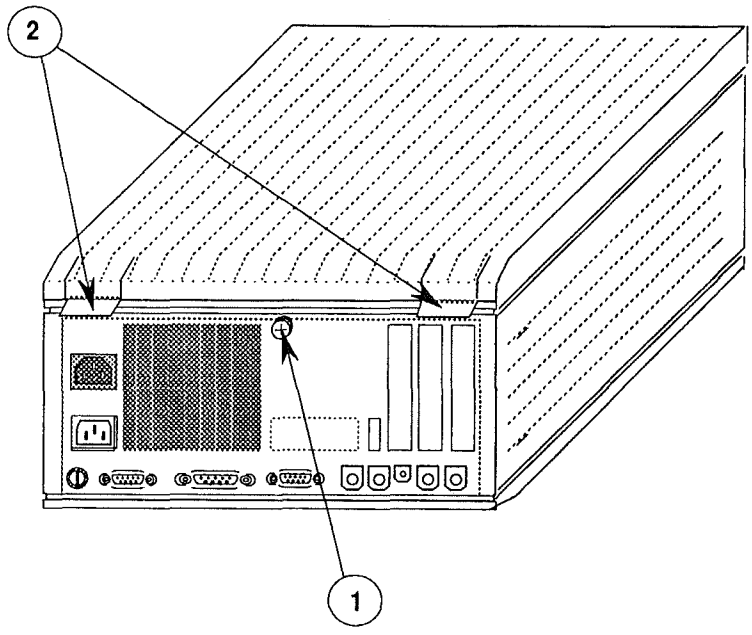


FIGURE 1

3. Push up on the tabs on the back of the lid (Figure 1, #2) and lift up the lid from the back to the front until the lid comes off the front end.

Replace

1. Insert the front end of the lid onto the front end of the unit, making sure that the tabs on the lid fit into the receptacle on the unit.
2. Swing the lid down toward the back of the unit, pressing down on the back until you hear a small click.
3. Replace the Phillips screw on the rear of the unit (Figure 1, #1).

❑ INTERFACE CARDS

The following procedure can be used to remove or replace any interface or expansion card that is installed in the Macintosh IIci.

Remove

1. Remove the top cover.

2. Touch the metal on the power supply case inside the computer to discharge any static electricity that might be on your body or clothing.

WARNING: *If the computer has been on, let it cool for 5 minutes before touching the power supply.*

3. Carefully grasp each end of the card and pull straight up to remove it. To put the least possible stress on the logic board, gently tilt the card forward and back while pulling upward.

   Note: When removing the card, pull up evenly on both sides of the card to avoid bending the connector pins.

Replace

1. Position the card so that the connector on the bottom of the card lines up with the slot. Align the card so that the metal guides—at the top and bottom of the rear slot opening—fit through the metal shield attached to the card.

2. Place one hand on the card, directly over the connector area, and push down firmly until the connector is fully seated.

CAUTION: *Do not force the card. If you meet a lot of resistance, remove the card and try again.*

3. Replace the top cover.

❑ SPEAKER BRACKET AND SPEAKER

The speaker is secured in a speaker bracket that must be removed from the case before the speaker can be removed.

Remove

1. Remove the top lid.

2. Find the speaker (Figure 2, #1) in the speaker bracket (Figure 2, #2) located at the front of the unit and pull out the two-wire connector going to the main logic board.

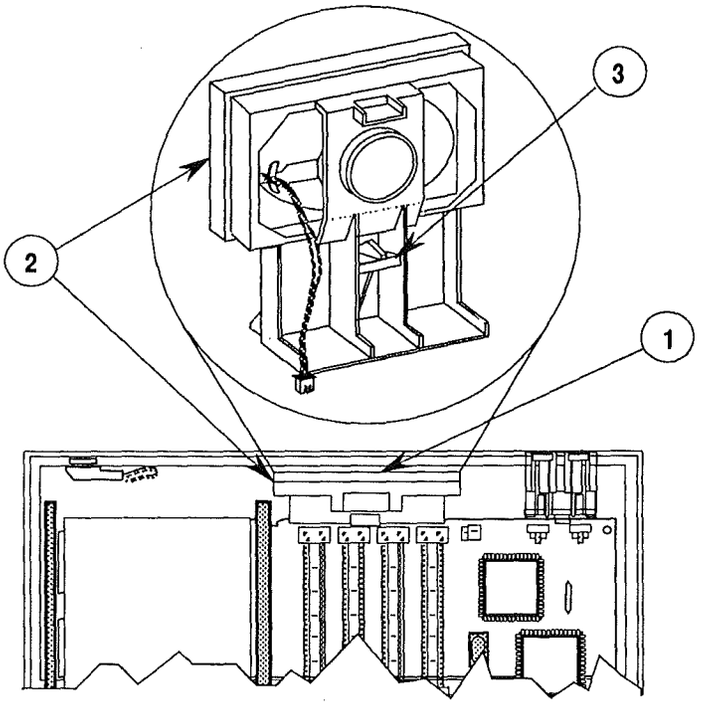


FIGURE 2

3. Gently lift up on the tab (Figure 2, #3) in the center of the bracket and at the same time pull back on the top of the speaker bracket until it comes loose from the bottom area.

CAUTION: *In the next step, do not push on the heavy paper part of the speaker, or you will damage the speaker.*

4. Gently push the speaker out of the bracket by applying force at the center of the rear of the speaker (Figure 3, #1).

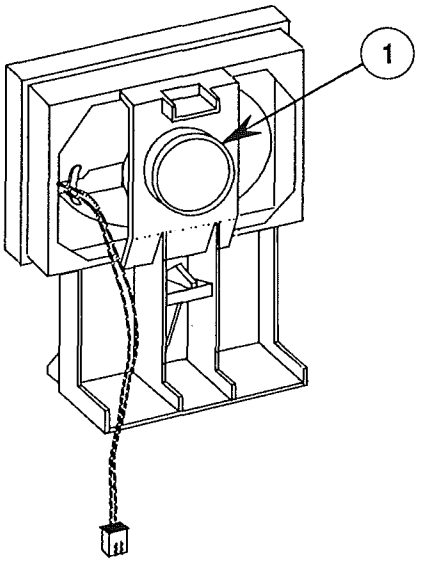


FIGURE 3

Replace

1. Line up the rear part (Figure 4, #1) of the speaker (the round metal part that sticks out on the back of the speaker) with the round hole in the speaker bracket.

2. Make sure that the two wires (Figure 4, #2) from the speaker are protruding through one of the two openings on either side of the round hole on the bracket.

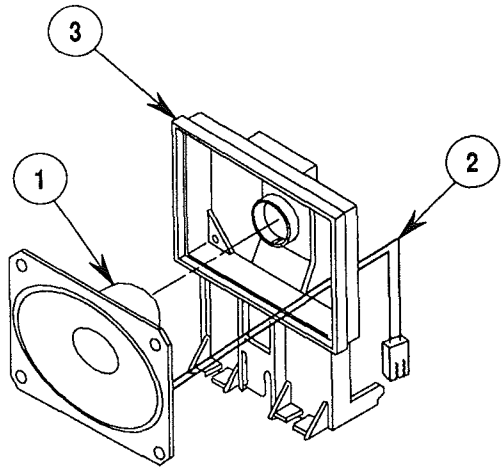


FIGURE 4

3. Gently push the round metal part of the speaker into the round hole on the bracket until it stops going in and the rectangular front part of the speaker is embedded in the rectangular frame of the bracket (Figure 4, #3).

4. With the speaker facing the front of the case, insert the bottom of the bracket at an angle so that the bottom back side of the bracket is at the edge of the logic board.

5. Push the top of the bracket down and forward toward the front of the case. This action should wedge the bottom of the bracket between the edge of the logic board and the front of the case.

6. Press the top of the bracket forward to make sure it is secured to the front of the case.

7. Connect the two-wire speaker cable to the 2-pin connector (J23) on the logic board.

❑ POWER SUPPLY

Remove

1. Remove the AC power cable.

2. Remove the top lid.

3. Reach down and underneath the front right of the power supply (Figure 5, #1) where the disk drive carrier is touching the power supply, and find the tab (Figure 5, #2) that is latched to the bottom of the power supply. (This tab is part of the disk drive carrier unit.)

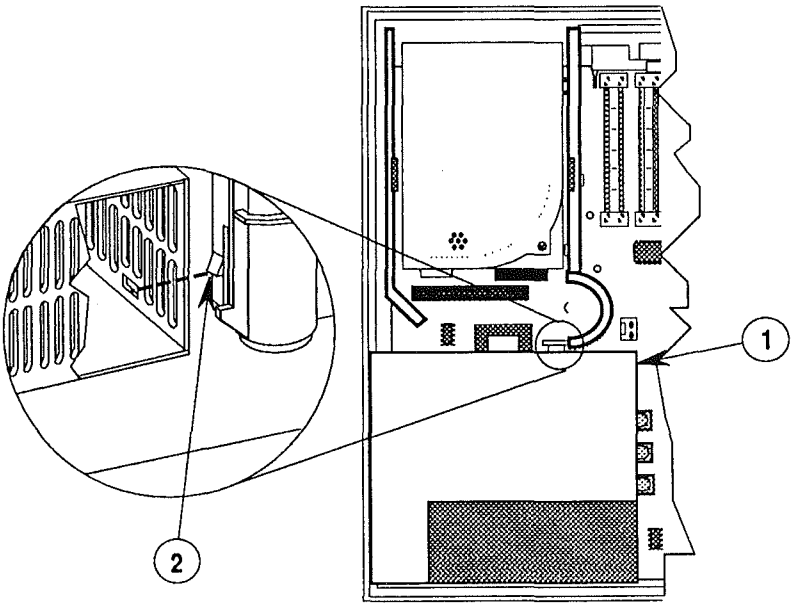


FIGURE 5

4. Using a finger, push the end of the tab toward the front of the case and at the same time lift up on the power supply. You will have to use some force to loosen the power supply, since you are pulling out a connector while you're lifting. If the power supply seems as if it won't move, make sure you are unlatching it correctly at the tab underneath.

   Once the power supply begins to move, it will come completely up and out of the case.

Replace

1. Line up the power supply correctly over the space on the logic board. Make sure that the two lips on the power supply case (Figure 6, #1) line up with the slot on the left side of the case and the slot on the back wall of the case (Figure 6, #2).

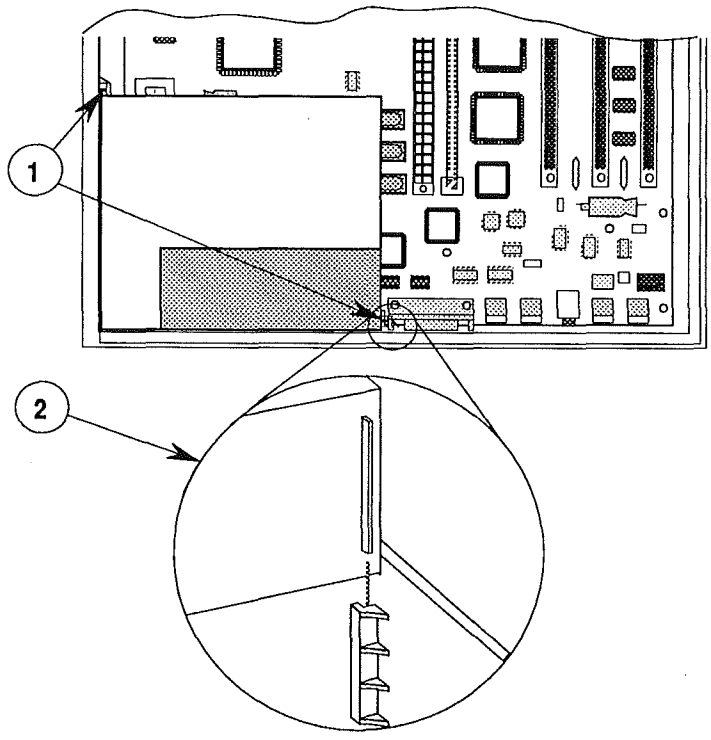


FIGURE 6

Note: Don't worry about the connector on the bottom of the power supply. This is a self-aligning connector that will go into the connector on the logic board, as long as you have properly aligned the power supply.

2. Slide the power supply down into the case until you hear a click. If you don't hear the click, you either did not align the case properly or the connector is not pushed in far enough. Lift out the supply and start over again. You must hear the click.

❑ FAN BRACKET AND FAN

The fan and fan bracket are two separate units. To remove the fan, you must first remove the fan bracket.

Remove

1. Remove the power supply.

2. Unlatch the two bracket latches (Figure 7, #1) that protrude from the bottom of the power supply by gently squeezing them together until they clear the metal tabs. As the tabs are released, push up on them so that the fan bracket starts to come out of the power supply case.

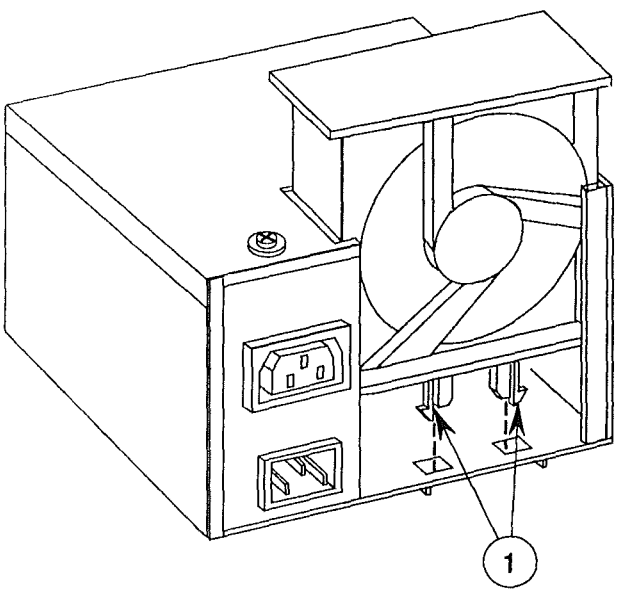


FIGURE 7

3. Pull out the bracket completely.

4. When the bracket is completely out, unplug the connector that attaches to the printed circuit board inside the power supply case.

5. On the fan side of the bracket (the side from which the wires exit), unlatch the two plastic tabs (one on each side of the fan) (Figure 8, #1), and push the fan out of the bracket.

