

Macintosh Portable

Technical Procedures

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Macintosh Portable

Section 1 – Basics

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- 1.38 Materials Required



CAUTION

CAUTION: *It is important to read and follow the procedures very carefully wherever this symbol appears.*

□ PRODUCT DESCRIPTION

The Macintosh® Portable computer is a mobile version of the Macintosh computer. This product is designed for portability through the use of a built-in rechargeable lead-acid battery. This battery can provide power for the computer and its options for up to ten hours. The actual time will vary depending on the combination of options installed, usage of these options, and the use of a number of software-controllable power management features.

The architecture of the Macintosh Portable is based on the Macintosh SE and uses many of the same components. Software compatibility with other members of the Macintosh family is maintained.

Features

Figure 1. The Macintosh Portable has the following features:

- 16-MHz MC68HC000 low-power CMOS microprocessor
- 1 MB of static RAM, expandable to 9 MB
- 256K of ROM, expandable to 4 MB
- 640 x 400 reflective, active-matrix flat-panel display
- 96-pin internal processor-dependent expansion slot
- Operates for up to 10 hours from internal, rechargeable battery
- Apple standard keyboard, trackball, and low-power mouse
- Ambidextrous input devices
- External video interface
- External disk drive interface
- SCSI interface
- Apple Desktop Bus™ interface
- Dual RS-422 serial interfaces
- Stereo audio connector
- Internal expansion slots for optional 300/1200/2400 bps modem, RAM card, and ROM card
- Optional 40-MB SCSI hard drive
- Optional numeric keypad
- Optional battery recharger

PRODUCT DESCRIPTION □

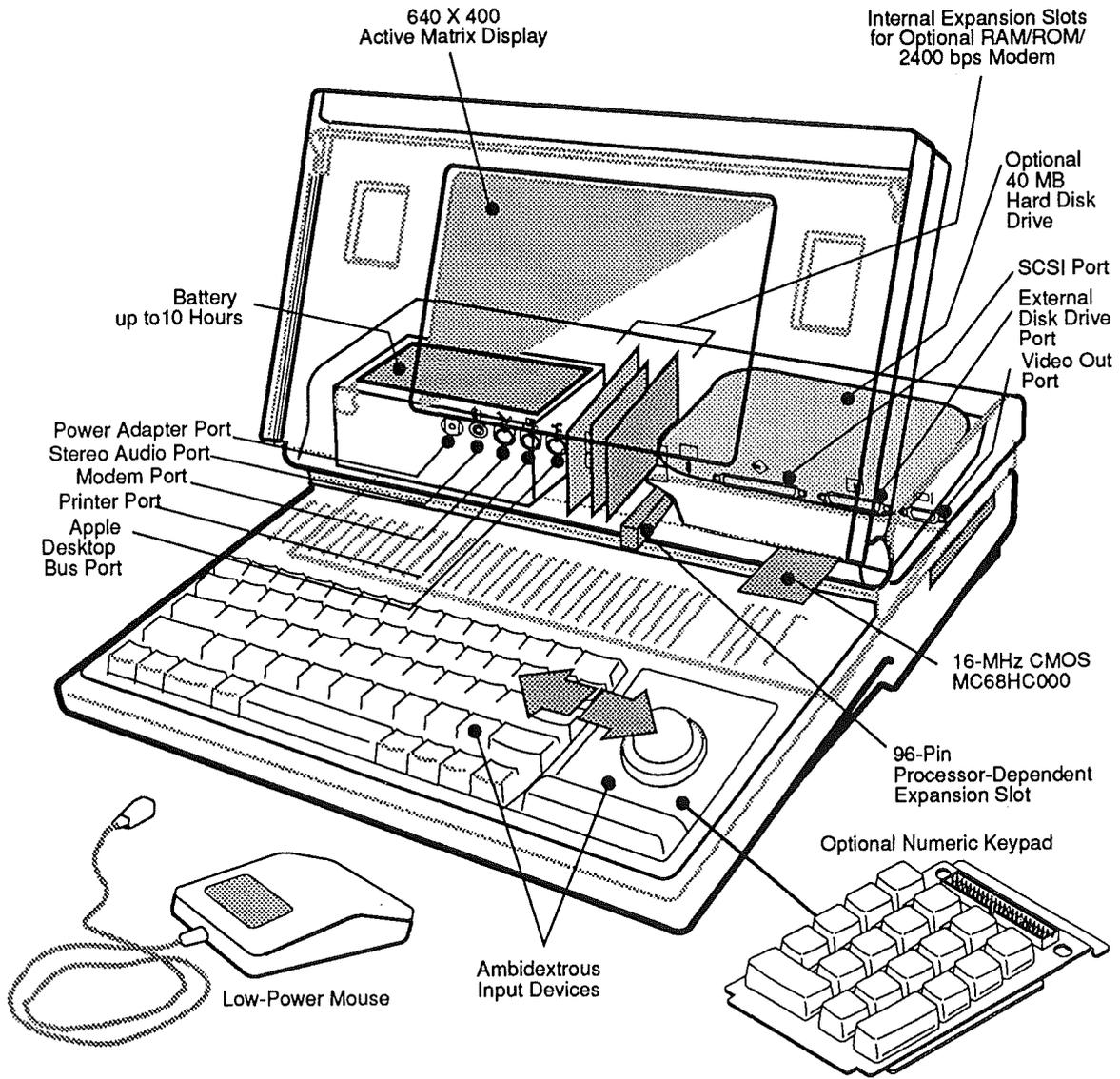


FIGURE 1

□ PRODUCT DESCRIPTION

Configurations

Figure 2. The Macintosh Portable is available from Apple in two configurations:

- **Figure 2-A.** Single floppy drive system.
- **Figure 2-B.** Single floppy drive and 40-MB SCSI hard drive system.

These are not the only possible configurations. Apple offers a number of options to enhance the operation of the Portable. These options are described later in this section. Since the Portable offers a number of expansion connectors, third-party products may be installed. You may see systems with different amounts of RAM, different hard disk drives, optional modem, RAM or ROM cards, external peripherals, and third-party options.

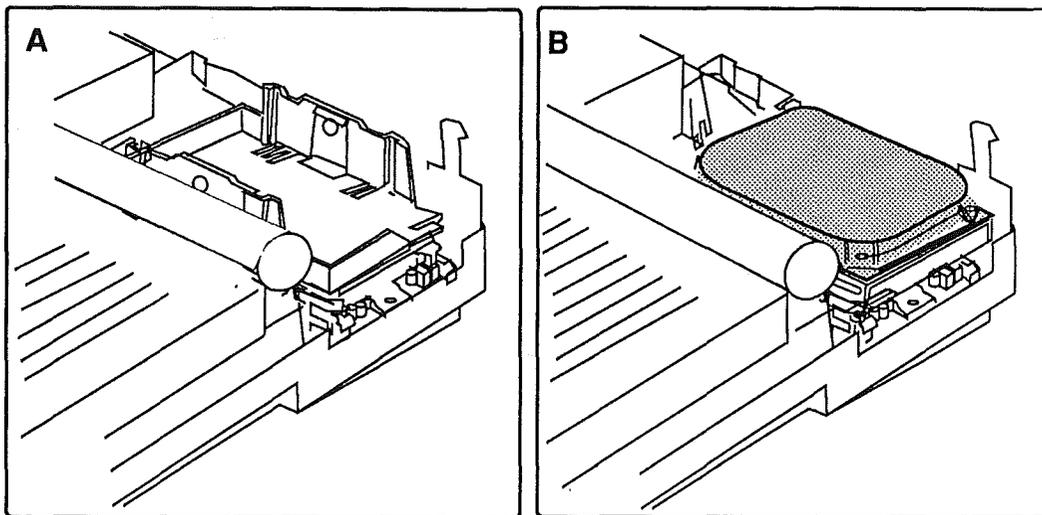


FIGURE 2

PRODUCT DESCRIPTION □

Module Identification

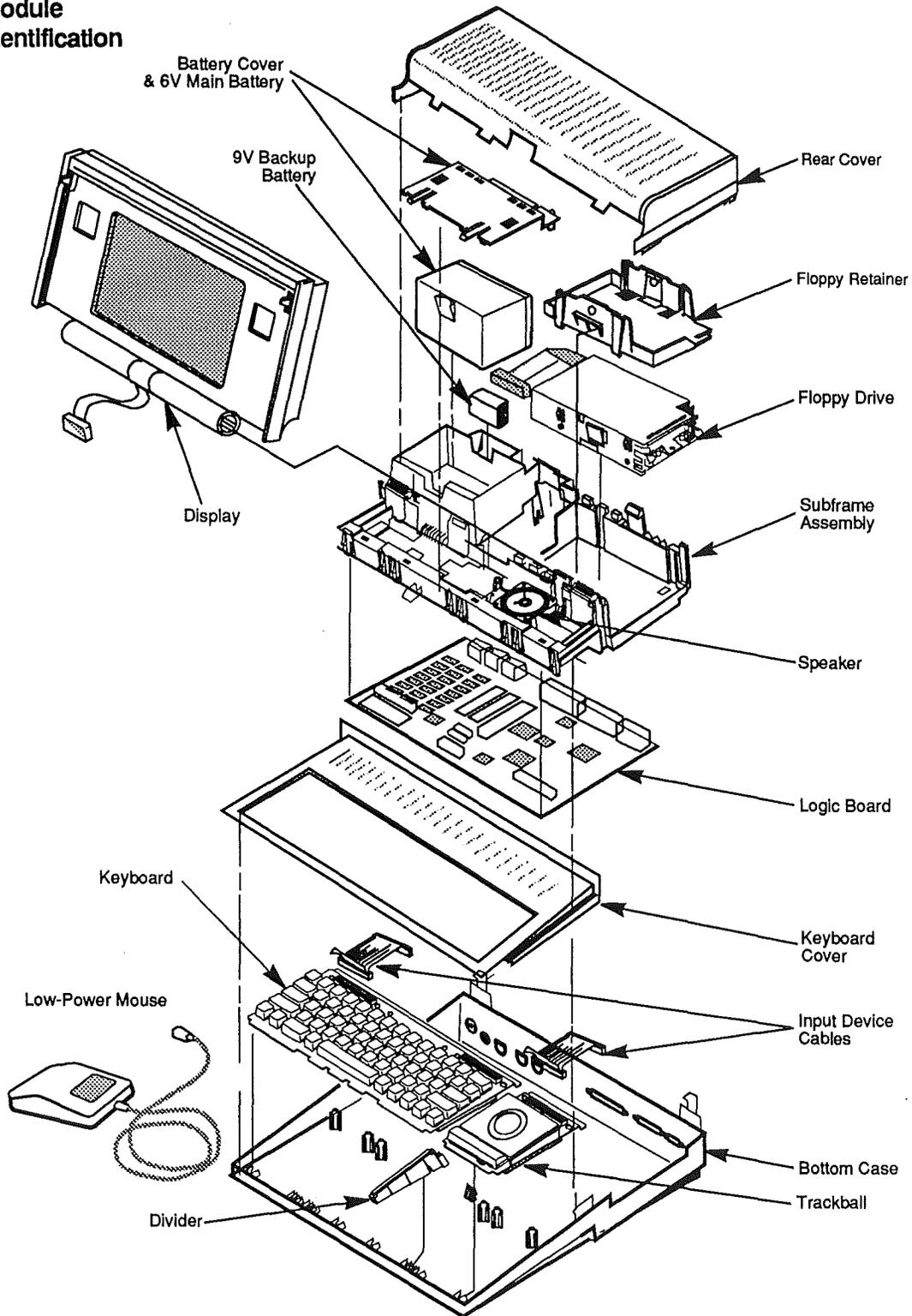


FIGURE 3

□ PRODUCT DESCRIPTION

Options

Apple offers a number of options to enhance the performance and usability of the Macintosh Portable.

- 2400 bps internal modem
- 1 MB RAM expansion card
- Battery recharger
- 40 MB SCSI hard disk drive
- 1.4 MB FDHD™ floppy disk drive
- Numeric keypad

Technical Procedures for all the above options are provided in Section 5, Additional Procedures. Troubleshooting for the floppy drive and SCSI hard disk are included in Section 4, Troubleshooting.

The following is an overview of each of these options and their associated Technical Procedures.

Portable Data Modem 2400 and the Int'l XP 2400

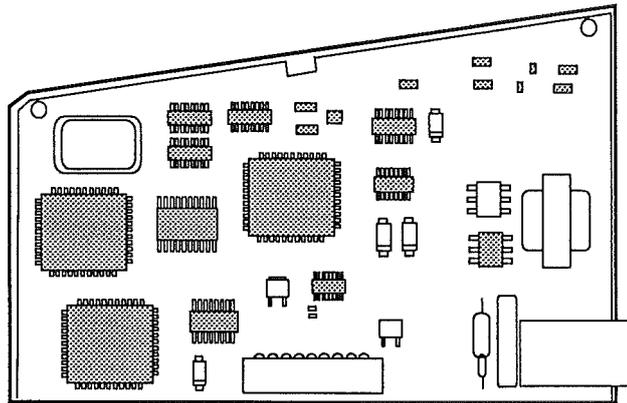
Figures 4-A, 4-B, and 4-C. The Portable Data Modem 2400 (United States and Canada) and the Int'l XP 2400 (international) are internal 2400 bps modems. These modems allow the Portable to communicate with remote computers without an external device. The Data Modem 2400 is shown in **Figure 4-A**. The Int'l XP 2400 is shown in **Figure 4-B**. A Data Access Arrangement (DAA) adapter for the Int'l XP 2400 is shown in **Figure 4-C**. Technical procedures for these cards cover installation, check-out, and troubleshooting.

1 MB RAM Expansion Card

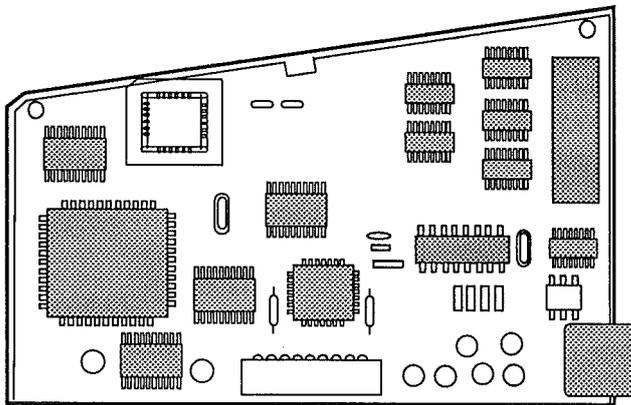
Figure 4-D. The RAM Expansion Card is a 1 MB static RAM card. Installing the card increases the amount of memory available for applications and data from 1 to 2 MB. Installation, check-out, and troubleshooting procedures for the card are provided.

PRODUCT DESCRIPTION □

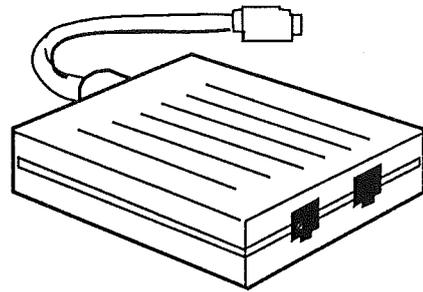
A Portabile Data Modem 2400



B Int'l XP 2400



C Data Access Arrangement (DAA)



D 1 MB RAM Expansion Card

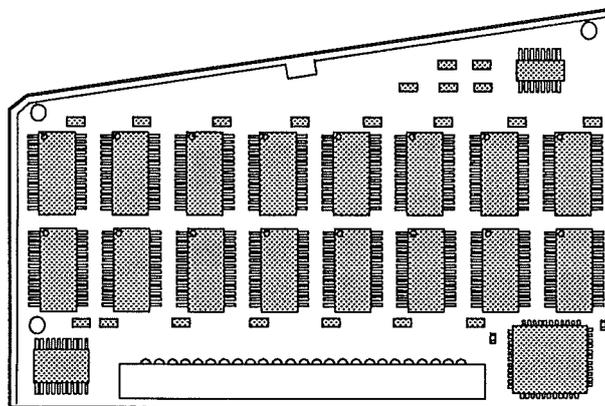


FIGURE 4

□ PRODUCT DESCRIPTION

Battery Recharger

Figure 5-A. The optional external battery recharger is used to recharge the main battery while an optional second battery is used in the computer. Technical procedures cover operation and troubleshooting.

40 MB SCSI Hard Disk Drive

Figure 5-B. An optional 40 MB SCSI hard disk drive is available. The drive is a low-power, one-third-height, 3.5-inch model. The low-power feature makes the drive ideal for use in a battery-operated portable computer. The drive is also lightweight, rugged, and fast. The Portable supports a maximum of two internal disk drives. The computer can have either two floppy disk drives or one floppy drive and one hard disk. Installation, check-out, and troubleshooting procedures are provided.

1.4 MB FDHD Floppy Disk Drive

Figure 5-C. An optional second Apple FDHD floppy disk drive is available. This drive provides the Portable with an additional 1.4 MB of permanent storage. The Portable supports a maximum of two internal disk drives. The computer can have either two floppy disk drives or one floppy drive and one hard disk. Procedures are included for installation, check-out, and troubleshooting.

Numeric Keypad

Figure 5-D. The optional numeric keypad can be installed in place of the trackball. To use the numeric keypad, remove the trackball and use the low-power mouse instead. Installation procedures are located under "Reconfiguring Input Devices."

PRODUCT DESCRIPTION □

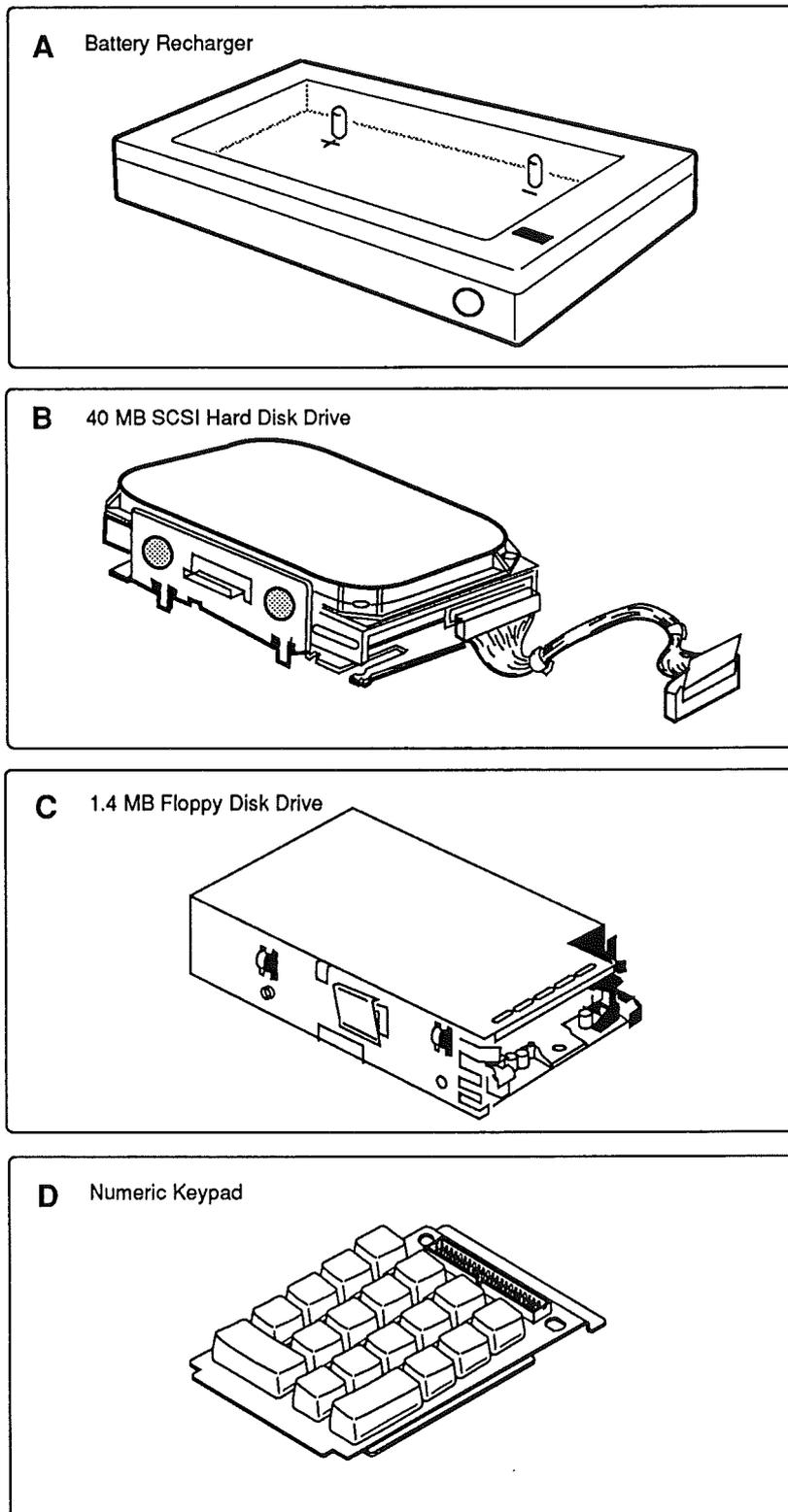


FIGURE 5

□ CONNECTOR AND SWITCH IDENTIFICATION

Rear Panel

Figure 6-A. The Macintosh Portable has seven interface connectors, one power connector, and an opening for the connector for the optional modem card on its rear panel. Pin-outs and signal descriptions for the interface connectors can be found in the *Apple Service Technical Procedures Peripheral Interface Guide*.

Internal

Figure 6-B. The Macintosh Portable logic board has seven connectors and one four-position DIP switch.