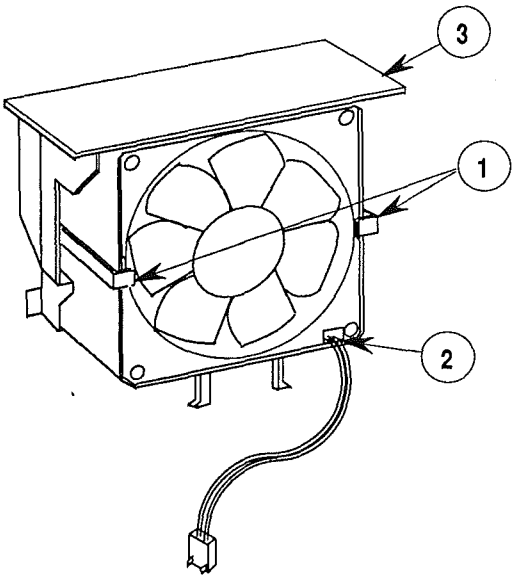


FIGURE 8

Replace

1. Align the fan in the bracket so that the hub of the fan (with the wiring) goes into the bracket. This way the wires will be sticking out of the fan away from the bracket (Figure 8, #2). It is also important that the wire side be toward the bottom of the bracket. The large flat side (Figure 8, #3) of the bracket is the top.

2. Start the fan bracket into the power supply. The wires should be facing toward the inside of the supply. Plug the 2-wire connector into the connector on the power supply logic board.

   Note: Make sure the fan wire is pushed back into the power supply to prevent the wire from hitting the blades.

3. Push the bracket all the way down until the two latches protrude through the bottom of the power supply and engage the two metal tabs.

4. Hand-spin the fan and listen to determine if the blades are hitting the wire. If they are, remove the fan bracket again and readjust the wire so it won't hit the fan blades.

5. Replace the power supply.

❑ HARD DISK DRIVE

The hard disk drive (Figure 9, #1) is located in the top portion of the disk drive carrier unit (Figure 9, #2). The hard disk drive can be removed with or without removing the carrier unit. The following procedure describes how to remove the hard disk drive without removing the carrier unit. (The procedure for removing the carrier unit is explained later in these Take-Apart procedures.)

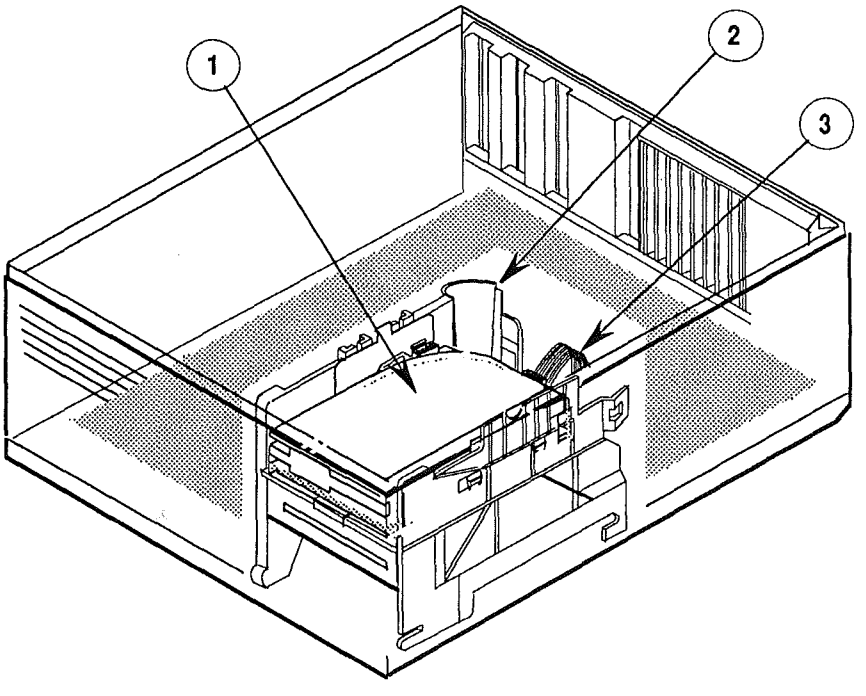


FIGURE 9

Remove

1. Remove the top lid.
2. Carefully pull out the 50-pin connector from the back of the hard disk drive (Figure 9, #3).
3. Remove the diode drive light on the front of the case (Figure 10) by lifting up on the plastic holder (Figure 10, #1) and pulling the diode (Figure 10, #2) out from the holder.

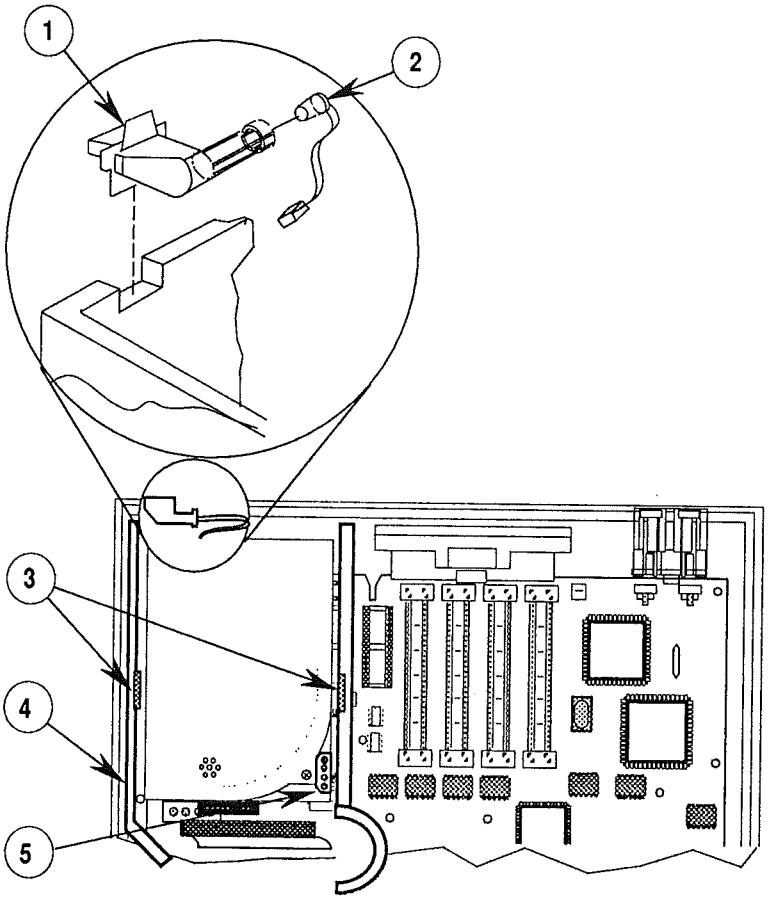


FIGURE 10

4. Grasp the two metals tabs (Figure 10, #3) located on the side of the hard disk drive bracket. Squeeze the tabs and gently pull up on the bracket.

   Note: On some hard disk drives, the power connector may not be on the top (as shown in the diagram). The connector may be on the back of the hard disk drive next to the 50-pin connector.

   The hard disk drive (with its metal bracket) will start to come out from the large plastic carrier unit (Figure 10, #4). However, the hard disk drive will not pull out all the way; you must first disconnect the power supply connector (Figure 10, #5). Then remove the hard disk drive.

5. Remove the hard disk drive from its metal bracket by removing the four Phillips screws on the bottom of the bracket (Figure 11, #1).

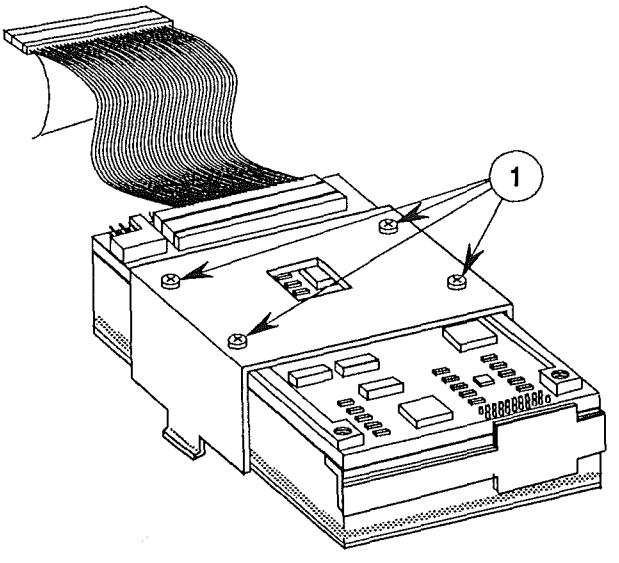


FIGURE 11

Note: If you are replacing the hard disk drive, you must remove the metal bracket. Replacement drives do not come with a bracket.

Replace

1. Mount the hard disk drive onto the metal bracket and secure it with the four Phillips screws.

2. Position the bracket and drive over the plastic disk drive carrier unit, and push in the power supply connector. Be careful not to push too hard or the printed circuit board may break. It is best to put your thumb on the back of the board to support it, and then squeeze the connector all the way on.

3. Push the bracket and drive down into the carrier unit until the hard disk drive snaps into place.

4. Connect the 50-pin connector on the back of the hard disk drive.

5. Put the drive diode light back into the clear plastic lens.

6. Reinsert the clear plastic lens into the front case housing.

7. Replace the top lid.

❑ DISK DRIVE CARRIER AND FLOPPY DISK DRIVE

To remove the floppy disk drive, it is necessary to remove the whole plastic disk drive carrier unit (Figure 12, #1) that holds both the hard disk drive and the floppy disk drive.

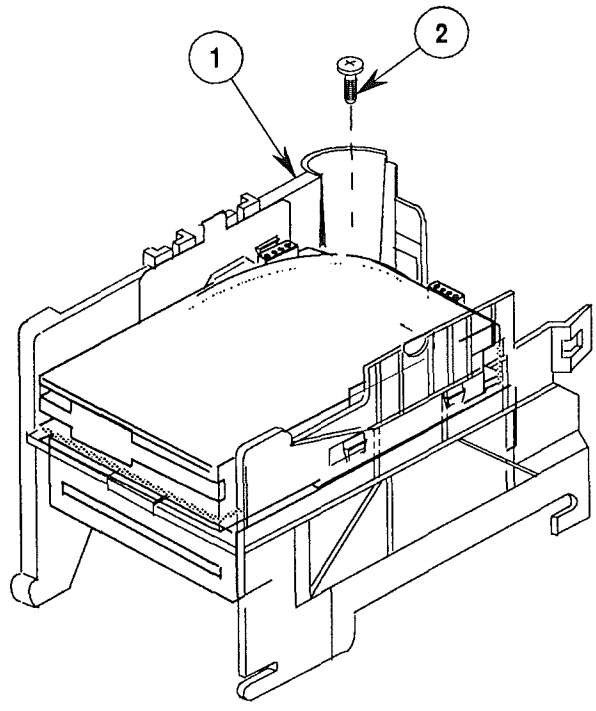


FIGURE 12

Remove

1. Remove the top lid.
2. Remove the power supply.
3. Remove the Phillips screw (Figure 12, #2) from the disk carrier.
4. Remove the diode from the lens (Figure 13, #1).
5. Pull up on the paper connector tab (Figure 13, #2) on the 50-pin connector (that secures the signal cable to the main logic board) and disconnect the cable connector.

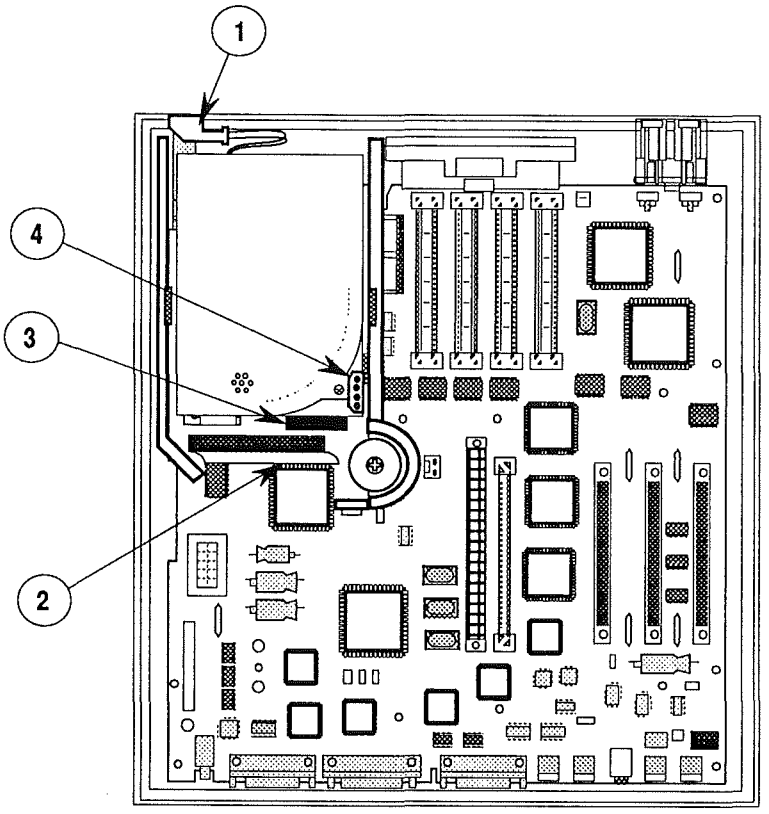


FIGURE 13

6. Disconnect the 20-pin connector (Figure 13, #3) from the logic board.

7. Disconnect the power cable connector from the hard disk drive (Figure 13, #4).

...Continued on next page

8. Unlatch the bracket (Figure 14, #1) along the side of the carrier unit, and at the same time pull the whole carrier toward the rear of the case about a half-inch. When this distance is reached, lift up on the carrier to remove it from the case.

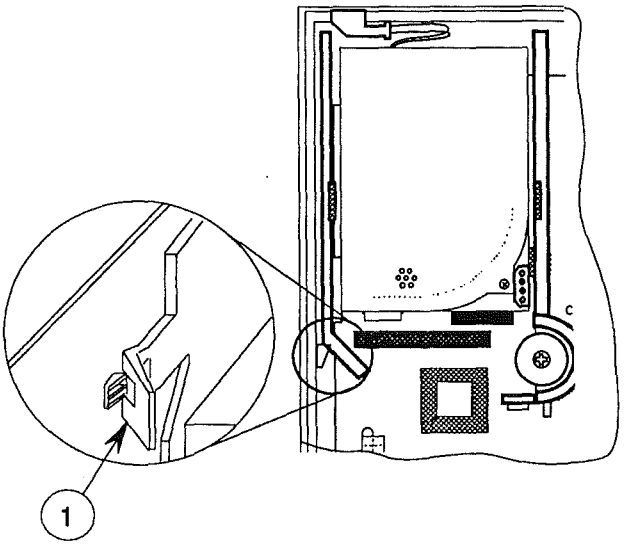


FIGURE 14

Note: If the hard disk drive is also to be removed, you can follow the removal steps in the "Hard Disk Drive" section above. It doesn't matter whether the disk drive carrier is in or out of the main case.

9. Turn over the carrier unit and gently push down on the latch (Figure 15, #1) that holds the front of the floppy disk drive.

10. Move the floppy disk drive toward the front of the carrier about one inch, and pull the front of the floppy drive away from the carrier. The rest of the drive will follow. Remove the drive.