CONNECTOR AND SWITCH IDENTIFICATION □

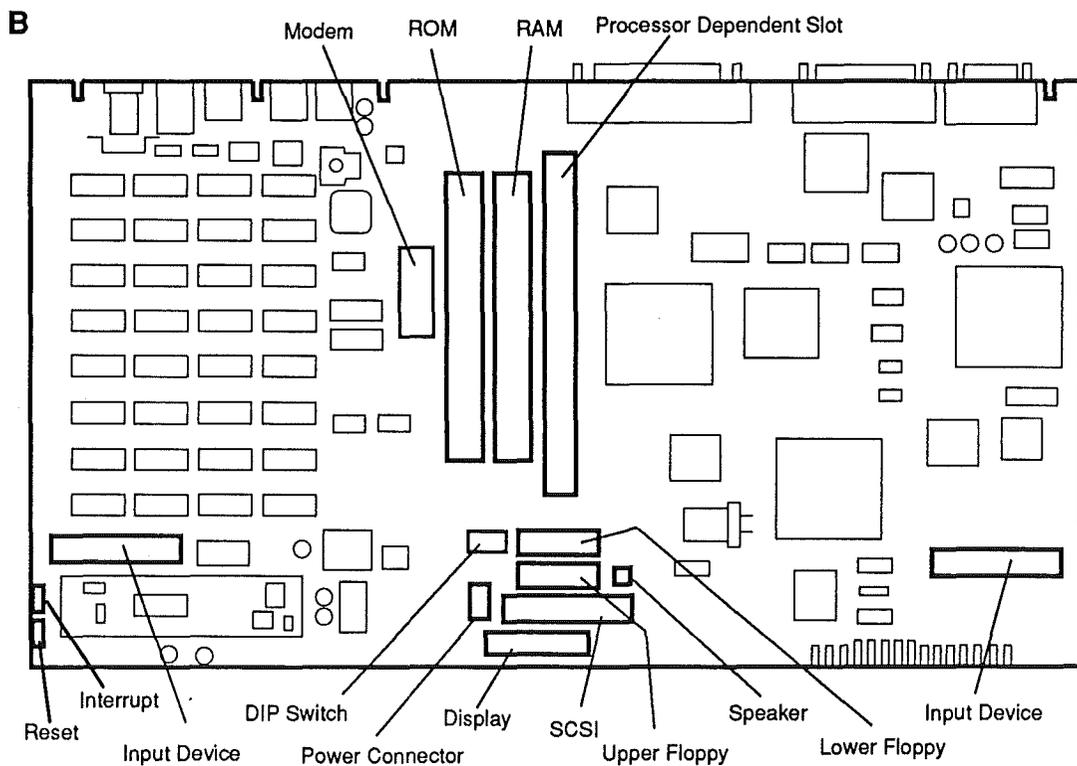
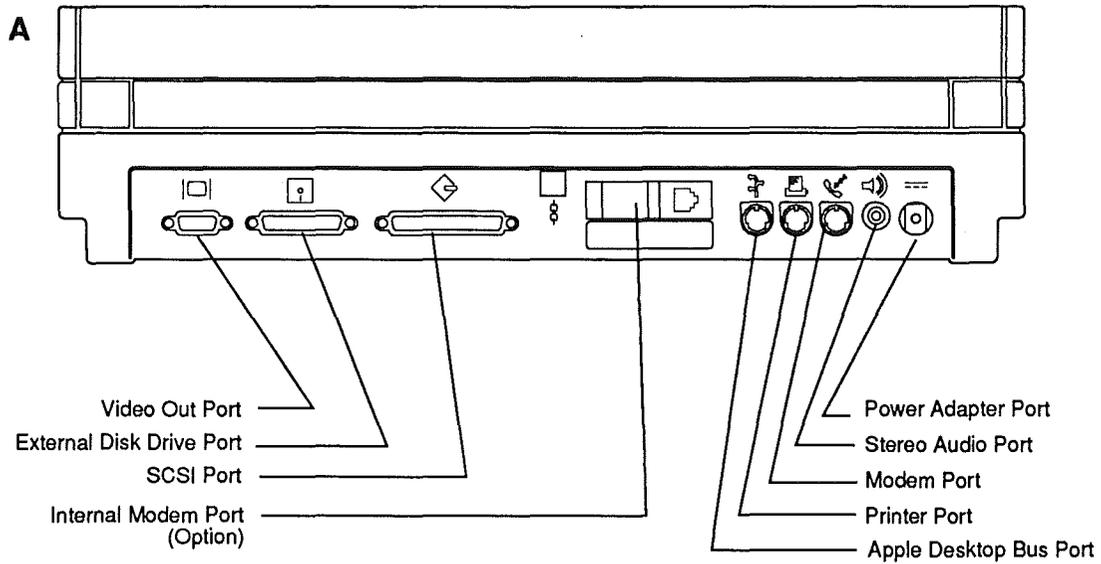


FIGURE 6

□ THEORY OF OPERATION

Introduction

The Macintosh Portable computer is made up of six modules: the logic board, Apple FDHD disk drive, the input devices, LCD display, main and backup batteries, and an external power adapter. A combination of two input devices is present. The combination of input devices can be either a keyboard and trackball, or a keyboard, numeric keypad, and mouse. A system block diagram is shown in **Figure 8**.

The information here will give you an understanding of how each module of the Macintosh Portable computer works, as well as how the system functions. This will assist you in performing logical troubleshooting on the Macintosh Portable computer.

Logic Board

Figure 7. The logic board is the heart of the system, the place where all processing of information takes place. Power management and battery recharging, video display memory and interface circuitry, and peripheral and expansion interfaces are also contained on the logic board. What follows is a list of the major components of the Macintosh Portable logic board and the functions they perform.

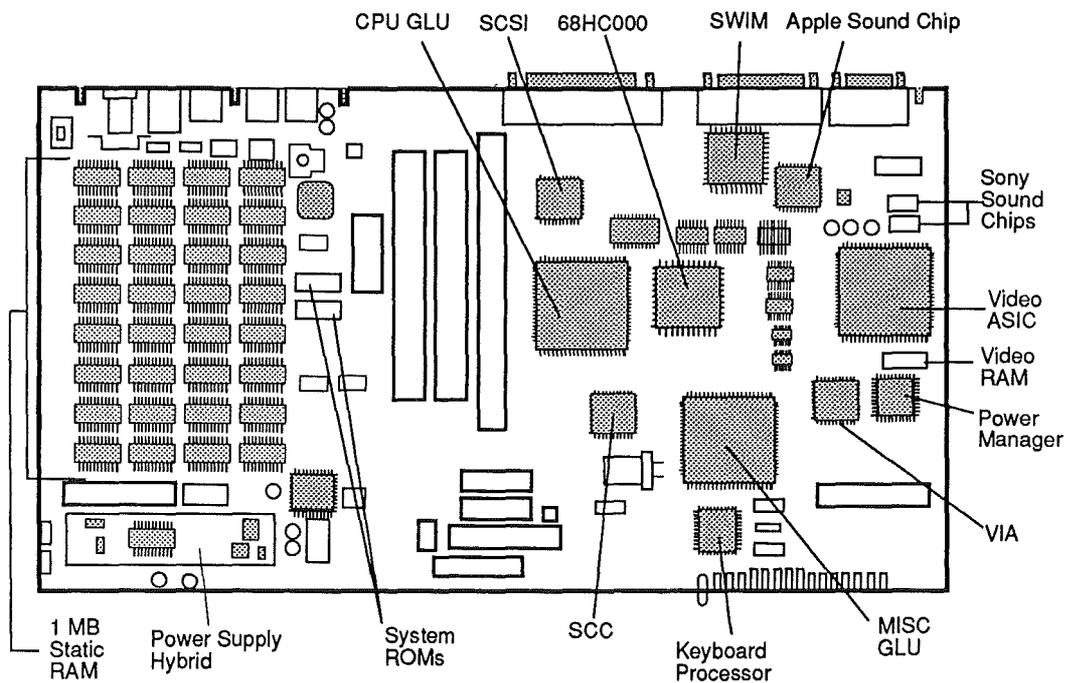


FIGURE 7

THEORY OF OPERATION □

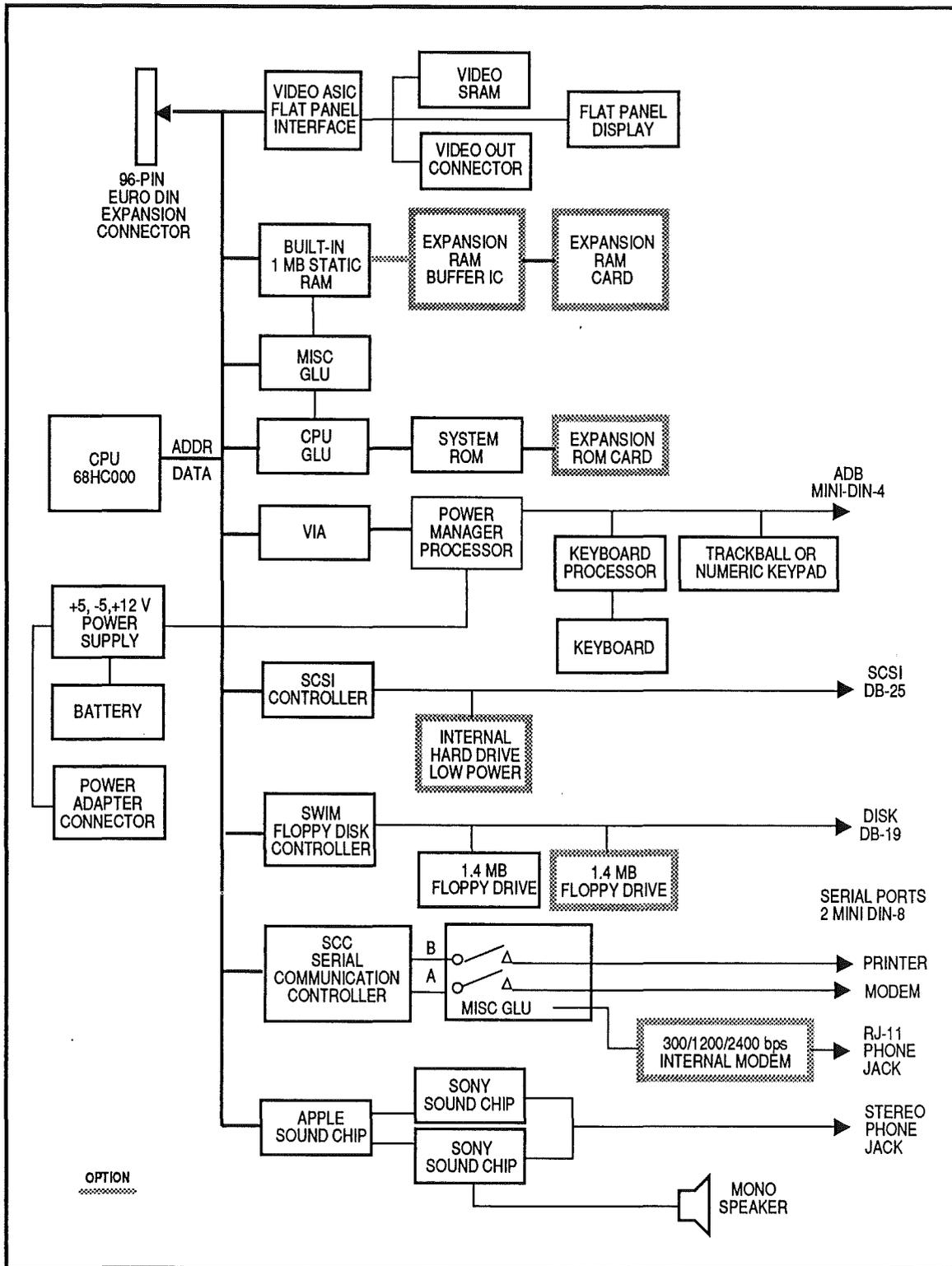


FIGURE 8

□ THEORY OF OPERATION

Microprocessor

The Macintosh Portable contains a Motorola MC68HC000 16-bit microprocessor operating at 15.667 MHz. This processor is completely software compatible with the 8-MHz 68000 used in the Macintosh, Macintosh Plus, and SE; the 32-bit 68020 used in the Macintosh II; and the 32-bit 68030 used in the Macintosh SE/30 and Macintosh Iix, Iicx, and Iici. The Portable will, therefore, run most existing Macintosh applications without modification. (The latest list of applications compatible with the Portable can be found in the Technical Information Library on AppleLink®.)