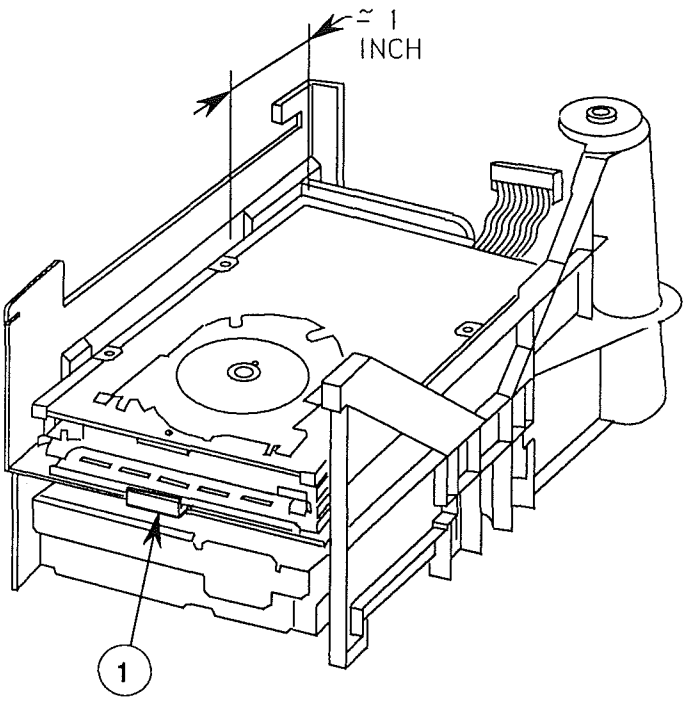


FIGURE 15

Replace

1. Turn the carrier unit upside down so that the bottom is facing up.

2. Insert the floppy drive into the carrier, back end first, printed circuit side up, about an inch from the back of the carrier.

3. Turn the carrier unit over, so that the floppy drive is now on the bottom.

4. Swing the floppy drive into the carrier so that it is parallel to the carrier. Then push the drive down toward the back of the carrier until you hear and see the latch (Figure 15, #1) click over the front top of the floppy disk drive.

5. Position the carrier unit over the logic board so that the front of the carrier is approximately one-half inch from the front of the case.

6. Lower the carrier onto the logic board approximately 1/2 to 3/4 inches from the front of the case, and then push the carrier forward until it snaps into position.

The latch (Figure 16, #1) on the outside rear of the carrier goes over the indent on the case side. The hole on the right-rear side of the carrier, where the screw goes, will line up with the hole in the logic board.

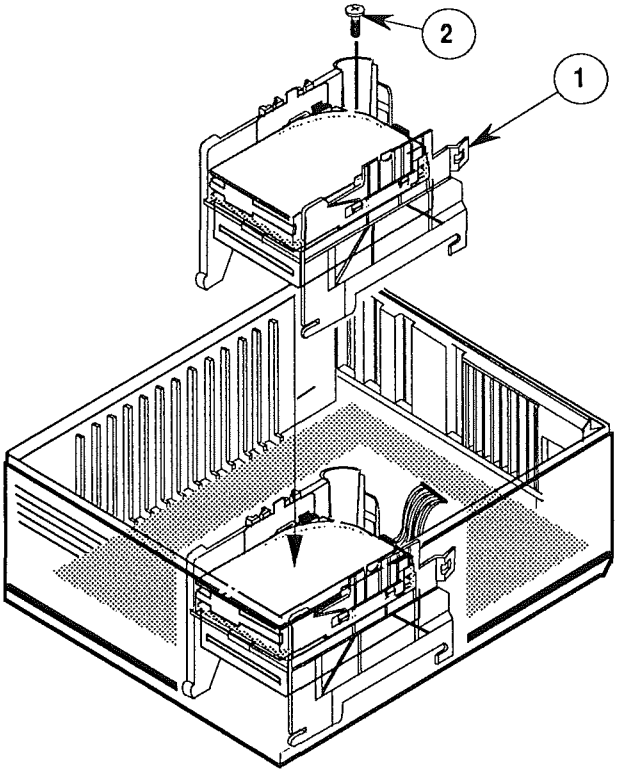


FIGURE 16

7. Secure the carrier to the bottom case with the Phillips screw (Figure 16, #2).

8. Connect the 20-pin floppy cable to the connector on the logic board.

9. Connect the 50-pin cable connector to the connector on the logic board by aligning the connector over the pins and then pushing down on the connector.

10. Connect the power connector to the hard disk printed circuit board.

11. Replace the power supply.

12. Replace the top lid.

❑ RESET/INTERRUPT SWITCH

If the reset/interrupt switch is installed, it must be removed before you can remove the main logic board.

Remove

1. Using one finger, lift up on the center tab (Figure 17, #1) of the switch. This action releases the switch from the logic board.

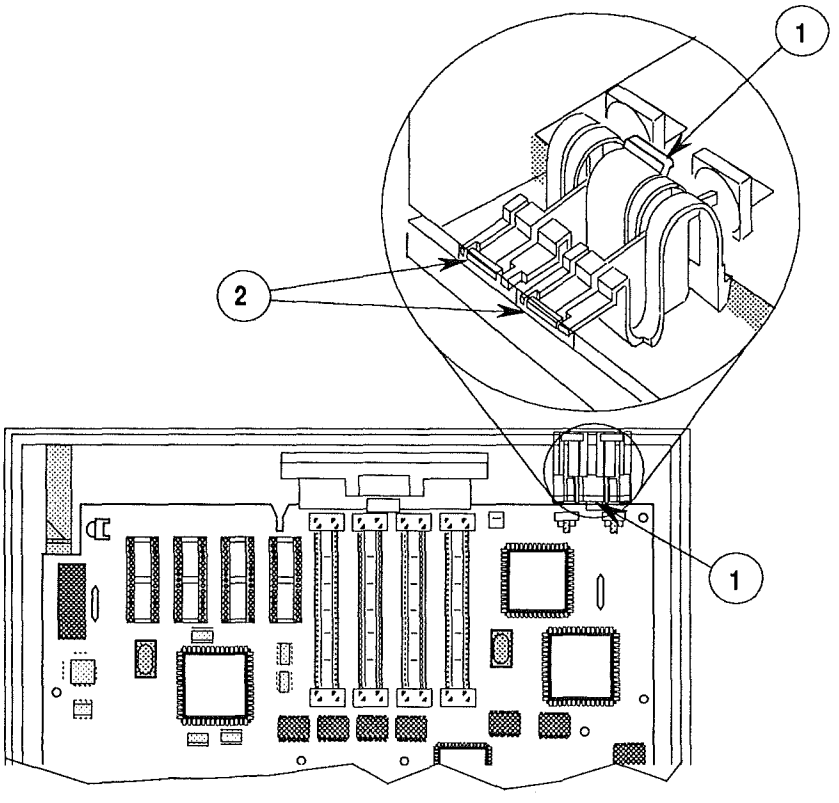


FIGURE 17

2. Lift the rear of the loosened switch up and away from the front of the case. You may have to wiggle the switch a little to get it to come away from the case. But do not force the switch; it can break easily.

Replace

Insert the front end of the switch (Figure 17, #2) down and into the two slots at the right-front bottom of the case. As the tabs on the front of the switch go into the slots, push the rest of the switch down until it snaps under the edge of the main logic board.

❑ MAIN LOGIC BOARD

Remove

1. Remove the top lid.
2. Remove interface cards.
3. Remove the power supply.
4. Remove the disk drive carrier.
5. Remove the reset/interrupt switch (if installed).
6. Remove the speaker bracket.
7. Slide the logic board toward the front of the case until it stops.
8. Gently begin lifting the front end of the logic board up and out; the back end will follow. Lift the board completely out of the case.

Replace

1. Insert the logic board into the case, back end first, so that its connectors gently align with the openings in the back of the bottom case.
2. Lay the board flat on the bottom, making sure that the slots in the logic board fit over the tabs on the bottom of the case.

   Note: Before sliding the logic board toward the rear of the case, make sure that all the metal grounding tabs that surround the port holes on the rear of the case are not folded in front of the port holes. These metal tabs should press against the logic board connectors to form a common ground shield when the board is pushed in place. If a tab is accidentally folded over in front of the hole and the board is pushed against it, the tab could break off or the port hole could be blocked.

3. Slide the logic board toward the rear of the case as far as it will go. You should feel and hear a slight thump.
4. Replace the reset/interrupt switch (only if needed).
5. Replace the speaker bracket.
6. Replace the disk drive carrier.

7. Replace the power supply.
8. Replace the interface cards (any that were removed).
9. Replace the top lid.

Macintosh IIci

Section 3 – Diagnostics

Not Available

The diagnostics are not available at this time. This section will be updated as soon as the diagnostics are ready. Until then, please refer to the Troubleshooting section to help with any system problems.

Apple Technical Procedures

Macintosh IIci

Section 4 – Troubleshooting

❑ CONTENTS

...Continued on next page

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

❑ INTRODUCTION

General Information

The following three test disks can be used to test portions of the Macintosh IIci system:

- *AppleCAT™ IIcx/IIci*
- *MacTest™ IIcx/IIci*
- *Apple Hard Disk Test* (version 1.0 or higher)

Use this troubleshooting section if you are unable to boot the *MacTest IIcx/IIci* disk, or if the disk is unable to detect a module failure. After you repair the system, run the test disk again to verify system operation.

Before You Start

Read the sections titled "Things to Remember," "Module Exchange Information," "Startup and Error Chords," "SIMM Verification," and "Battery Verification" before you begin troubleshooting. You need the information provided in these sections to troubleshoot the Macintosh IIci effectively.

Error Chords

When switched on, the Macintosh IIci executes a ROM-based self-test. If any part of the self-test fails, a sequence of chords will sound. To hear a sample of each sequence of chords, listen to the Diagnostic Sound Sampler on the *MacTest IIcx/IIci* disk. (Refer to Section 3, Diagnostics, for more information.)

How to Use the Symptom Chart

To use the symptom chart, first find the symptom that most nearly describes the problem; then perform the first corrective action on the solution list. If that corrective action does not fix the problem, go to the next one. If you replace a module and find that the problem remains, reinstall the original module before you go on to the next action.

If the symptoms displayed by the Macintosh IIci are not listed in the symptom chart, or if the system is not displaying a clearly defined problem, use the flowchart sections.

How to Use the Troubleshooting Flowcharts

There are five numbered flowcharts for the Macintosh IIci. On completion of Flowchart 1, you will be instructed to continue to the next flowchart. Continue until you complete Flowchart 5.

Each of the flowcharts includes references to notes that are either above the flowchart or on the opposite page. These notes provide additional instructions or referrals to other procedures.

Starting at the top of Flowchart 1, answer the questions and proceed down the chart. When you arrive at a rectangular box containing a list of actions, perform the actions in the sequence listed. On completion, return to the preceding diamond box. **If the problem remains, reinstall the original module before you go on to the next action.**

❑ THINGS TO REMEMBER

ESD

1. Follow all electrostatic discharge (ESD) precautions when working on the Macintosh IIci. Refer to the *You Oughta Know* tab in the *Apple Service Technical Procedures* for additional information.

Troubleshooting Hints

2. If available, use a known-good monitor and monitor cable. This will isolate the problem to the CPU, internal drive, keyboard, or mouse.

3. Before you begin troubleshooting, remove all interface cards and disconnect any external devices (printers, SCSI devices, and/or ADB devices other than the keyboard and mouse).

   After the Macintosh IIci has passed the diagnostic tests, each expansion card or peripheral must be installed and tested. Install one device and test the system before adding any other devices. Repeat the install-and-test process until all devices have been installed and tested.

4. Mark each known-good SIMM module on the exchange logic board with white correction fluid or a small sticker to prevent confusion during the troubleshooting procedure.

5. Use a known-good copy of the *MacTest IIcx/IIci* disk.

Normal Startup Tone

6. During a normal startup sequence, a medium-pitched soft chord is emitted. If this does not happen, refer to "Startup and Error Chords" for additional information.

System Configuration

7. To ensure that customers get back the same system configurations that they bring in, record the following information:

   - The size of the SCSI hard disk (20 MB, 40 MB, 80 MB), if one is installed
   - SIMM sizes for both banks
   - Type and serial number of expansion cards
   - If a ROM SIMM is installed

8. Verify that the customer is using System 6.0.4 and Finder 6.1. Using earlier versions may destroy data, or prevent the unit from booting.

❑ MODULE EXCHANGE INFORMATION

Logic Board Configuration

The Macintosh IIci logic board service exchange module is shipped without memory SIMMs.

To make sure that customers always get back the same logic board configurations that they brought in, be sure to record the following information before you exchange any modules:

- The amount of memory installed and the size of the SIMMs in each bank
- Whether a ROM SIMM is installed

Internal Hard Disk SCSI

The internal 20 MB, 40 MB, and 80 MB SCSI hard disk service modules are shipped without the SCSI cable connected. Be sure to keep the SCSI cable with the customer's Macintosh IIci system. The SCSI cable is sold as a separate replacement part and is not part of any module.

The SCSI power cable is not included with the internal SCSI drive modules. You must retain the power cable from the old drive to use on the replacement drive.

❑ STARTUP AND ERROR CHORDS

Introduction

When the Macintosh IIci is switched on, the ROM executes a self-test. If any part of the self-test fails, a sequence of chords will sound. To hear a sample of each sequence of chords, listen to the "Diagnostic Sound Sampler," which is included on the MacTest IIcx/IIci disk. (Refer to Section 3, Diagnostics, for more information.)

If you are unable to interpret the chords, use the flowcharts and ignore the question about the startup chord on Flowchart 1.

Startup Chord

During a normal startup sequence, a medium-pitched chord is emitted; then a disk icon with a flashing question mark is displayed on the screen. If a hard disk is installed, then there will not be any question mark.

Error Chords

If a startup chord and additional chords sound, a blank gray screen will usually be displayed. There will always be three sequences played if an error is encountered during startup: startup chord first, then the short, harsh error chord, followed closely by the test monitor chord (four chords, from low to high).

Initial Failure

If you hear the above sequence, then a failure has occured during the initial hardware self-tests. To correct the problem:

1. Exchange only the SIMMs in Bank A. (Refer to "SIMM Verification" in this section for complete instructions.)

2. Exchange only the SIMMs in Bank B. (Refer to "SIMM Verification" in this section for complete instructions.)

3. If these exchanges do not work, exchange the logic board. (Install the customer's SIMM modules on the exchange board.)