CPU GLU IC

The CPU GLU (general logic unit) IC is an Apple-designed custom gate array that performs a variety of support functions for the microprocessor. The CPU GLU provides an interface between the 68HC000 and system RAM and ROM, SCC, SCSI, VIA, SWIM, and Video ASIC peripheral chips. Also, the 96-pin expansion connector interface and a number of miscellaneous support functions are implemented.

Power Manager Microprocessor

The Portable uses a Mitsubishi M50753 microprocessor to perform a variety of control and support functions. This processor is referred to as the power manager.

The M50753 contains RAM, ROM, I/O ports, an analog-to-digital converter, a pulse-width modulation (PWM) output, and an 8-bit timer. These are used to monitor the battery charge level, govern power and clocks to the internal peripheral chips and devices, implement the Apple Desktop Bus transceiver and Macintosh real-time clock, and control the screen contrast setting. The operation of the power manager is discussed in greater detail in "Functional Overview."

Power Supply Hybrid

The power supply hybrid is a combination digital and analog device used to convert the 6.5 volts from the main battery to the voltages required by the computer. This chip also monitors the voltages available from the power adapter and the main battery.

RAM

The Portable comes with 1 MB of static random access memory. This 1 MB of RAM (referred to hereafter as system RAM) is available for use by the Macintosh operating system, applications, and data. (Video display memory is separate from system RAM and is discussed in the "Video Display Circuitry" section.) The memory is implemented using thirty two 32K x 8-bit RAMs with an access time of 100 nanoseconds. Static RAM is used instead of the dynamic RAM found on other Macintosh computers to reduce power consumption and relieve the 68HC000 from the task of providing the periodic refresh required by dynamic RAMs. To further reduce power consumption, 32K x 8-bit devices are used. By using RAMs 8-bits wide, only two are required to implement a 16-bit data width. Due to the nature of Macintosh applications, most programs run for extended periods in tight loops. This means that only two RAMs are required at any one time. All others can be in standby mode—requiring approximately 1/500th the power.

The contents of system RAM are maintained by battery power when the computer is in sleep mode. The contents will be maintained as long as the battery is charged.

RAM Expansion

RAM expansion is provided through a single 50-pin connector. All the required address, data, control, and power signals are brought to this connector. The memory expansion card installed here can contain a maximum of 4 MB. Note that this connector is electrically different than the ROM expansion slot. Therefore, the cards cannot be interchanged in their connectors. Presently, Apple has an optional 1 MB expansion card available. Further information on the RAM expansion card can be found in Section 5, Additional Procedures.

ROM

The Portable has 256K of nonvolatile read-only memory. Two 128K x 8-bit devices are used. These ROMs, which are based on the Macintosh SE ROMs, contain the Macintosh ToolBox; diagnostics and self-tests; support for the power manager, real-time clock, and Apple Desktop Bus; and other extensions to support the Portable.

□ THEORY OF OPERATION

System ROM upgrades are accomplished by installing an expansion ROM card containing new system ROMs in the ROM expansion connector and disabling the on-board ROMs via DIP switches.

ROM Expansion

Like RAM expansion, ROM expansion is provided through a single 50-pin connector. All required address, data, control, and power signals are brought to this connector. Note that this connector is electrically different from the RAM expansion slot. Therefore, the cards cannot be interchanged in their connectors.

The ROM expansion card can contain a maximum of 3.75 MB. This card can contain a variety of software, including new versions of the system ROMs from Apple and various software from third-party developers.

Input / Output Interfaces

The Portable offers a number of input/output interfaces:

- Two RS-422 serial ports – The serial ports include support for the internal modem card and are controlled by the Serial Communications Controller (SCC) circuitry.
- Floppy disk interface – The floppy interface can support two internal FDHD disk drives and a single 800K or 1.4 MB external drive. The interface is controlled by the SWIM circuitry.
- SCSI interface – Supports the optional internal SCSI hard drive and up to six additional external SCSI devices. This interface is controlled by the 53C80 SCSI controller circuitry.
- Apple Desktop Bus – This is a low-speed serial interface used to provide communication between the CPU and input devices. The Portable contains a total of three ADB connectors. Two connectors support the connection of the internal keyboard and trackball or numeric keypad. The third is an external connector for connecting an external device, such as a mouse or external keyboard.

THEORY OF OPERATION □

- Stereo sound port – The Portable contains stereo sound capability. Sound is controlled by the Apple and Sony Sound Chip circuitry.

Each of these interfaces is compatible with its counterparts found on Macintosh SE and II family computers.

The Portable also has several other interfaces not found on other Macintosh computers:

- Video interface – The video interface supports the built-in LCD display and the video-out port at the rear of the computer. The video interface is designed around the Video ASIC. The external video-out port supplies the same signals that are sent to the LCD display and requires an external adapter to convert the information into a form that can be used by an external video display, such as the Apple Hi-Resolution Monochrome Monitor.
- Expansion interface – Expansion capability is provided by a 96-pin connector called the Processor Dependent Slot (PDS). This connector is electrically, but not physically, compatible with the expansion connector on the Macintosh SE. The Misc GLU and Video ASICs provide interface support between the CPU and the expansion connector.

Serial Communications Controller (SCC)

The two serial ports are controlled by an 8530 Serial Communications Controller (SCC). Port 1, the modem port, can be programmed for asynchronous or synchronous protocols. Port 2, the printer port, can be programmed for asynchronous or AppleTalk[®] operation. The serial ports conform to the EIA RS-422 standard. These ports are used mainly for (though not limited to) connecting the Portable to AppleTalk networks or serial printers and modems.

The Portable uses two mini DIN-8 connectors for the two ports. These are the same connectors found on all Macintosh computers since the Macintosh Plus. 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.

□ THEORY OF OPERATION

Port 1, the modem port, is also used to communicate with the internal modem. When the modem is installed, the computer automatically selects the modem and disables the external serial port. The interface between the computer and modem is RS-232 and uses an 18-pin connector.

Note: When the internal modem is installed and selected, the external modem port is disabled. It is not possible to use both simultaneously.

SWIM Chip

The SWIM chip in the Macintosh Portable is a complete multimode floppy disk interface on a single IC. The SWIM is an enhanced version of its predecessor, the IWM, found in the Macintosh, Macintosh Plus, SE, and II. The SWIM chip incorporates the features of the IWM and provides the additional capability to read, write, and format in both Group Coded Recording (GCR) and Modified Frequency Modulation (MFM) data formats. The SWIM chip interprets, converts, and outputs dual-disk (clock/time) and file (data) signals as appropriate for either GCR (variable rotational speed) or MFM (constant rotational speed) 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). The disk interface on the Portable supports up to two internal drives and one external drive—a total of three drives.

Small Computer System Interface (SCSI)

The Small Computer System Interface (SCSI) consists of the 53C80 SCSI controller IC, an internal 34-pin connector to connect an optional internal SCSI hard disk, and an external DB-25 connector to attach up to six additional external SCSI devices. The SCSI controller is connected directly to both connectors, and it controls the high-speed parallel port for communicating with up to seven SCSI peripherals. Each SCSI device has a unique address. This address is used to direct information between devices. The Macintosh computer is always address 7. The optional internal hard disk is address 0. External SCSI devices can be addressed from 0 to 6. (If an internal hard disk is installed, address 0 cannot be used.)

THEORY OF OPERATION □

The Apple SCSI interface differs from the industry SCSI standard in two ways:

1. A DB-25 connector is used instead of the standard 50-pin "D" connector to attach external SCSI devices. The *Apple SCSI System Cable* is available to convert the connector to the standard.
2. Power for termination resistors is not provided. If the attached SCSI device does not have the required terminator resistor, the external device must either include a built-in terminator or provide power for an external terminator.

Apple Desktop Bus

The Apple Desktop Bus (ADB) is a low-speed serial communication bus used to connect input devices to the computer. ADB can be used to connect devices like keyboards and pointing devices. The standard input devices, the keyboard and trackball, are connected to the logic board via 34-pin flat cables. External ADB devices connect to the computer via a mini DIN-4 connector on the rear panel. Unlike other Macintosh computers with an ADB interface, the Portable does not use the standard ADB chip. The Portable has the function of the ADB chip incorporated into the power manager microprocessor.

All devices that are made for the Apple Desktop Bus have some kind of microprocessor that makes them intelligent devices. In the Portable, the microprocessor for the keyboard is part of the logic board. All external ADB devices, except the mouse, have a second ADB connector for connecting to other ADB devices. Because it has no connector, the mouse must be the last device attached to the Apple Desktop Bus.

□ THEORY OF OPERATION

Apple Sound Chip

The Apple Sound Chip generates a stereo audio signal. This signal is buffered by two Sony audio chips that filter the pulse-width-modulated (PWM) signal and drive the internal speaker (mono) or external audio port (stereo).

The sound generation system in the Macintosh Portable supports the previous Macintosh modes; it also offers a set of ROM tools known as the Sound Manager for performing sound generation.

Video Display Circuitry

The Portable has a special video interface to support the LCD display. The interface is based around the Video ASIC. The Video ASIC controls the interface between the CPU, video RAM, and the LCD display. This circuit also sends data and control signals to operate the display.

A 32K x 8-bit static RAM provides video display memory separate from main system memory. This separate video memory increases the amount of RAM available for use by applications and data and also eliminates contention problems between the CPU and video display circuitry. The elimination of contention problems improves system throughput.