4. If the system still does not work, you will need to do the SIMM verification with the exchange logic board.

❑ SYMPTOM CHART

Built-In Video Problems	Solutions
• *Screen is dark, audio and either drive operate, fan is running, and LED is lit*	1. Adjust brightness on monitor. 2. Replace monitor. 3. Replace video cable. 4. Make sure ROM jumper is on (refer to Section 1, Basics). 5. Replace SIMMs (refer to "SIMM Verification" in this section). 6. Replace logic board. 7. Replace power supply.
• *Screen dark, no audio, no drive, but fan is running and LED is lit*	1. Replace video cable. 2. Replace monitor. 3. Make sure ROM jumper is on (refer to Section 1, Basics). 4. Remove any NuBus cards, if installed. 5. Remove any external perherial, if attached. 6. Replace SIMMs (refer to "SIMM Verification" in this section). 7. Replace logic board. 8. Replace power supply.
• *Partial or whole screen is bright and audio is present, but no video information is visible*	1. Replace monitor. 2. Replace video cable. 3. Make sure ROM jumper is on (refer to Section 1, Basics). 4. Replace logic board only.
• *Screen is completely dark, fan is not running, and LED is not lit*	1. Plug the monitor directly into the wall socket, and verify that the monitor has power. 2. NuBus cards drawing more than 45 Watts. Remove the NuBus card and try power up again. 3. Remove any external perherial if attached. 4. Replace power supply. 5. Replace logic board only.

Note: If replacing the monitor will correct the problem, refer to the appropriate Technical Procedures to obtain replacement information.

Floppy Drive Problems	Solutions
• *Audio and video present, but internal drive does not operate*	1. Replace bad disk. 2. Verify that all external SCSI devices are disconnected. 3. Replace internal disk drive cable. 4. Replace internal disk drive. 5. Replace logic board only. 6. Replace power supply.
• *Disk ejects; display shows icon with blinking "X"*	1. Replace disk with known-good system disk. 2. Replace internal disk drive cable. 3. Replace internal disk drive. 4. Replace logic board only.
• *Will not eject disk*	1. Switch off system and hold mouse button down while switching on. 2. Try ejecting disk manually. 3. Replace disk drive.
• *Attempts to eject disk, but doesn't*	1. Try pushing disk completely back in. 2. Try ejecting disk manually. 3. Replace disk drive.

SCSI Problems	Solutions
• *Internal disk drive runs continuously*	1. Replace bad disk. 2. Replace internal disk drive cable. 3. Replace internal disk drive. 4. Replace logic board only.
• *Internal hard disk will not operate*	1. Replace SCSI cable connector. 2. Replace SCSI power connector. 3. Replace hard disk. 4. Replace logic board only.

Peripheral Problems	Solutions
• *Works with internal or external SCSI device but will not work with both*	1. Verify that SCSI select level switch on external device is set to a different priority from internal. 2. Replace terminator on the external device. 3. Verify terminator is installed on the internal SCSI drive. 4. Replace SCSI device select cable.
• *Cursor does not move*	1. Reboot system. 2. Check mouse connection. 3. If mouse was connected to keyboard, connect the mouse to a rear ADB port instead, and disconnect the keyboard. If mouse works, keyboard should be replaced. 4. If mouse does not work in any ADB port, replace mouse. 5. Replace logic board only.
• *Cursor moves, but clicking the mouse button has no effect*	1. Replace mouse. 2. Replace logic board only.
• *Cannot double-click to open an application, disk, or server*	1. Remove any multiple system files on the hard disk. 2. Clear parameter RAM. Hold down the <Shift><Option><Command> keys and select Control Panel from the Apple menu. Reset mouse controls. 3. If mouse was connected to keyboard, connect it to a rear ADB port instead. If mouse works, keyboard should be replaced. 4. If mouse does not work in any ADB port, replace mouse. 5. Replace main logic board.
• *No response to any key on the keyboard*	1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board only.

- *Known-good ImageWriter or ImageWriter II will not print*

1. Make sure System 6.0.4 and Finder 6.1 (or higher) are used.
2. Make sure that the Chooser and the Control Panel are set correctly.
3. Replace printer interface cable.
4. Replace logic board only.

- *Known-good LaserWriter will not print*

1. Make sure System 6.0.4 and Finder 6.1 (or higher) are used.
2. Make sure that the Chooser and the Control Panel are set correctly.
3. Refer to the *Networks* tab in the *Apple Service Technical Procedures* for more information.

Miscellaneous Problems	Solutions
• *Clicking, chirping, or thumping sound*	1. Replace power supply. 2. Disconnect HDA; replace if noise disappears. 3. Replace logic board only.
• *System shuts down intermittently*	1. Make sure air vents on the back side and top of the main unit are kept clear. Thermal protection circuitry may shut down the system. After 30 to 40 minutes, the system should be OK. 2. Replace power cable. 3. Replace power supply. 4. Replace logic board only.
• *System intermittently crashes or locks up*	1. Make sure System 6.0.4 and Finder 6.1 (or higher) are being used. 2. Make sure software is known-good. 3. Replace logic board only. 4. Replace SIMMs (refer to "SIMM Verification" in this section). 5. Replace power supply.
• *No sound from speaker*	1. Verify that the volume setting in the Control Panel is set to 1 or above. 2. Replace speaker. 3. Replace logic board only.
• *Clock not running*	1. Replace battery (see "Battery Verification" in this section). 2. Replace logic board only.
• *Systems seems to boot, then message "Finder is old version" displays*	1. Clear parameter RAM by holding down the <Command> <Option> <P> <R> keys and re-booting the system. Keep these keys held down, you will hear the normal startup chords and about two seconds later you will get another chord. This means the parameter RAM has been cleared. 2. Replace logic board only.

❑ MACINTOSH IIci FLOWCHARTS

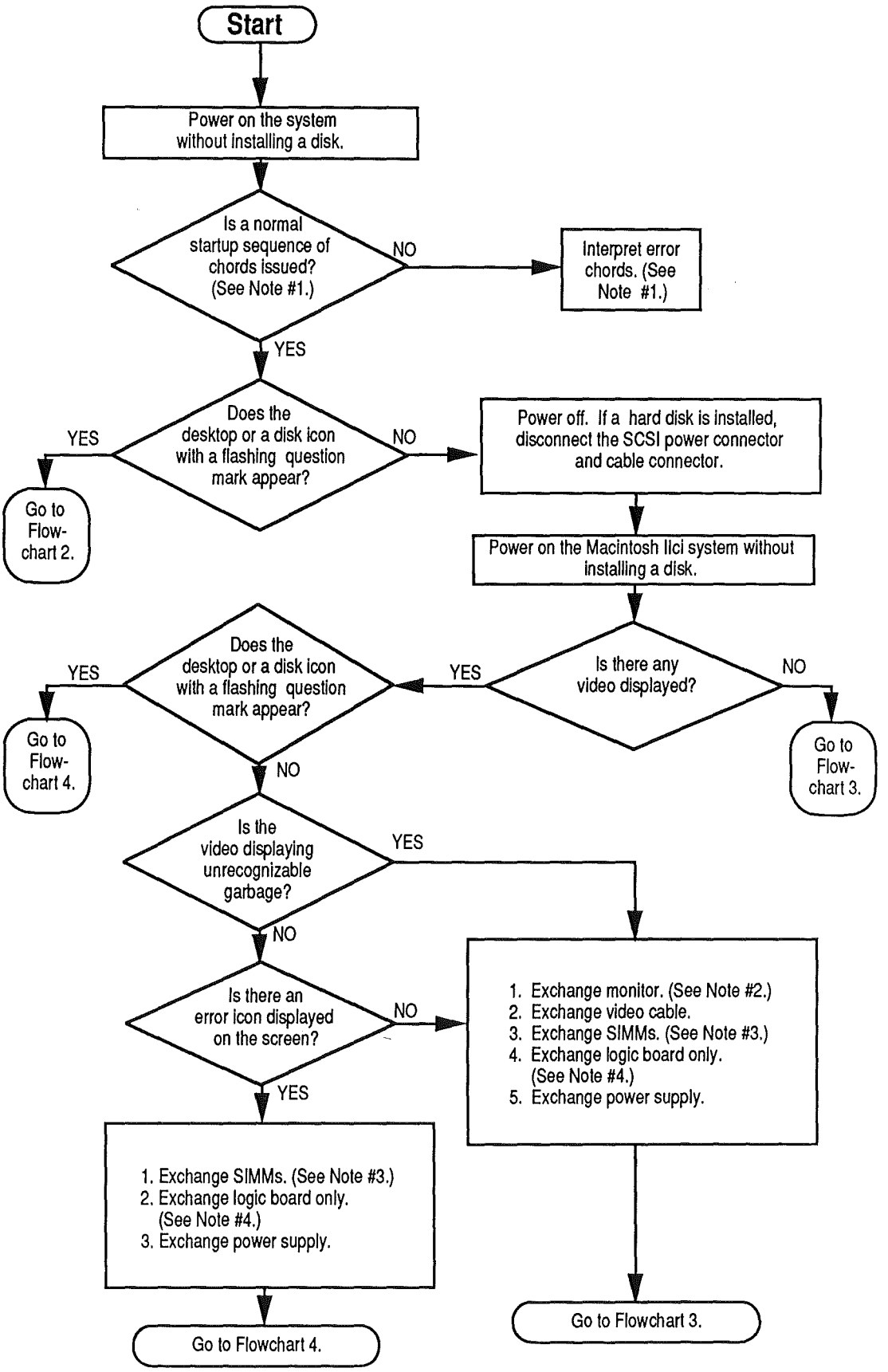
Flowchart 1
Notes

1. During a normal startup sequence, a medium-pitched soft chord is emitted. If this does not happen, refer to "Startup and Error Chords" for additional information. If you cannot interpret the chords, continue with the flowchart.

2. If exchanging the monitor will correct the problem, refer to the *Apple High-Res Monochrome Monitor, Apple High-Res RGB Monitor,* or the *Apple Two-Page Monochrome Monitor Technical Procedures* to isolate the monitor problem to the module level.

3. There are two steps to perform when exchanging the SIMM modules. Refer to "SIMM Verification" for complete instructions on verifying and troubleshooting the SIMMs.

4. If the known-good SIMMs do not correct the problem, install the customer's SIMMs on the replacement logic board.

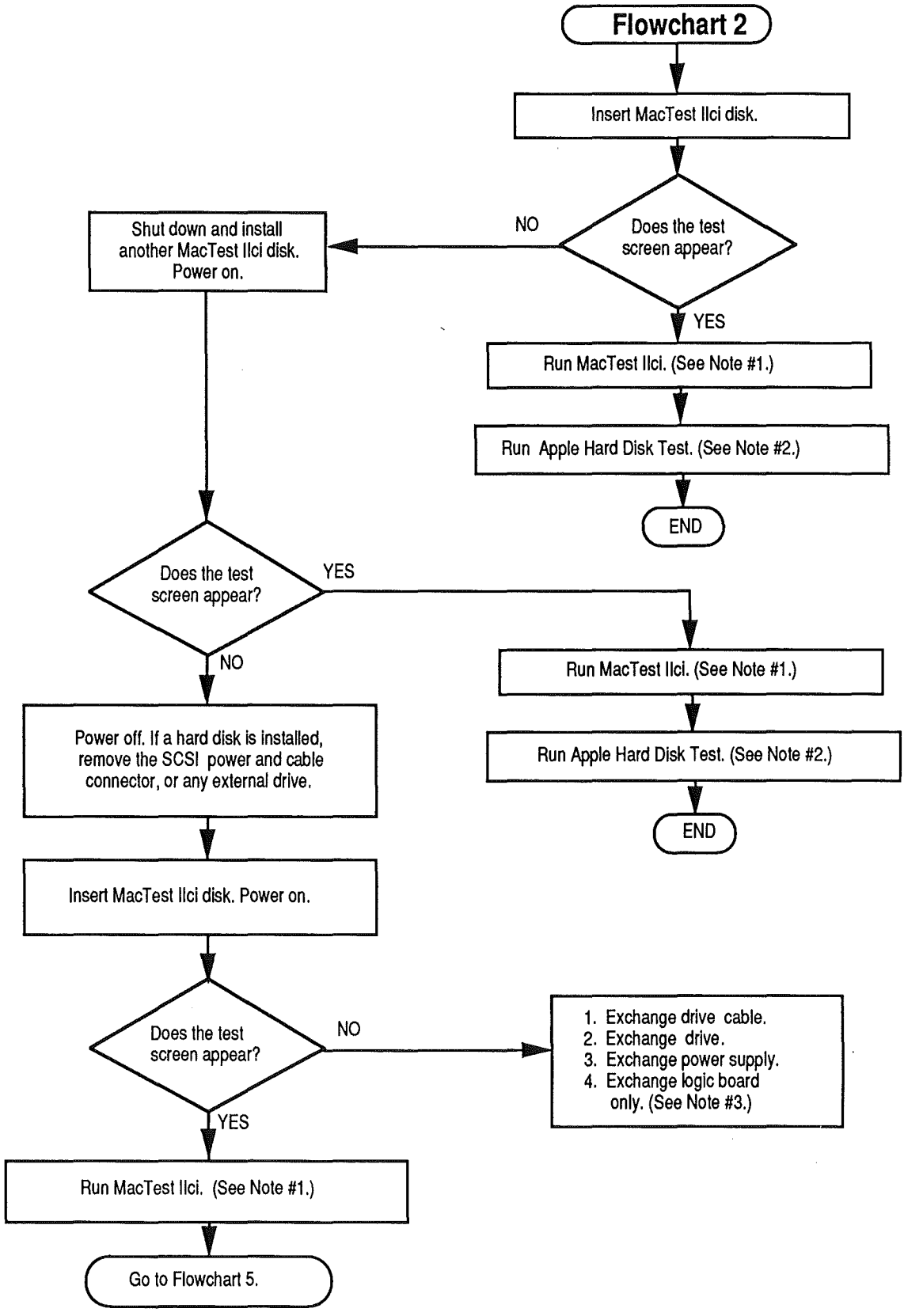

Start
Power on the system without installing a disk.
Is a normal startup sequence of chords issued? (See Note #1.)
NO
Interpret error chords. (See Note #1.)
YES
Does the desktop or a disk icon with a flashing question mark appear?
YES
Go to Flow-chart 2.
NO
Power off. If a hard disk is installed, disconnect the SCSI power connector and cable connector.
Power on the Macintosh IIci system without installing a disk.
Is there any video displayed?
YES
NO
Go to Flow-chart 3.
Does the desktop or a disk icon with a flashing question mark appear?
YES
Go to Flow-chart 4.
NO
Is the video displaying unrecognizable garbage?
YES
NO
Is there an error icon displayed on the screen?
NO
1. Exchange monitor. (See Note #2.)
2. Exchange video cable.
3. Exchange SIMMs. (See Note #3.)
4. Exchange logic board only. (See Note #4.)
5. Exchange power supply.
YES
1. Exchange SIMMs. (See Note #3.)
2. Exchange logic board only. (See Note #4.)
3. Exchange power supply.
Go to Flowchart 4.
Go to Flowchart 3.