Versatile Interface Adapter

The Macintosh Portable contains one 65C22A Versatile Interface Adapter (VIA). The VIA provides an 8-bit bidirectional data bus and handshaking between the power manager microprocessor and the 68HC000, floppy drive head selection, and miscellaneous support for the internal modem, SCSI interface, and SCC.

Expansion Interface

The Portable has a 96-pin EuroDIN connector to provide system expansion capabilities. All the 68HC000 data, address, and control signals and are brought to this connector. This connector, although it contains the same signals as the one in the Macintosh SE, does not support SE expansion cards. Interface support between the 68HC000 and the expansion slot are provided by the Video ASIC.

THEORY OF OPERATION □

Apple FDHD Disk Drive

Each internal floppy disk drive connects to the logic board through a 20-pin 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.

The Macintosh operating system does not recognize other disk formats so 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.

Keyboard

The keyboard used in the Portable is modeled after the Apple Keyboard used with the Macintosh SE. Communication between the CPU and keyboard is via an Apple Desktop Bus connector on the logic board. The connecting cable is a 34-pin flat cable. A keyboard processor located on the logic board interprets the signals coming from the keyswitch matrix.

Trackball

To provide a truly portable computer, a trackball has been provided to use in place of the Apple Desktop Bus mouse. The trackball emulates the mouse in operation and communicates with the CPU via the Apple Desktop Bus. A 34-pin flat cable connects the trackball to the logic board.

Low-Power Mouse

The low-power mouse can be used when the optional numeric keypad is installed and the trackball is unavailable or whenever a mouse is desired. The Portable requires the use of a special low-power version of the mouse to minimize power use. Apple strongly recommends that the regular ADB mouse not be used with the Portable.

Low Power Devices



FIGURE 9

Figure 9. Devices which receive power from the computer, such as the mouse and hard disk, are available in low-power versions. These low-power devices display an icon to indicate they are specially designed for use with the Macintosh Portable. These low-power devices should be used wherever possible to provide maximum system operation when running on battery power.

□ THEORY OF OPERATION

LCD Display

The Macintosh Portable uses a new flat-panel display technology called reflective active matrix. Active matrix technology was chosen for several reasons:

- Low power
- Fast response
- Large contrast and viewing angle
- Bright
- Durable
- Low weight

Figure 10. The display operates by the reflection of light from the front surface onto a reflector plate at the rear of the display. The display has high contrast in all but very low-light levels.

The display is made up of 640 pixels horizontally and 400 pixels vertically, for a total of 256,000 pixels. The result is a resolution of 75 pixels (dots) per inch (dpi). The density is slightly more than the normal 72 dpi of the Macintosh, Macintosh Plus, SE, and SE/30, resulting in a slight variation in the display aspect ratios.

Screen contrast is software selectable through the Portable control panel device (CDEV) in the Control Panel. (Refer to "System Software" later in this section.) The power manager microprocessor contains a digital-to-analog (D/A) converter, which is used to select one of 32 contrast levels.

Screen Defects

Screen defects fall into three categories—voids, stuck pixels, and black lines or streaks. A void is a pixel that will not turn on. Apple specifications permit a maximum of five voids per display. A display which has six or more voids is considered defective and should be replaced. A stuck pixel is any pixel which never turns off. A display with any stuck pixels should be replaced. Black lines or streaks can be seen as either a row or column of pixels that is stuck on or as a "ghost" of an image on the display. Any display that exhibits black streaks or lines should be replaced.

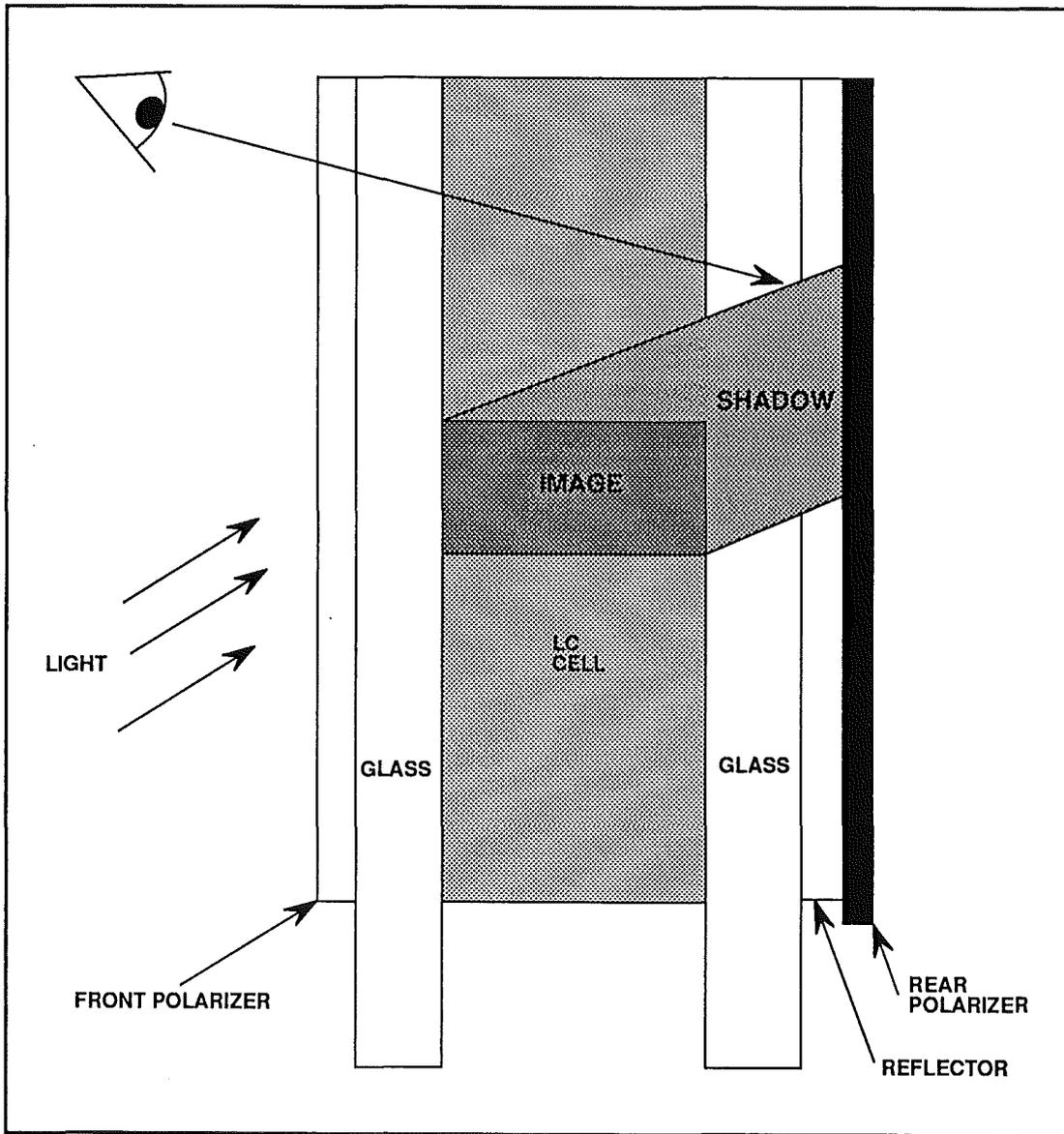


FIGURE 10

□ THEORY OF OPERATION

Main and Backup Batteries

The main battery used in the Portable is a rechargeable, sealed, lead-acid battery providing 6.5 volts DC. The battery is designed to be easy to install and remove by having no connecting wires. The battery connects via a wiring harness to the main logic board where the power supply hybrid converts the 6.5 volts to the +5, -5, and +12 volts required by the computer. The floppy disk drives, LCD display, input devices, external ADB devices, option cards, and optional SCSI hard disk drive receive their power from the logic board. Power management of these devices is handled by the power manager microprocessor.

The backup battery is a non-rechargeable 9-volt transistor battery. The battery connects to the logic board via the same wiring harness that connects the main battery. The battery is located in the rear of the main battery compartment. This battery supplies power to the logic board when the main battery has been removed or has been exhausted.

The backup battery is also used to maintain power to the system when the main battery is removed from the computer. This allows the contents of system and parameter RAM to be maintained while replacing the main battery. The battery being used is determined by the state of a microswitch located in the battery compartment. The battery cover has a tab that activates the microswitch when the cover is installed. When the cover is installed and the microswitch closed, the computer will use the main battery as its power source. However, whenever the cover is removed, the main battery is switched out and the backup battery is used.

Note that the power manager is not connected to this microswitch and is unaware of which battery is being used. This means that should an attempt be made to startup the system or have it return from system sleep the power manager will not know that the backup battery is being used. The backup battery, however, does not provide enough power to operate the system and the battery will be drained and require replacement. Also, damage could be done to the computer.

THEORY OF OPERATION □

WARNING: *The main battery contains toxic materials (lead and sulfuric acid). Although the battery is sealed at the factory, leakage of a small amount of sulfuric acid electrolyte may occur if the battery is damaged by rough handling. Any sulfuric acid can cause severe burns to the skin and eyes. If contact is made with a damaged battery, immediately wash the contact area with water for at least five minutes.*

To avoid possible injury or damage to the battery,

- *Recharge the battery only as described in the Macintosh Portable Owner's Guide.*
 - *Charge the battery in well ventilated areas only.*
 - *Do not short-circuit the battery terminals as this can cause an explosion or fire.*
 - *Do not puncture, disassemble, mutilate, or incinerate the battery.*
 - *To avoid improper disposal of toxic waste materials, return worn out, undamaged batteries to Apple for proper disposal.*
-

Power Adapter

The power adapter converts the AC line power to the 7.5 volts DC required by the Portable. The charger has a voltage input range of 85 to 270 volts (120/240 nominal) with a frequency of 48 to 62 Hz (50/60 Hz nominal). The power adapter limits output current to 1.5 amps.

□ THEORY OF OPERATION

Functional Overview

The following sections describe the operation of the Macintosh Portable. This information is valuable in helping you logically troubleshoot the system.

Power System

The Macintosh Portable uses +5, +12, and -5 volts DC to power its various components. These voltages are generated by applying the 6.5-volts from the main battery to the power supply hybrid. The power supply hybrid, which is comprised of a combination of analog and digital circuitry, also monitors the main battery voltage, monitors and controls the charging of the main battery, and monitors the power adapter input voltage.

If the battery voltage falls below +5.65 volts, the power monitor circuit will turn off power to the computer with the exception of itself and the circuit monitoring the input from the power adapter. Prior to doing so, the user will be prompted a number of times that the battery voltage is approaching a very low level and either the power adapter should be connected or a charged battery installed. If this is not done, the computer will shut-down. The computer cannot be turned on again until the power adapter is connected or a charged battery is installed. To prevent battery sulfation, the monitor circuit will turn off the +12 and -5 volt power supplies.

The power adapter input voltage is continuously compared with the battery voltage to determine if the battery requires recharging. If the power adapter is connected to the computer, has power applied to it, and the battery is below 6.4 volts, the battery will begin charging.