Flowchart 2 Notes

1. Refer to Section 3, Diagnostics, for complete information.

2. Refer to the *SCSI Hard Disk Drives Technical Procedures* for complete instructions.

3. Install the customer's SIMMs on the replacement logic board.

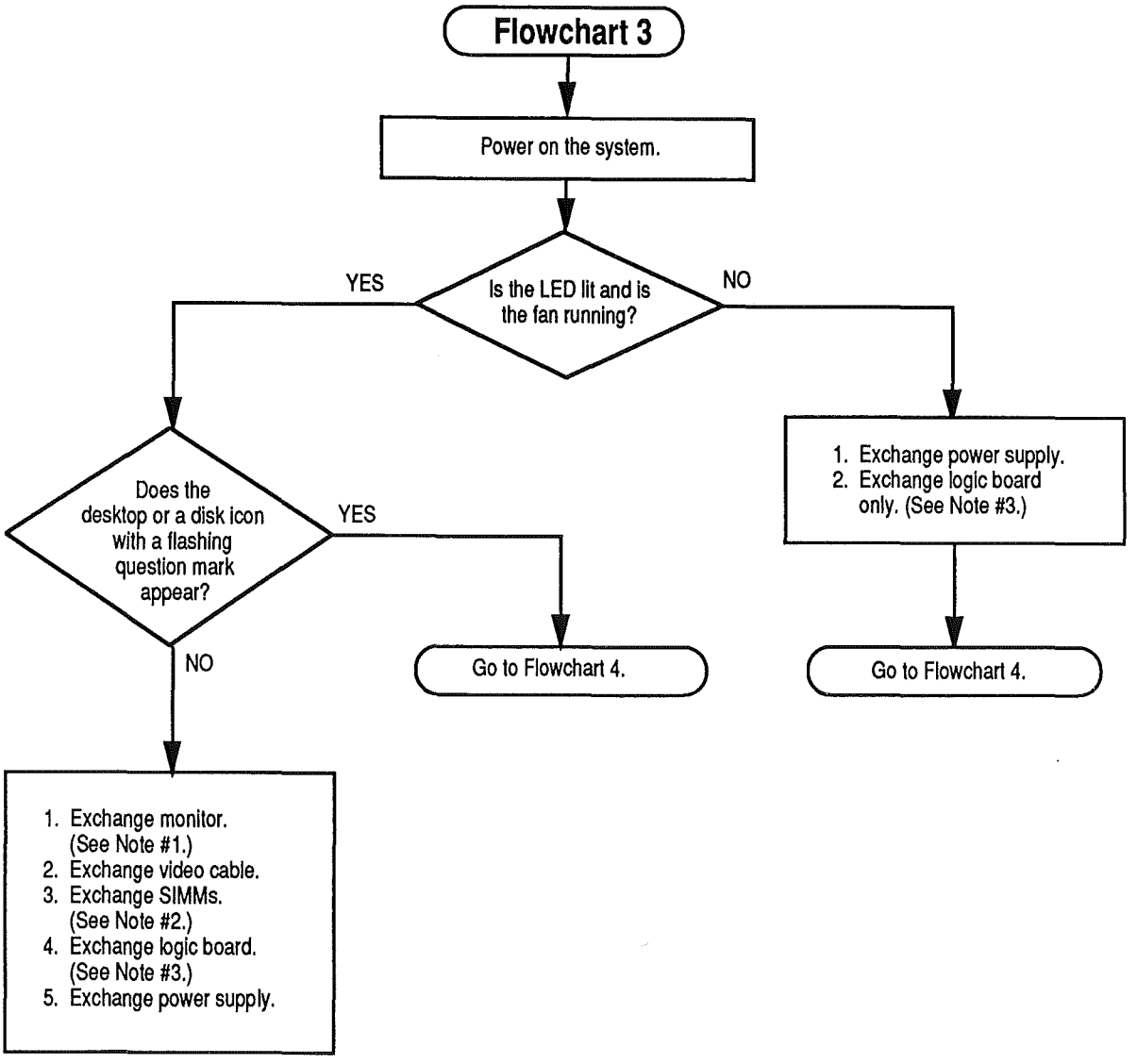

Flowchart 2
Insert MacTest IIci disk.
Does the test screen appear?
NO
Shut down and install another MacTest IIci disk. Power on.
YES
Run MacTest IIci. (See Note #1.)
Run Apple Hard Disk Test. (See Note #2.)
END
Does the test screen appear?
YES
NO
Run MacTest IIci. (See Note #1.)
Run Apple Hard Disk Test. (See Note #2.)
END
Power off. If a hard disk is installed, remove the SCSI power and cable connector, or any external drive.
Insert MacTest IIci disk. Power on.
Does the test screen appear?
NO
1. Exchange drive cable.
2. Exchange drive.
3. Exchange power supply.
4. Exchange logic board only. (See Note #3.)
YES
Run MacTest IIci. (See Note #1.)
Go to Flowchart 5.

Flowchart 3 Notes

1. If exchanging the monitor will correct the problem, refer to the *Apple High-Res Monochrome Monitor, Apple High-Res RGB Monitor,* or the *Apple Two-Page Monochrome Monitor Technical Procedures* to isolate the monitor problem to the module level.

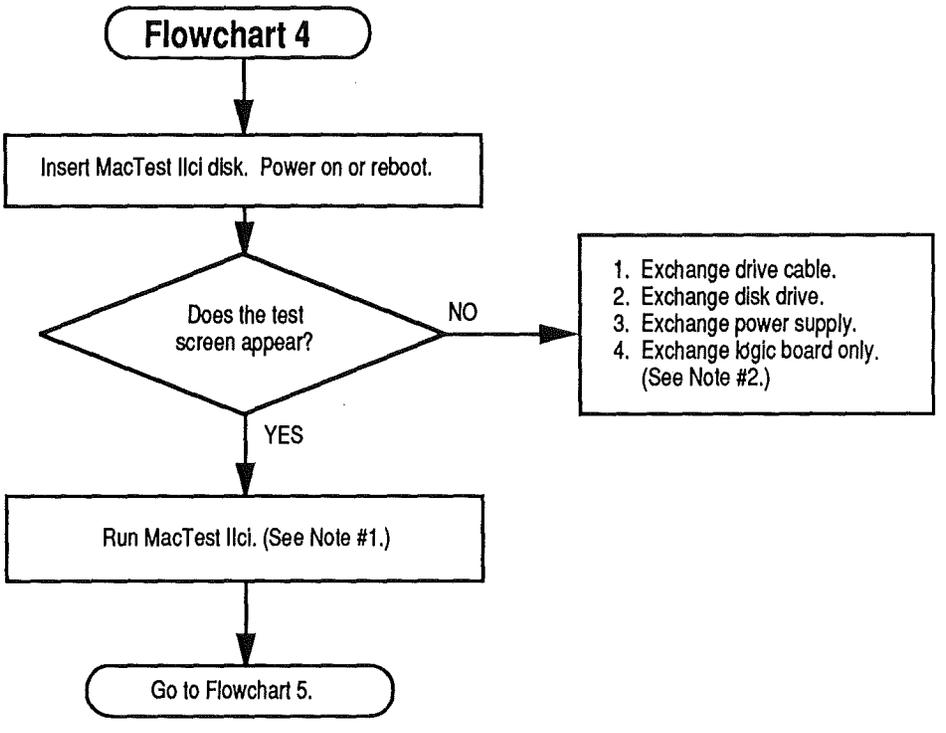
2. There are two steps to perform when exchanging the SIMM modules. Refer to "SIMM Verification" for complete instructions on verifying and troubleshooting the SIMMs.

3. Install the customer's SIMMs on the replacement logic board.



Flowchart 4 Notes

1. Refer to Section 3, Diagnostics, for complete information.
2. Install the customer's SIMMs on the replacement logic board.



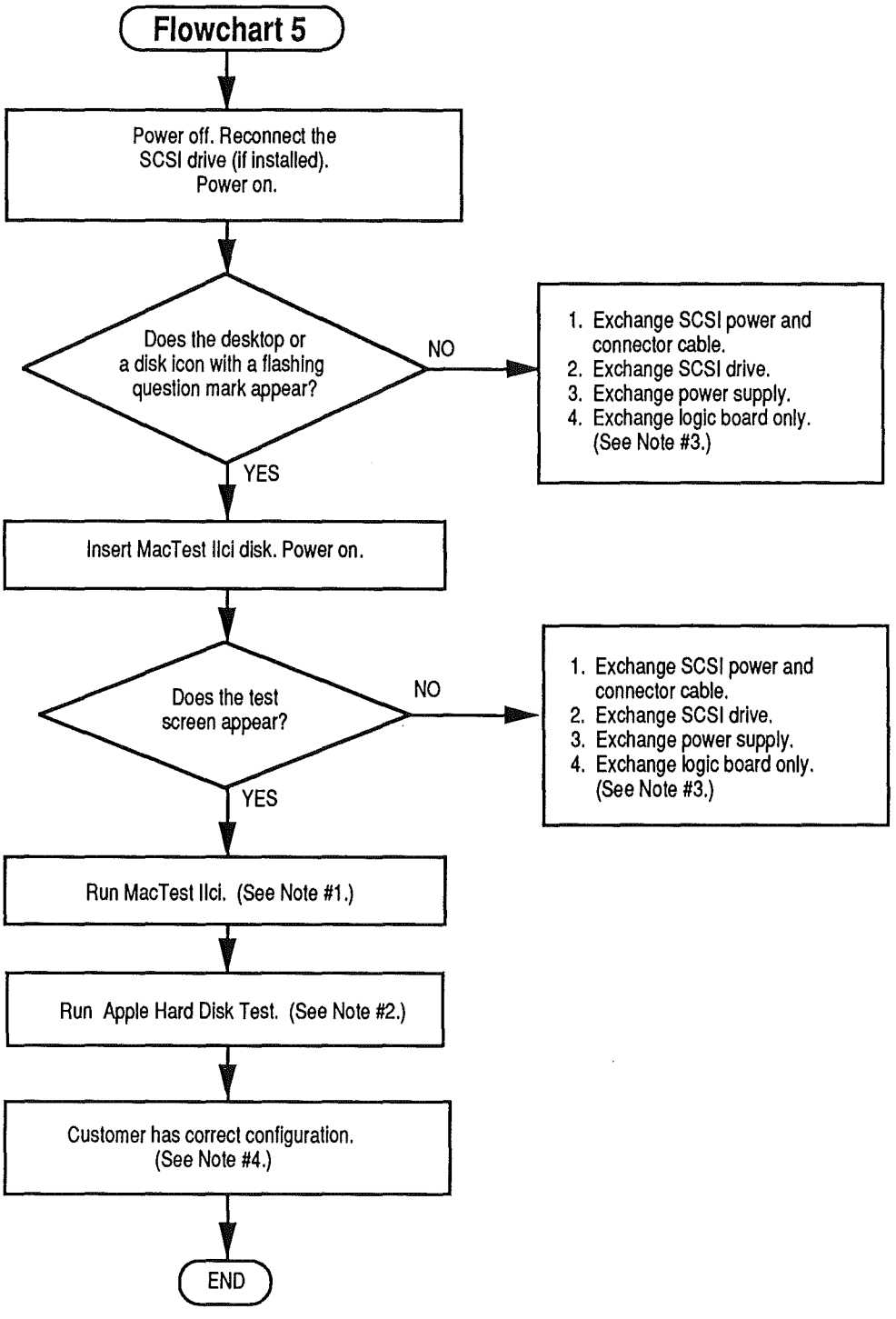
Flowchart 5 Notes

1. Refer to Section 3, Diagnostics, for complete information.

2. Refer to *SCSI Hard Disk Drives Technical Procedures* for complete instructions.

3. Install the customer's SIMMs on the replacement logic board.

4. Customers must always get back the same system configurations they bring in. Refer to "Module Exchange Information" in this section.


Flowchart 5
Power off. Reconnect the SCSI drive (if installed). Power on.
Does the desktop or a disk icon with a flashing question mark appear?
NO
1. Exchange SCSI power and connector cable.
2. Exchange SCSI drive.
3. Exchange power supply.
4. Exchange logic board only. (See Note #3.)
YES
Insert MacTest IIci disk. Power on.
Does the test screen appear?
NO
1. Exchange SCSI power and connector cable.
2. Exchange SCSI drive.
3. Exchange power supply.
4. Exchange logic board only. (See Note #3.)
YES
Run MacTest IIci. (See Note #1.)
Run Apple Hard Disk Test. (See Note #2.)
Customer has correct configuration. (See Note #4.)
END

❑ SIMM VERIFICATION

Introduction

The service exchange logic board comes without RAM SIMMs.

The SIMMs installed on the customer's logic board may be defective. To verify this, you will be removing all of the customer's SIMMs and installing known-good SIMMs. Mark each known-good SIMM with a dot of white correction fluid or a small sticker. Whatever you use, be sure it will not come off while you are testing.

Isolating to the Customer's SIMMs

1. Remove the top cover.

CAUTION: *Before removing the SIMMs, be sure to use proper ESD procedures. If an ESD pad is not available, touch bare metal on the power supply before proceeding. Failure to do so can result in damage to the logic board.*

2. Remove the customer's SIMMs, using the SIMM removal tool. See *You Oughta Know* for SIMM tool use.

   Note: Record the number and the sizes of the SIMMs. The customer should get the same number and sizes back! Refer to Section 5, Additional Procedures, for information on identifying the SIMMs.

3. Install the four known-good SIMMs in Bank A (Figure 1, #1).

   Note: You must use only SIMMs with 80 ns fast page mode DRAMs. Do not use SIMMs with 100, 120, or 150 ns DRAMs. Also, if the customer's SIMMs are parity SIMMs (9-bit), you must replace them with know-good parity SIMMs.

4. Switch on the system.

5. Insert the *MacTest IIcx/IIci* disk.

   If the test boots, run it. Then continue with the appropriate verification procedure.

   If the test does not boot, return to the appropriate flowchart.

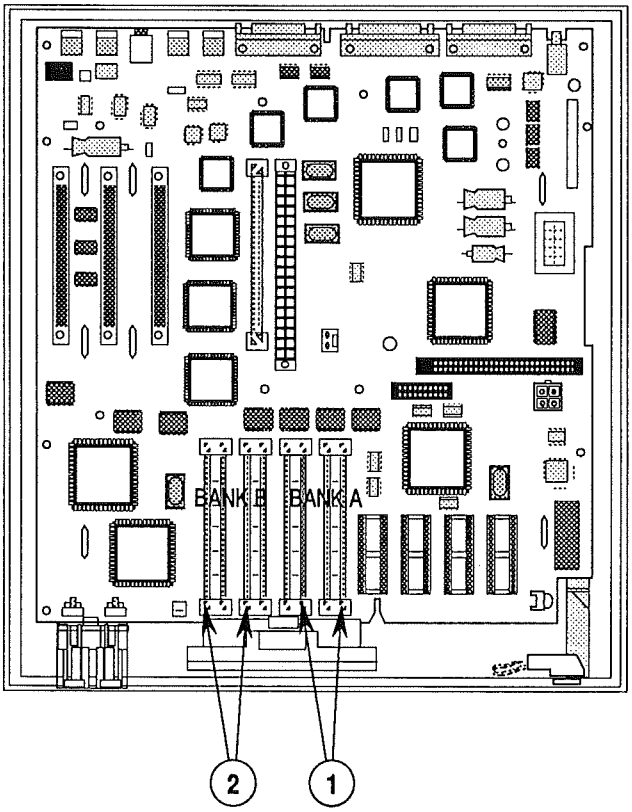


FIGURE 1

Verification

If the customer has 256K SIMMs or 1 MB SIMMs installed, you will need to verify all of them. Use the flowchart and referenced notes on the next two pages to perform the verification of the SIMMs.

Materials Required

If verifying 256K SIMMs, you will need four known-good 256K SIMMs.

If verifying 1 MB SIMMs, you will need four known-good 1 MB SIMMs.

If verifying 1 MB x 9-bit SIMMs (parity), you will need four known-good 1 MB x 9-bit SIMMs.

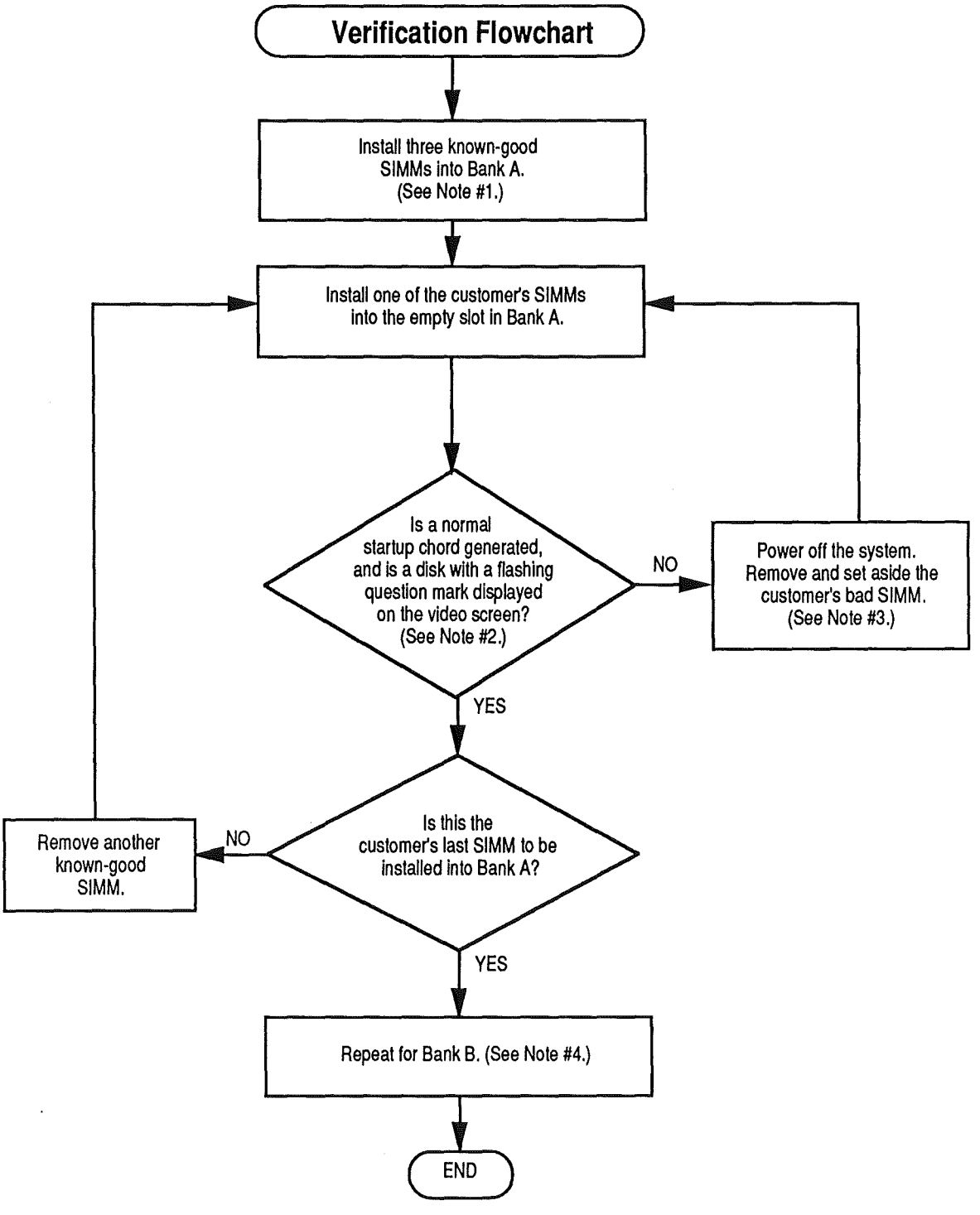
Verification Flowchart Notes

1. Locate Bank A on the logic board and install three known-good SIMMs (Figure 1, #1).

2. During a normal startup sequence, a medium-pitched soft chord is emitted; then a disk icon with a flashing question mark is displayed on the screen. If either of these things does not happen, refer to "Startup and Error Chords" for additional information.

3. Be sure to set the defective SIMM where it will not be mixed up with the others.

4. Return to the beginning of the flowchart and perform the same procedure for Bank B (Figure 1, #2).


Verification Flowchart
Install three known-good SIMMs into Bank A. (See Note #1.)
Install one of the customer's SIMMs into the empty slot in Bank A.
Is a normal startup chord generated, and is a disk with a flashing question mark displayed on the video screen? (See Note #2.)
NO
Power off the system. Remove and set aside the customer's bad SIMM. (See Note #3.)
YES
Is this the customer's last SIMM to be installed into Bank A?
NO
Remove another known-good SIMM.
YES
Repeat for Bank B. (See Note #4.)
END

❑ BATTERY VERIFICATION

Introduction

There is one lithium battery on the Macintosh IIci logic board. This battery maintains the clock and PRAM while the unit is powered off.

WARNING: *Lithium batteries, the type used in the Macintosh IIci, have some potential for explosion if improperly handled. Follow the procedure below exactly as written.*

Materials Required

Voltmeter

Verification Procedure

To check the lithium battery with a voltmeter,

1. Be sure power is off. Then remove the top lid.
2. Remove the power supply.
3. Remove the drive carrier.
4. Set the voltmeter range to measure 10 volts DC.
5. Touch and hold the **positive probe** of the voltmeter to the **positive side** of the battery (Figure 2, #1).

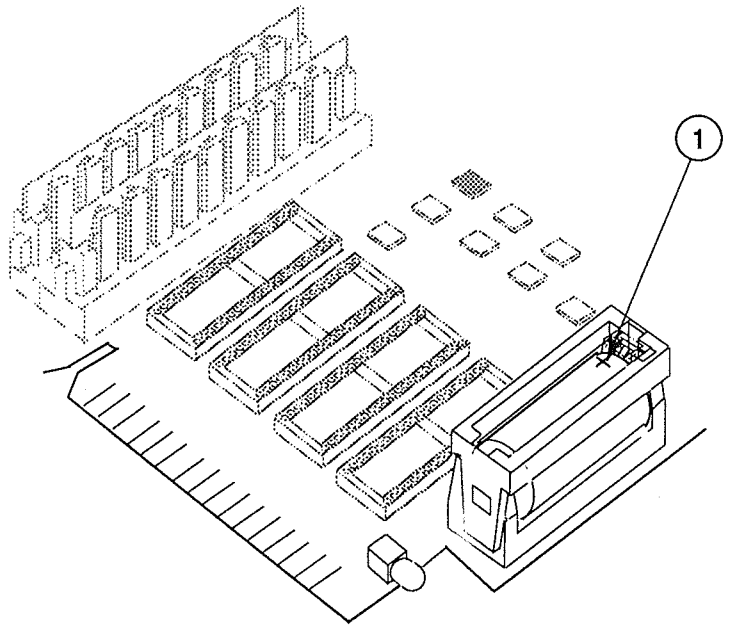


FIGURE 2

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

5. The reading for a good battery should be **above 2.8 volts**. If the battery falls below 2.8 volts, replace it. Refer to Section 5, Additional Procedures, for replacement instructions.

Apple Technical Procedures

Macintosh IIci

Section 5 - Additional Procedures

❑ CONTENTS

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

❑ BATTERY REPLACEMENT

WARNING: *A lithium battery, the type used in the Macintosh IIci, has some potential for explosion if improperly handled.*

Storage and Handling

Take the following precautions when storing and handling lithium batteries:

- When Apple's lithium battery is shipped to you, it is sealed in an individual zip-lock wrapper. When you receive it, check to make sure the wrapper is intact. If it is not, mend the wrapper before you store the battery.
- Store the battery in the packaging in which you received it.
- The storage area for lithium batteries should be well marked, and access to the area should be restricted.
- Never store batteries together where they may short together or explode.

Disposal

Lithium batteries cannot be recharged and will require disposal when "dead." You cannot throw them away as you would other batteries: lithium is water-reactive, in addition to being potentially explosive. Lithium batteries must be disposed of as hazardous waste.

WARNING: *"Dead" lithium batteries are considered hazardous waste and must be returned to Apple in their original packaging for disposal following EPA guidelines.*

Because of this hazard, Apple recommends the following course of action:

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

The long-life lithium battery in the Macintosh IIci should serve many years. Refer to Section 4, Troubleshooting, to check the condition of the battery. If the battery should fail for some reason, replace it according to the following procedure.

Materials Required

Grounded workbench and wriststrap

***CAUTION:** Use ESD precautions before removing or replacing the battery. Failure to do so may result in logic board failure.*

Remove

1. Remove the logic board.
2. Locate the battery holder (Figure 1, #1) and battery (Figure 1, #2) toward the front of the logic board.

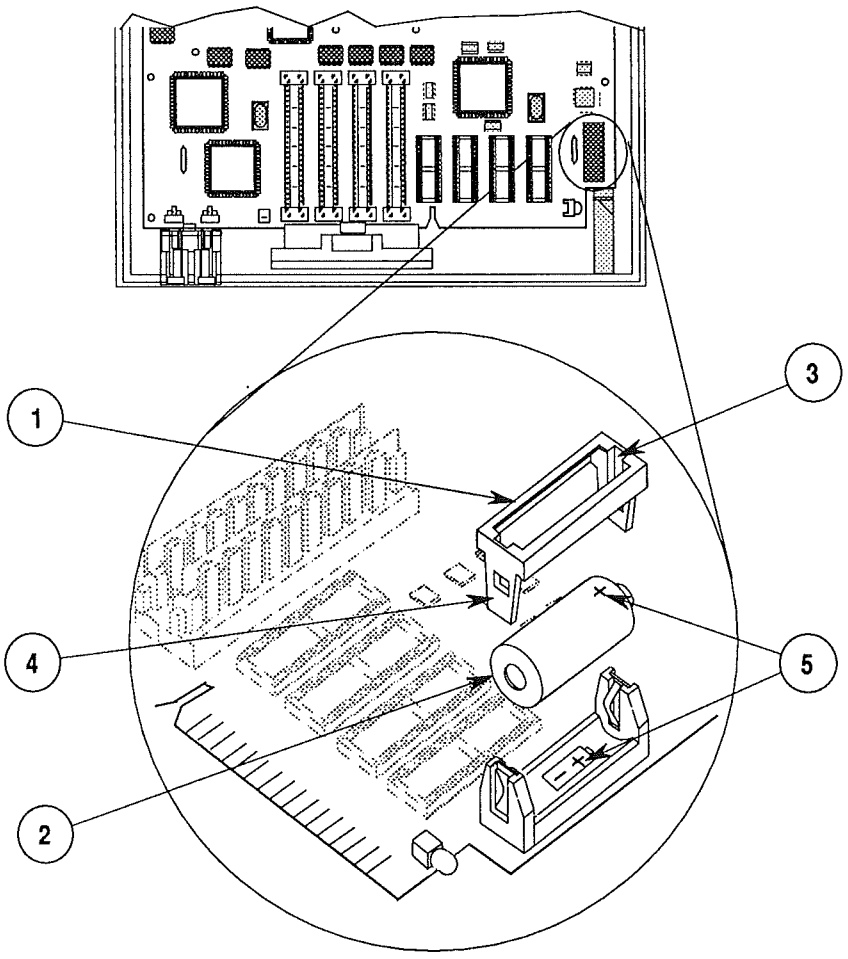


FIGURE 1

3. On one side of the battery holder, insert a small (1/8") flat-blade screwdriver into the top (Figure 1, #3) and gently push the screwdriver down until the side tab (Figure 1, #4) pushes out. The battery holder cover will come loose; do the same on the other end and remove the cover from the holder.

4. Grasp the battery between the thumb and forefinger and lift out the battery.

Replace

1. Insert the new battery so the positive side of the battery is inserted into the positive-marked side of the holder (Figure 1, #5), the side away from the LED.

CAUTION: *Be sure the positive side of the battery is in the correct location (see Figure 1). An incorrectly placed battery can damage the logic board.*

2. Replace the holder cover.

3. Replace the logic board.

4. Set the clock using the Control Panel.

❑ LOGIC BOARD RAM IDENTIFICATION AND UPGRADES

Introduction

RAM for the Macintosh IIci is provided in packages known as Single In-line Memory Modules (SIMMs). A SIMM is a circuit board 3.5-inches long and from 5/8-inch to 1-inch high, with two or eight (nine if parity chip is present) memory chips. The memory chips may be surface-mounted, or they may be mounted through the board. Each SIMM board has contacts on one edge that fit into sockets on the logic board.

Identification

The SIMMs are available with two sizes of RAM, 256K and 1 MB, and come in a few configurations that can be used interchangeably.

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

Note: When you are removing SIMMs from the logic board, use the SIMM removal tool. Instructions for using this tool are located in *You Oughta Know.*

256K SIMMs

The 256K SOJ (Single Out-line JLead) SIMMs (Figure 2) contain two surface-mounted ICs. Each IC has ten pins (or legs) on each of two sides.

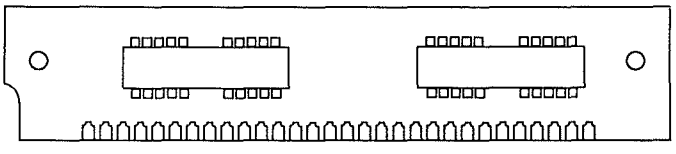


FIGURE 2

IMPORTANT: *You must use 80ns fast page mode SIMMs on the Macintosh IIci. The 100, 120, and 150ns SIMMs will cause serious timing problems.*

256K SIMMs are available in several speeds. However, only the 80ns SIMMs are suitable for the Macintosh IIci. You can identify a 80ns SIMM by the number 8 after the vendor's part number printed on the top of each chip. Only the 256K SIMMs that have two 1 MB chips (256K x 4 x 2) have been Apple qualified.

1 MB SIMMs

The 1 MB SIMMs come in two configurations:

- 1 MB SOJ SIMM (Figure 3, #1)
  The 1 MB SOJ (Single Out-line JLead) SIMM contains eight surface-mounted ICs. Each IC has ten legs on each of two sides.