The power manager also uses the information from the battery voltage monitor to do its job of managing the power consumption of internal peripheral chips and devices. Components which are not needed are powered off to conserve power. Two methods are available to reduce peripheral device power consumption—clock control and power control.

THEORY OF OPERATION □

Clocked devices—the SWIM and SCC—reduce their power consumption by removing the clock input to the chip. For devices that do not have a clock input, the power to the chip must be removed to reduce power consumption. The -5 and +12 volt power supplies, the serial line drivers, the Apple Sound Chip, SCSI controller, and internal modem card are in this category.

The 68HC000 is grouped with system RAM, ROM, and some support logic for their power management. The contents of system variables, peripheral device internal registers, and the 68HC000's internal registers must be saved prior to powering down these devices. After this is done, the power manager can then place the RAM, ROM, and support logic in standby mode and the 68HC000 is put in an extended wait state to reduce power consumption.

System Startup

When the computer is turned on, the system begins a carefully synchronized sequence of events. First, the processor is held in a wait state while a series of circuits puts the system in a known state in preparation for operation. During this time, the versatile interface adapter and the SWIM chip are initialized, and the mapping of RAM and ROM is altered temporarily in order to test the system.

The software contained in the Read-Only Memory (ROM) then performs a RAM test to determine how much RAM is present in the machine and to verify the proper operation of that RAM. Several other system tests are then performed. When the system is fully tested and initialized, system RAM is mapped for normal operation.

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—lower drive first, followed by upper drive
- 2) External floppy disk drive
- 3) Startup device set in the control panel
- 4) RAM disk containing a valid system folder
- 5) SCSI devices—starting with internal drive, then in declining order of device ID (6 to 0)

□ THEORY OF OPERATION

Note: The startup device will default to the device with SCSI address 0 if both the main and backup batteries are removed, the backup battery fails, the battery cable is disconnected, or the parameter RAM is destroyed.

Once a readable disk containing boot tracks and a System Folder are found, the disk is read and the disk startup process is completed.

System Sleep and Waking

One of the requirements of a portable computer is providing for battery operation for the maximum amount of time possible. The Portable has three methods of power conservation:

- Powering off the system
- Powering off peripheral chips and internal peripheral devices when they are not needed
- Slowing the 68HC000 when full speed is not needed

The power manager will put the computer into system sleep if either a very low battery condition is detected or if the 68HC000 sends a sleep command. The 68HC000 will send the sleep command when no user activity is detected for a period of time specified in the Portable CDEV or the user selects **Sleep** from the Macintosh Finder™.

The computer can be brought out of system sleep in three ways: any key on the keyboard except <Caps Lock> is pressed, the automatic wake-up time set in the Portable CDEV matches the real-time clock time, or if an internal modem is installed and the **When Phone Rings** option of automatic wake-up is selected in the Portable CDEV.

The Macintosh Portable uses version 6.0.4 or later of the Macintosh operating system. Earlier versions are not compatible and should not be used.

Systems shipped from Apple with the SCSI hard disk installed will contain system software and HyperCard preloaded on the hard disk. If the software becomes unusable or the drive needs replacement, you'll need to reinstall this software. You should also install system software and HyperCard on the hard disk if you are installing the optional SCSI hard disk. The installation procedures are included here.

Features of System Software 6.0.4

To support the new features found on the Macintosh Portable, Apple has updated Macintosh system software to version 6.0.4. You must use this version or later. **Earlier versions are not compatible with the Portable and may cause damage to the computer, reduced battery life, or loss of data.**

Some of the new features of system software 6.0.4 are described below.

RAM Disk

System 6.0.4 has the ability to create a RAM disk. By copying the System file and the Finder™ to RAM disk, the Portable can boot from a RAM disk without a startup floppy or hard disk. Also, the time to load the operating system is greatly reduced. The RAM disk is created using the new Portable CDEV described next.

□ SYSTEM SOFTWARE

Portable CDEV

Figure 11-A. The Portable control panel device (CDEV) lets you adjust the screen contrast, set sleep settings for the system and hard disk, create a RAM disk, and control the internal modem.

System Rest

The Portable has the ability to slow the microprocessor from its normal speed of approximately 16 MHz to about 1 MHz during idle periods. This feature is called *system rest* and is used to reduce power consumption by the 68HC000. The computer will switch to system rest if no input device activity occurs for fifteen seconds. The system returns to full speed when a user presses a key, moves the trackball or mouse, or a peripheral requests attention.

System rest may interfere with the operation of some programs. If you need to disable system rest, hold down the <Option> key and click anywhere on the words **Minutes Until Automatic Sleep**. The dialog box appears in **Figure 11-B**. Then click **Don't Rest** and **OK**.

Battery Desk Accessory

Figure 11-C. The battery desk accessory displays the amount of battery charge remaining, indicates whether the power adapter is connected, and allows the user to put the computer in sleep mode.

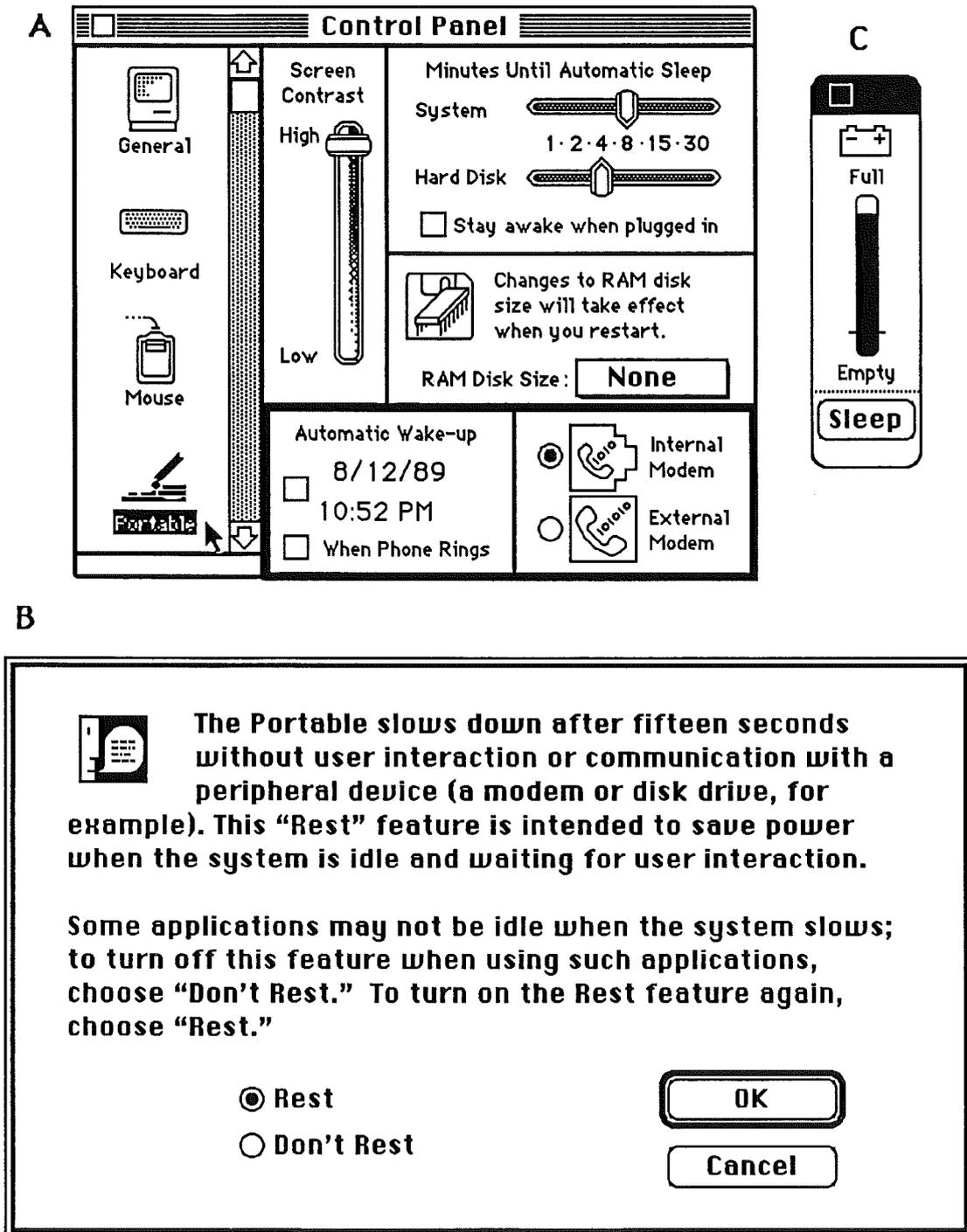


FIGURE 11

□ SYSTEM SOFTWARE

Installation Procedure

Before beginning to install system software, be sure to make backup copies of the system software disks and use the copies to perform the installation.

Materials Required

Macintosh System Software (version 6.0.4 or later)
System Tools, Printing Tools, Utilities 1, and Utilities 2
HyperCard® software

Procedure

1. Insert the *System Tools* disk in any available floppy disk drive.
2. Turn on the computer by pressing any key except <Caps Lock>.
3. When the desktop appears, double-click on the *System Tools* disk to open it.
4. Double-click on the *Installer* to launch it.
5. When the welcome screen appears, click **OK**.
6. Select the disk you want to install system software onto. The name of the currently selected disk appears next to the disk icon. If it's not the disk you want, click **Switch Disk** until you see the name of the disk you want.
7. Click **Install**. The installer will place a complete set of system software for the Portable and printer software for all Apple printers on the selected disk.
8. When the **Installation was successful** message appears, click **Quit**.
9. Choose **Restart** from the **Special** menu. The Portable reboots.
10. When the desktop appears, create a new folder on the hard disk called *HyperCard*.
11. Copy the four *HyperCard* floppy disks to the hard disk.

System software and *HyperCard* installation is complete.

SPECIFICATIONS □

Processor

<i>Type</i>	Motorola MC68HC000, 16-bit CMOS microprocessor
<i>Addressing</i>	32-bit internal registers 24-bit address bus 16-bit data bus
<i>Clock Rate</i>	15.6672 MHz
<i>Wait States</i>	1

Memory

<i>RAM</i>	1 MB using thirty-two 32K x 8-bit static RAMs; 100-nsec access time; addressing supports up to 9 MB Expandable to 2 MB with optional 1 MB RAM Expansion Card 128 bytes of system parameter memory 32K of static video display memory
<i>ROM</i>	256K using two 128K x 8-bit devices; 150-nsec access time; addressing supports up to 4 MB Expandable to 4 MB with optional ROM Expansion Card

Display

<i>Type</i>	Reflective, active-matrix liquid crystal flat-panel display
<i>Size</i>	10-inch (25.4 cm) diagonal
<i>Resolution</i>	640 x 400 pixels, 75 dpi
<i>Dot Size</i>	.28 mm
<i>Dot Pitch</i>	.33 mm
<i>Active Area</i>	80%
<i>Other</i>	Variable tilt Contrast is software adjustable (using the Control Panel) to one of 32 levels

□ SPECIFICATIONS

I/O Devices

<i>Keyboard</i>	63 keys N-key rollover Apple Desktop Bus interface US, British, French Canadian, Japanese, German, Spanish, French, Swedish, and Italian versions available
<i>Trackball</i>	Apple Desktop Bus interface
<i>Low-Power ADB Mouse</i>	Low-power version of the Apple Desktop Bus Mouse Opto-mechanical type Apple Desktop Bus interface
<i>Numeric Keypad (Optional)</i>	18 keys Apple Desktop Bus interface US, Pacific, and European versions available
<i>Floppy Disk Drive</i>	1.4 MB FDHD high-density disk drive 512 bytes per sector 9 sectors per track for 800K; 18 for 1.4 MB 368.64K/side for 800K; 737.28K for 1.4 MB 737.28K/disk for 800K; 1474.56K for 1.4 MB
<i>40-MB Hard Disk Drive (Optional)</i>	40-MB formatted capacity Apple SCSI interface 3.5-inch, one-third-height mechanism 1:1 interleave 25-millisecond average access time
 I/O Interfaces	
<i>Disk Interface</i>	Apple SWIM chip MFM/GCR modes Supports Macintosh 800K Disk Drive, Apple 3.5 Drive, Apple FDHD, and Apple Hard Disk 20
<i>Video-Out Port</i>	Supports the connection of external video devices
<i>SCSI Interface</i>	7.5 MB/second transfer rate Supports a maximum of 8 devices (The computer is always device 7. Optional internal SCSI hard disk drive is device 0.)
<i>Apple Desktop Bus</i>	Low-speed serial interface Supports optional low-power mouse

SPECIFICATIONS □

Serial Interfaces Two RS-232/RS-422
230.4K baud maximum
0.920 Mbit/second if external clock source is provided (modem interface only)
Asynchronous, synchronous (modem only), and AppleTalk (printer only) protocols supported
Internal connector supports the optional Macintosh Portable Data Modem 2400

Stereo Audio Stereo compatible
Output impedance of 8 to 600 ohms
Short-circuit protected
Disables internal speaker when in use

Expansion Connector Processor dependent slot (PDS)
96-pin EuroDIN connector

Environmental

Operating Temperature 10° C to 35° C
50° F to 95° F

Storage Temperature -40° C to 47° C
-40° F to 116.6° F

Relative Humidity 5% to 95% noncondensing

Altitude 0 to 10,000 feet
0 to 3048 m

Electrical

Main Battery Type: Sealed lead-acid
Voltage: 6.5 volts
Capacity: Up to 10 hours (fully charged battery)
(Actual time depends on system configuration and power management settings)

Backup Battery 9-volt transistor

□ SPECIFICATIONS

Power Adapter AC input voltage: 85–270 volts AC, RMS (100/240 nominal)
48–62 Hz (50/60 nominal)
Output voltages: 7.0–7.6 volts (7.5 nominal)
5 milliamps–2.0 amps (1.5 nominal)
Versions available for US, Japan, United Kingdom, Australia, and Europe.

Battery Recharger (Optional) Input voltage: 7.5 volts AC
Output voltage: 6.5 volts DC

Physical

Dimensions (Display Open)

Width	15.25 inches (387.35 mm)
Height	11.0 inches (279.4 mm)
Depth	14.83 inches (365.25 mm)
Height at rear panel	4.05 inches (102.87 mm)
Height at front panel	2.10 inches (53.34 mm)

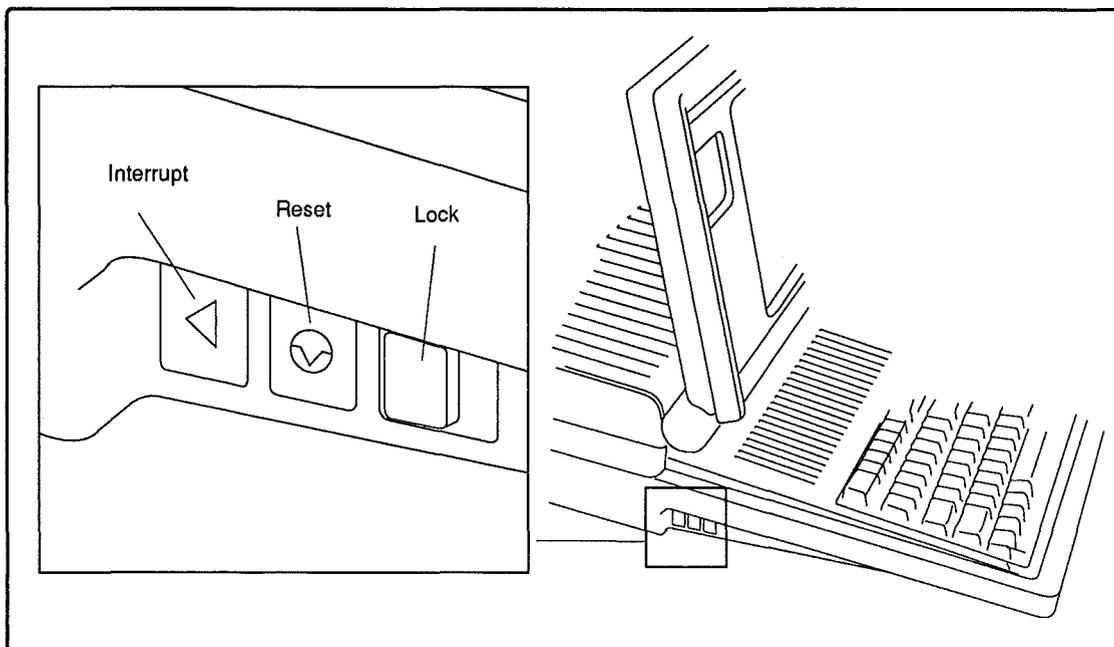
Weight (With Battery) 13.75 lbs. (6.25 kg) without hard disk
15.75 lbs. (7.16 kg) with hard disk

Sound Apple Sound Chip
1- or 4-voice mono (1 or 2 voices in stereo) with 4-bit digital-to-analog conversion using a 22 KHz sampling rate
Filtered by two Sony sound chips

Programmer's Switch

Figure 12. The programmer's switch can be used to reset the computer, reset the power manager microprocessor, or place the computer in test monitor mode. A sliding lock is provided to prevent accidentally depressing either switch and possibly causing a loss of unsaved information.

- **Reset switch** – Pressing the reset switch will reset the 68HC000 and reboot the computer. Doing so will cause any information in system RAM, including the RAM disk, to be lost.
- **Interrupt switch** – Pressing the interrupt switch will cause the computer to enter the test monitor mode.
- **Reset and interrupt switches together** – Pressing the reset and interrupt switches together will reset the power manager microprocessor. Resetting the power manager can often solve problems with ADB devices, bringing the system out of system sleep, or starting up.

**FIGURE 12**

□ OTHER INFORMATION

Materials Required

Figure 13. A minimum of tools are required to maintain and repair the Macintosh Portable computer.

- Flat-blade screwdriver
- 2.44 mm jeweler's screwdriver
- Grounded workstation pad
- Grounding wriststrap

Certain procedures require other items such as software or manuals. These items will be indicated where required.