- 1 MB x 9-bit SOJ SIMM (Figure 3, #2)
  The 1 MB SOJ (Single Out-line JLead) parity SIMM contains nine surface-mounted ICs. Each IC has ten legs on each of two sides.

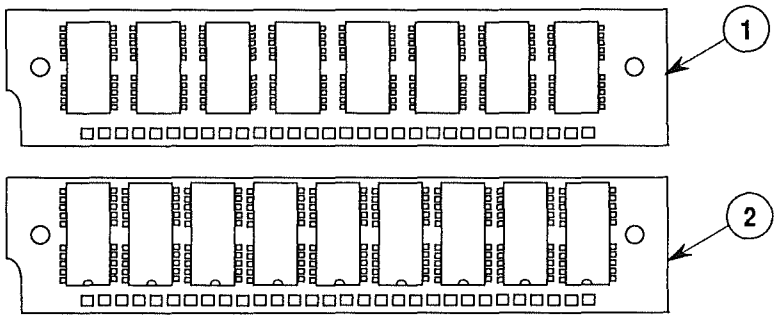


FIGURE 3

Upgrades

Various RAM upgrades are possible on the Macintosh IIci, depending on the number and size of the SIMMs that you install on the logic board.

For installation purposes, two banks of SIMM sockets are located on the logic board and are labeled Bank A (Figure 4, #1) and Bank B (Figure 4, #2). Each bank contains four slots, which are grouped into twos. All four slots within a bank must be filled with SIMMs of the same RAM size.

Each bank may contain either no RAM or four 256K, 1 MB, 4 MB, or 16 MB SIMMs. (The 4 MB and 16 MB SIMMs can be used when available.) But at least one of the banks must have RAM in it.

If you are using built-in video, you must have SIMMs in bank A, because the built-in video uses bank A for video framing. If you are using a video card, then using bank A is optional.

If the unit is a parity system, you can upgrade to more memory, but you must use the parity SIMMs (1 MB x 9-bit SOJ SIMMs) to do so. If parity SIMMs are not used, the parity function will be disabled.

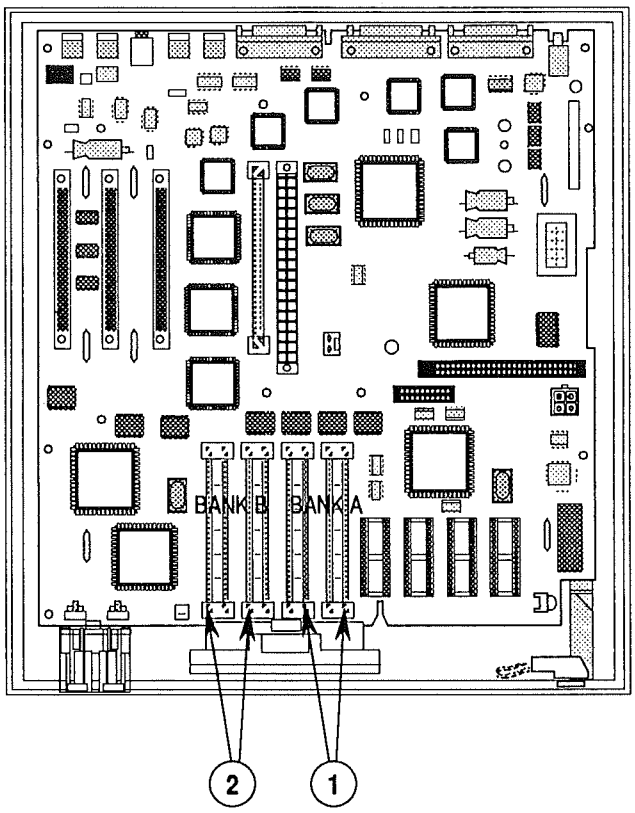


FIGURE 4

The following chart summarizes the configurations that the Macintosh IIci supports:

RAM	Bank A	Bank B
1 MB	Four 256K SIMMs	Empty
	Empty*	Four 256K SIMMs
2 MB	Four 256K SIMMs	Four 256K SIMMs
4 MB	Four 1 MB SIMMs	Empty
	Empty*	Four 1 MB SIMMs
5 MB	Four 1 MB SIMMs	Four 256K SIMMs
	Four 256K SIMMs	Four 1 MB SIMMs
8 MB	Four 1 MB SIMMs	Four 1 MB SIMMs
4 MB Parity	Four 1 MB parity SIMMs	Empty
	Empty*	Four 1 MB parity SIMMs
8 MB Parity	Four 1 MB parity SIMMs	Four 1 MB parity SIMMs

CAUTION: *Other configurations, such as a single SIMM or a pair of different-size SIMMs, will not function correctly.*

* DRAM is needed in bank A when built-in video is used.

Apple Technical Procedures

Macintosh IIci

Illustrated Parts List

❑ CONTENTS

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

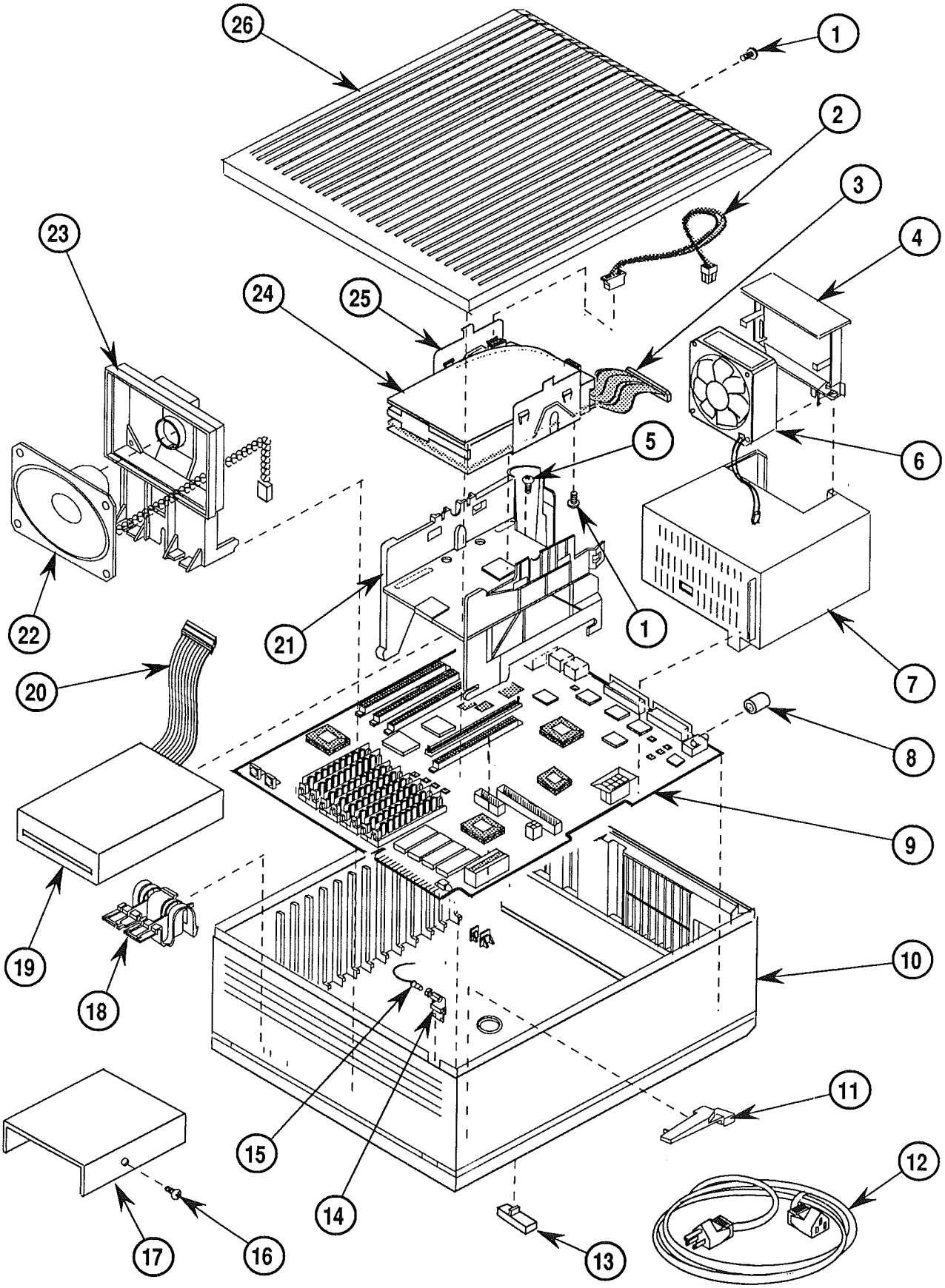


FIGURE 1

❑ MACINTOSH IIci—SYSTEM EXPLODED VIEW (Figure 1)

Item	Part No.	Description
1	416-1412	Screw, M 3.5 x .6 x 8 (Top Cover, HDA Bracket to Bottom Case)
2	590-0512	Cable, Internal HDA Power
3	590-0609	Cable, Internal HDA
4	815-5071	Bracket, Power Supply Fan
5	444-6104	Screw, 6-32 x .250 (HDA to HDA Bracket)
6	982-0023	Power Supply Fan
7	661-0467	Power Supply with Fan
8	815-6033	On-Off Button
9	661-0532	Logic Board
	661-0583	Logic Board, Parity
10	630-5662	Bottom Case
11	815-6032	Light Pipe, Power On
12	590-0380	Cable, Power AC (smoke)
13	865-0026	Rubber Feet
14	815-6036	Light Pipe, HDA
15	590-0506	Cable, HDA LED (amber)
16	844-0018	Screw, Socket, Phillips (1.4 MB Mechanism)
17	805-0961	Shield, Internal 1.4 MB Mechanism
18	815-6034	Reset/Interrupt Switch
19	661-0474	1.4 MB Mechanism, Apple FDHD
20	590-0607	Cable, Internal 1.4 MB Mechanism
21	815-6030	Drive Carrier
22	590-5503	Speaker
23	815-6031	Speaker Bracket
24	661-0373	HDA, Internal 3.5 SCSI, 20 MB
	661-0464	HDA, Internal 3.5 SCSI, 40 MB
	661-0600	HDA, Internal 3.5 SCSI, 80 MB
25	805-5078	Bracket, HDA, Mounting
26	810-6028	Top Cover

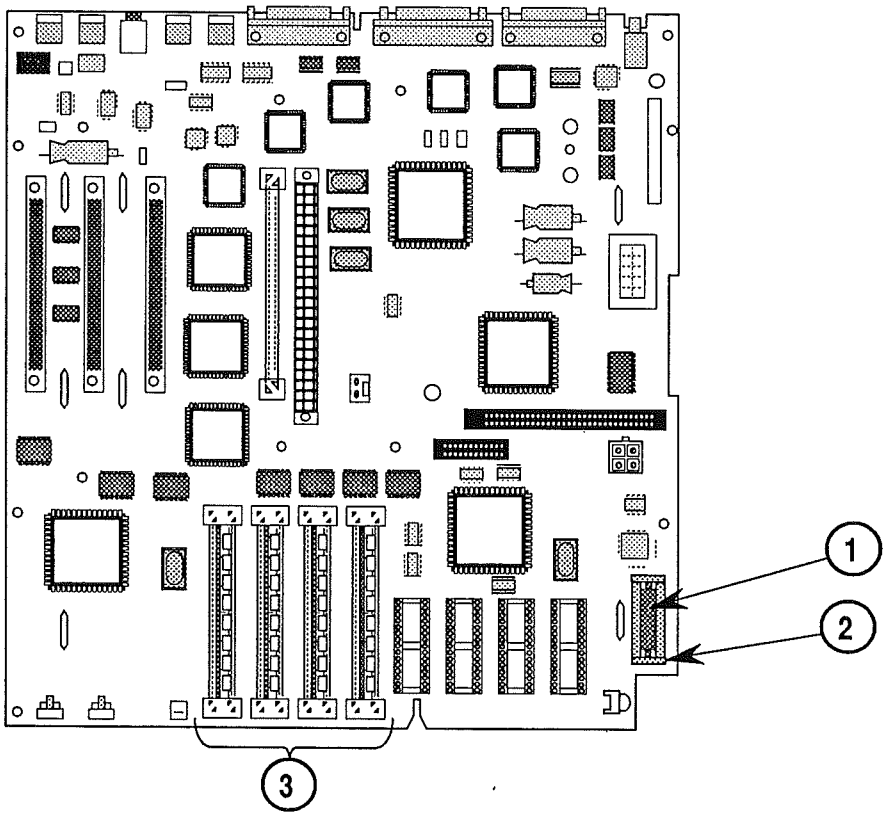


FIGURE 2

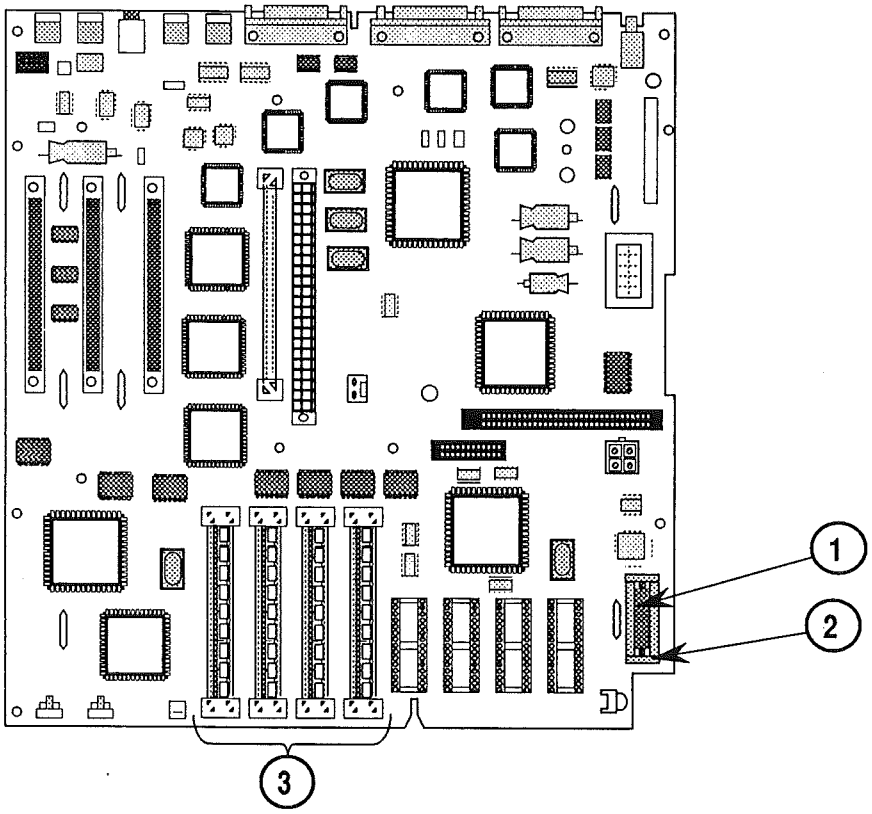


FIGURE 3

❑ MACINTOSH IIci—LOGIC BOARD (Figure 2)

Item	Part No.	Description
–	661-0532	Logic Board
1	742-0011	Lithium Battery
2	520-0344	Battery Holder Cover
3	661-0519	SIMM, 256K x 4, 80 ns
	661-0520	SIMM, 1 MB, 80 ns

❑ MACINTOSH IIci—LOGIC BOARD WITH PARITY (Figure 3)

Item	Part No.	Description
–	661-0583	Logic Board, Parity
1	742-0011	Lithium Battery
2	520-0344	Battery Holder Cover
3	661-0546	SIMM, 1 MB x 9, 80 ns, Parity

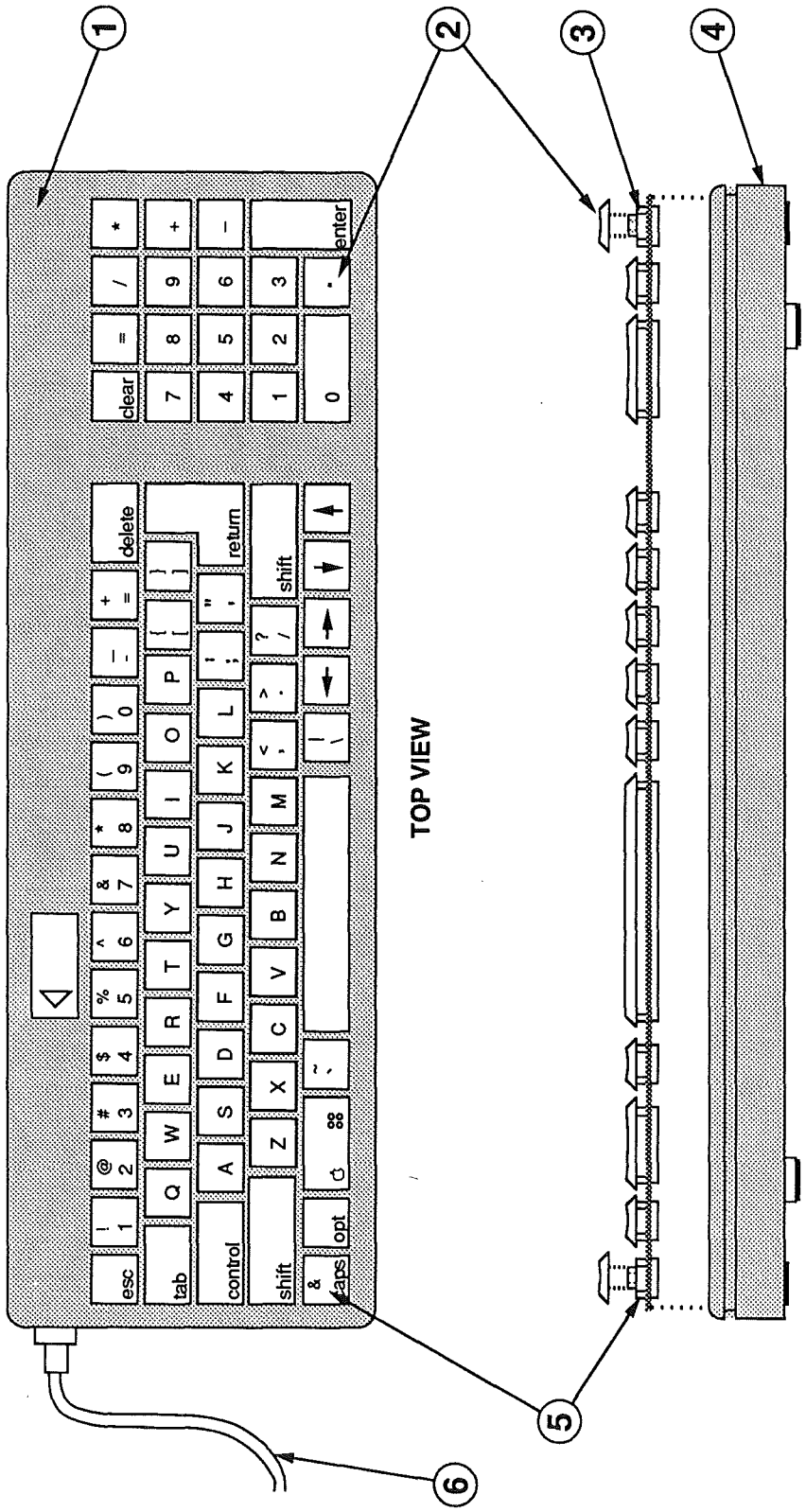


FIGURE 4

❑ KEYBOARD (Figure 4)

Item	Part No.	Description
–	661-0383	Apple Keyboard
	C661-0383	Apple Keyboard, French Canadian
	E661-0383	Apple Keyboard, Spanish
1	815-1016	Top Case
2	658-7011	Key Cap Set
3	076-0209	Keyswitch Set, ADB Keyboard (Set of 10)
4	815-1017	Bottom Case
5	970-1263	Alps Locking Keyswitch
6	590-0361	Keyboard Cable, 1 meter
	590-0152	Keyboard Cable, 2 meter

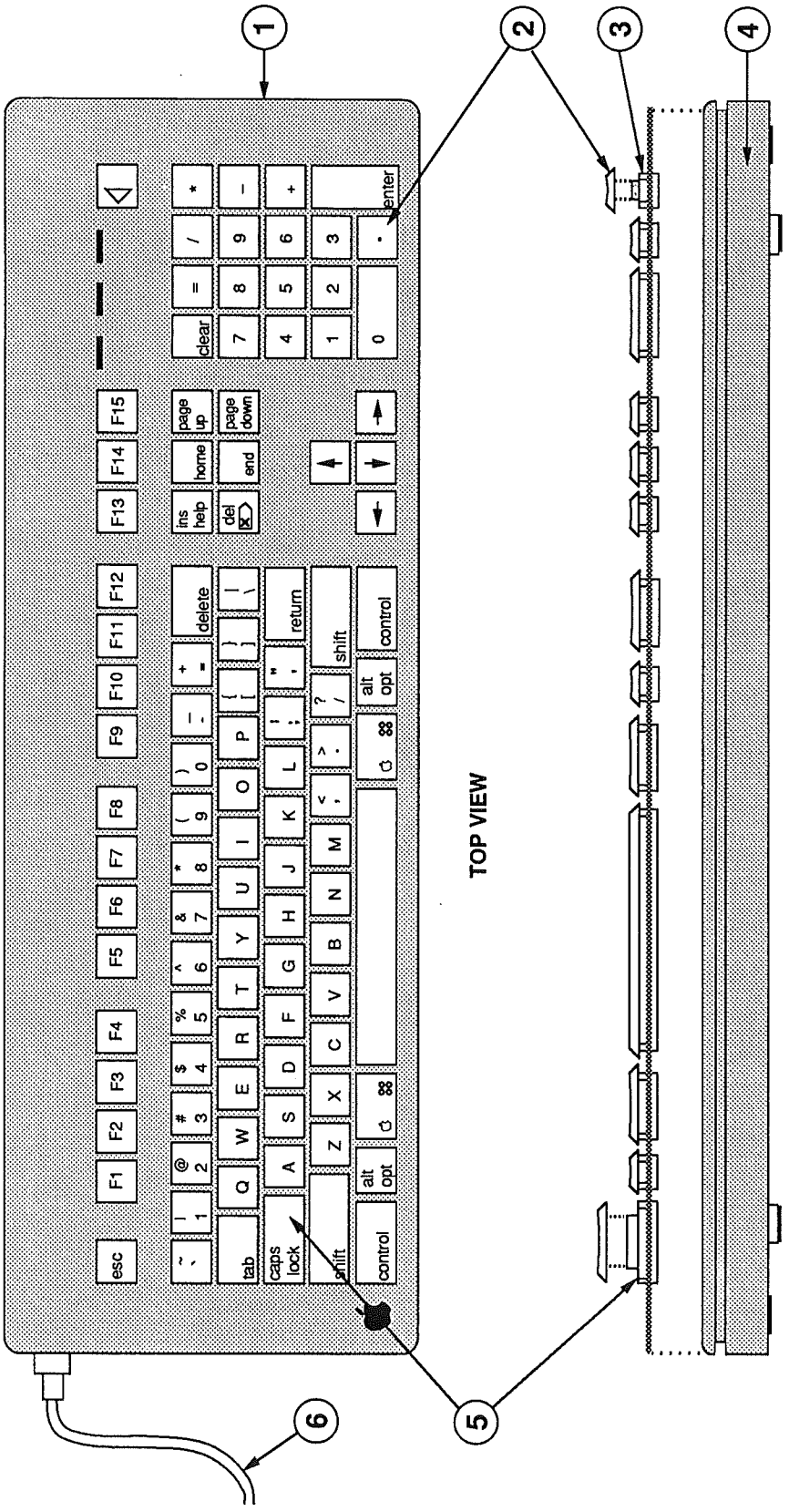
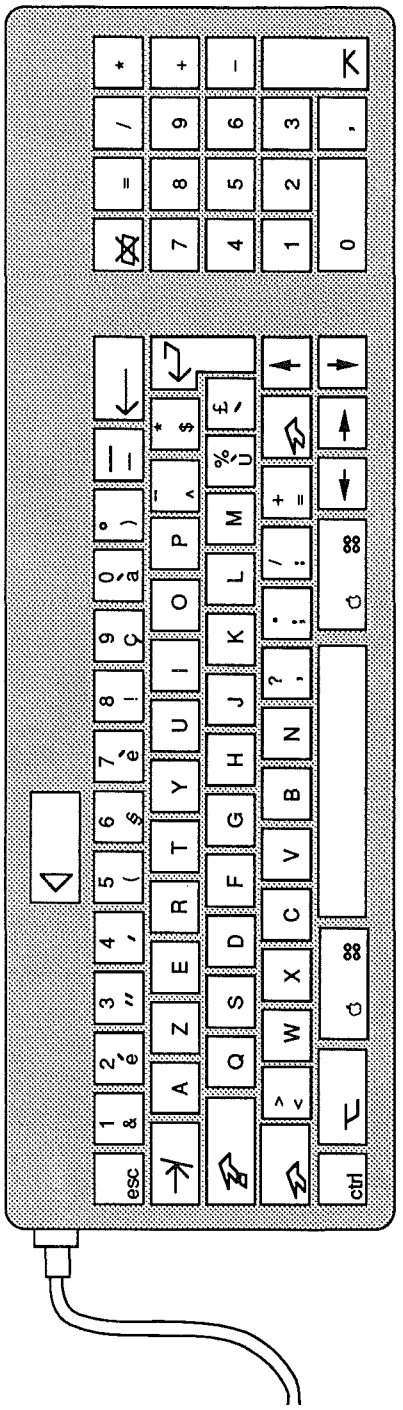


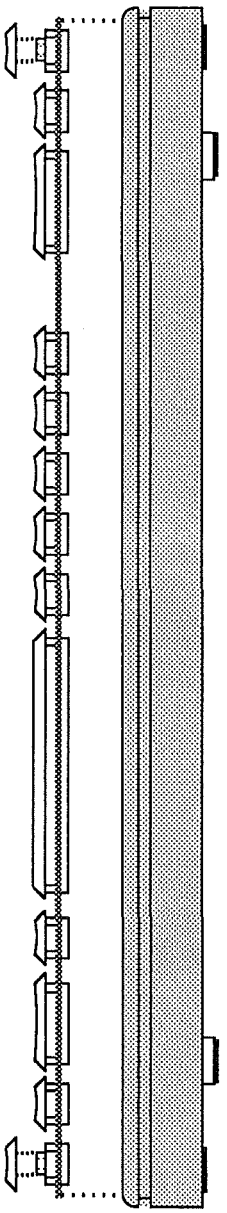
FIGURE 5

❑ EXTENDED KEYBOARD (Figure 5)

Item	Part No.	Description
–	661-0384	Apple Extended Keyboard
	C661-0384	Apple Extended Keyboard, French Canadian
	D661-0384	Apple Extended Keyboard, German
	E661-0384	Apple Extended Keyboard, Spanish
	F661-0384	Apple Extended Keyboard, French
	T661-0384	Apple Extended Keyboard, Italian
1	815-1018	Top Case
2	658-7010	Key Cap Set
3	076-0209	Keyswitch Set, ADB Keyboard (Set of 10)
4	815-1019	Bottom Case
5	970-1263	Alps Locking Keyswitch
6	590-0361	Keyboard Cable, 1 meter



TOP VIEW



FRONT VIEW

FIGURE 6

❑ ISO KEYBOARD (Figure 6)

Item	Part No.	Description
–	D661-0454	Keyboard, Apple ISO, German
	F661-0454	Keyboard, Apple ISO, French
	T661-0454	Keyboard, Apple ISO, Italian

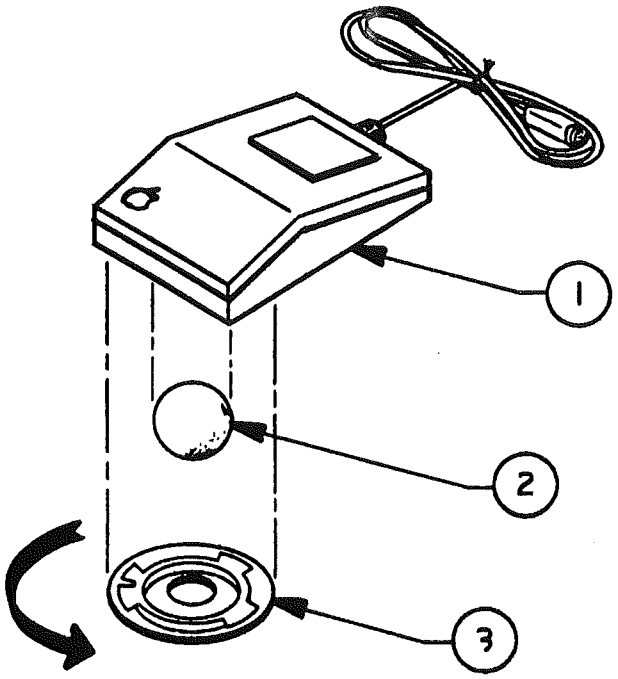


FIGURE 7

❑ MOUSE (Figure 7)

Item	Part No.	Description
1	661-0479	ADB Mouse (replacing part number 661-0338)
2	815-1135	Mouse Ball (for part number 661-0479)
3	815-1136	Retainer, ADB Mouse (for part number 661-0479)

Note: The ADB Mouse (part number 661-0338) has been replaced by part number 661-0479. Below is the list of parts for part number 661-0338.

Item	Part No.	Description
2	699-8001	Mouse Ball (25.4 mm dia)
	699-8038	Mouse Ball (21.9 mm dia)
3	076-0231	Retainer, ADB Mouse (38 mm dia)
	815-0816	Retainer, ADB Mouse (34 mm dia)