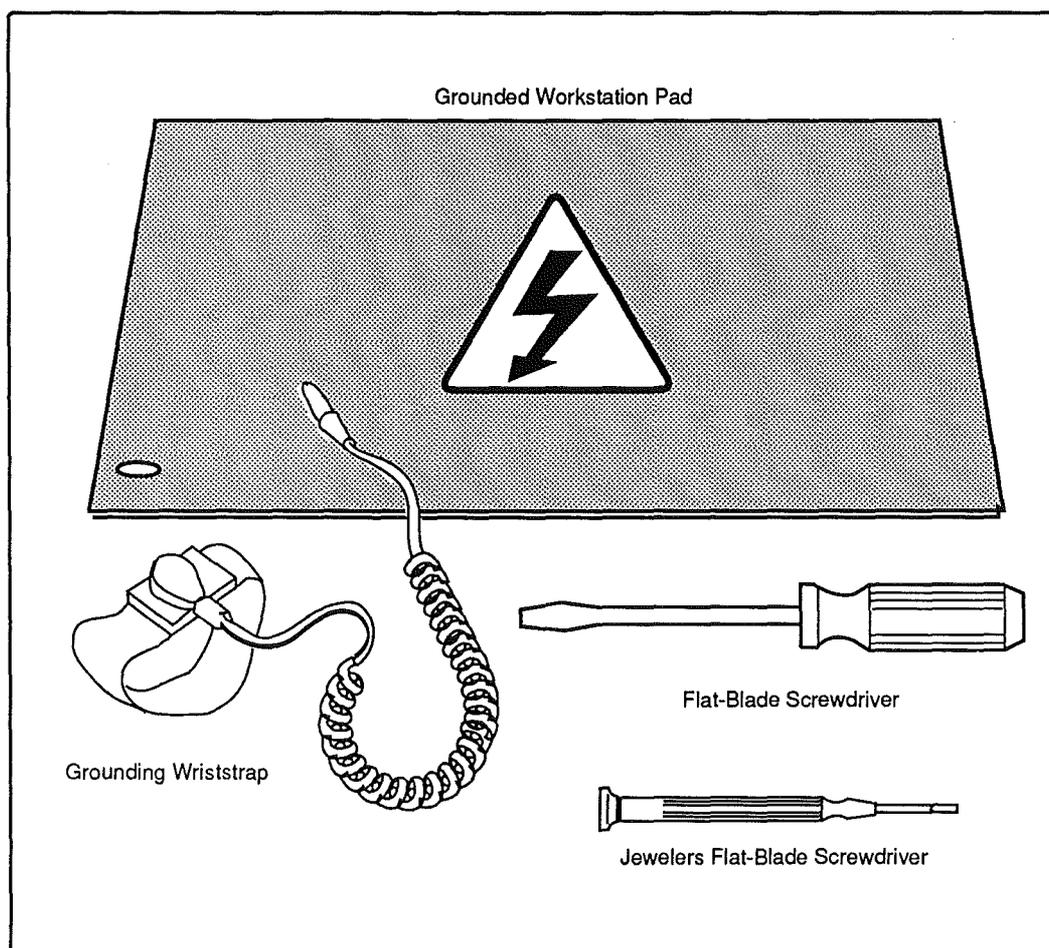


FIGURE 13

Macintosh Portable

Section 2 – Take-Apart

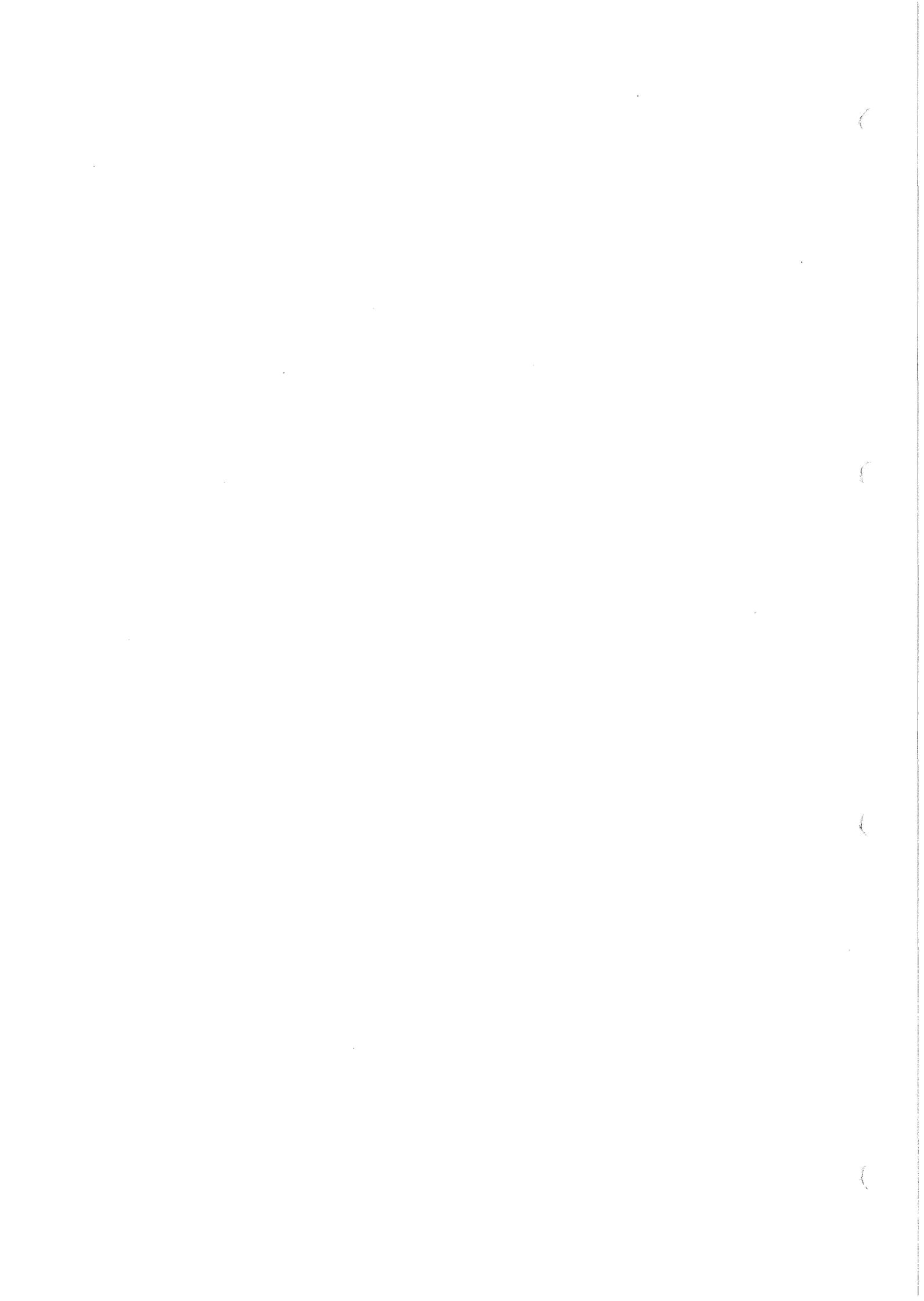
□ CONTENTS

- 2.3 Introduction
- 2.3 Materials Required
- 2.3 Power Information
- 2.3 Electrostatic Discharge (ESD) Precautions
- 2.4 Rear Cover
- 2.6 Keyboard Cover
- 2.8 Main Battery
- 2.10 Backup Battery
- 2.12 Option Cards
- 2.14 SCSI Hard Disk Drive
- 2.16 Upper Floppy Disk Drive
- 2.18 Lower Floppy Disk Drive
- 2.20 Keyboard, Trackball, and Numeric Keypad
- 2.22 Speaker
- 2.24 Display Assembly
- 2.28 LCD Display
- 2.34 Logic Board

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



CAUTION: *Be sure to read the "Power Information" section prior to beginning Take-Apart. This section contains important information necessary to preventing possible damage to the Macintosh Portable.*



Materials Required

Flat-blade screwdriver
2.44 mm jeweler's screwdriver
Grounded workstation pad
Grounding wriststrap

Power Information

Prior to removing or replacing any modules within the Macintosh Portable, you must unplug the power adapter, remove the main battery, and replace the battery cover. By replacing the battery cover you prevent the computer from attempting to operate using the 9-volt battery. **Failure to replace the battery cover can cause damage to the computer.**

**CAUTION**

CAUTION: *If a RAM disk is present, be sure to save its contents before beginning Take-Apart. Otherwise, the contents of the RAM disk will be lost.*

Battery Disposal

If you are unable to recharge a battery or the battery fails to hold a charge, the battery should be replaced. The old battery is considered toxic waste and must be returned to Apple in the packaging that the replacement battery was shipped in. Apple will dispose of the battery following Environmental Protection Agency (EPA) guidelines.

WARNING: *Do not expose the battery to an open flame, attempt to open the plastic case, or dispose of the battery with other trash.*

Electrostatic Discharge (ESD) Precautions

The Macintosh Portable makes extensive use of low-power complementary metal oxide semiconductor (CMOS) devices. These devices 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 modules, observe the appropriate ESD precautions. The protective tape on the component side of the LCD display must not be removed. Complete information on ESD prevention and workstation setup can be found in *You Oughta Know*.

□ REAR COVER

Remove

1. Place the computer on the grounded workstation mat with the rear panel facing you.
2. **Figure 1-A and 1-B.** Press in the two plastic cover latches at the upper left rear and upper right rear of the computer. Next pivot the rear of the cover up and toward the front of the computer, and lift off the rear cover.

Replace

- **Figure 1-C.** Center the rear cover over the computer, place the front edge in position, and pivot the rear down. Press down on the rear of the cover until it snaps in place.

REAR COVER □

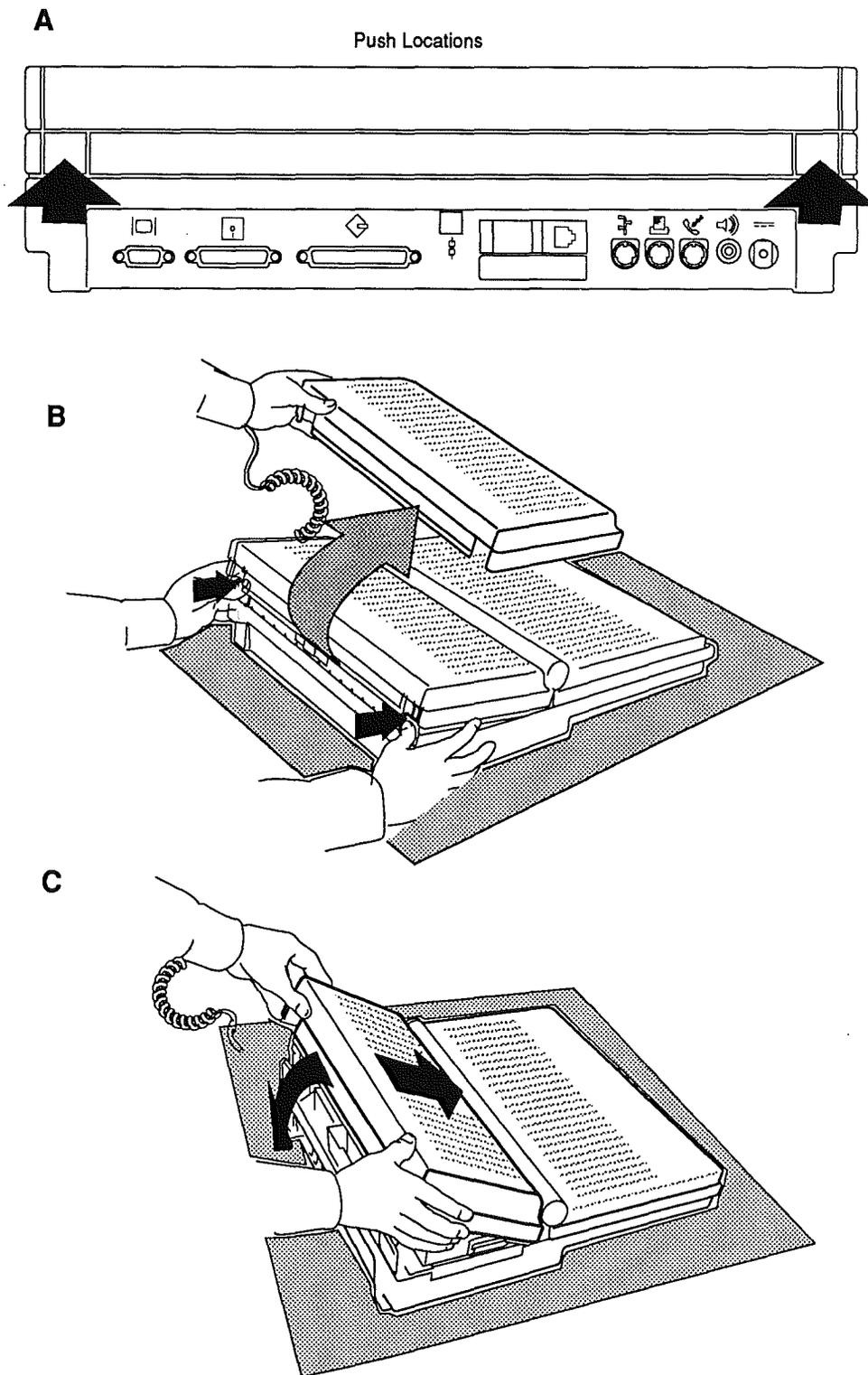


FIGURE 1

□ KEYBOARD COVER

Remove

1. Open the display by pushing the carrying handle toward the computer and lifting the display.
2. **Figure 2-A.** Position the computer as shown.
3. **Figure 2-A1.** Locate the plastic feet at the top left and top right of the case. Remove each foot by inserting the tip of the screwdriver under the center of the foot and gently lifting the foot away from the case.
4. **Figure 2-A2.** Push the tip of the jeweler's screwdriver into the center hole on the top right of the bottom case. Push the screwdriver down and out until the corner unsnaps.
5. Repeat step 4 for the left side of the cover.
6. Place the computer flat on the grounded workstation pad.
7. **Figure 2-B.** Starting at the edges and working toward the center, slide your index fingers between the bottom case and the keyboard cover until the cover is released.

Note: Two latches attach the center of the cover to the bottom case, so you'll feel some resistance as you lift the center of the cover. Don't worry—the cover won't break.

Replace

1. **Figure 2-C.** Place the rear edge of the keyboard cover in place and pivot the front of the cover down as shown.

Note: Make sure the battery wires are flat against the subframe or they may interfere with putting on the cover.

2. Press down on the left corner, right corner, and center of the cover until it snaps in place.
3. **Figure 2-A.** Place the unit back in the position shown and replace the rubber feet.

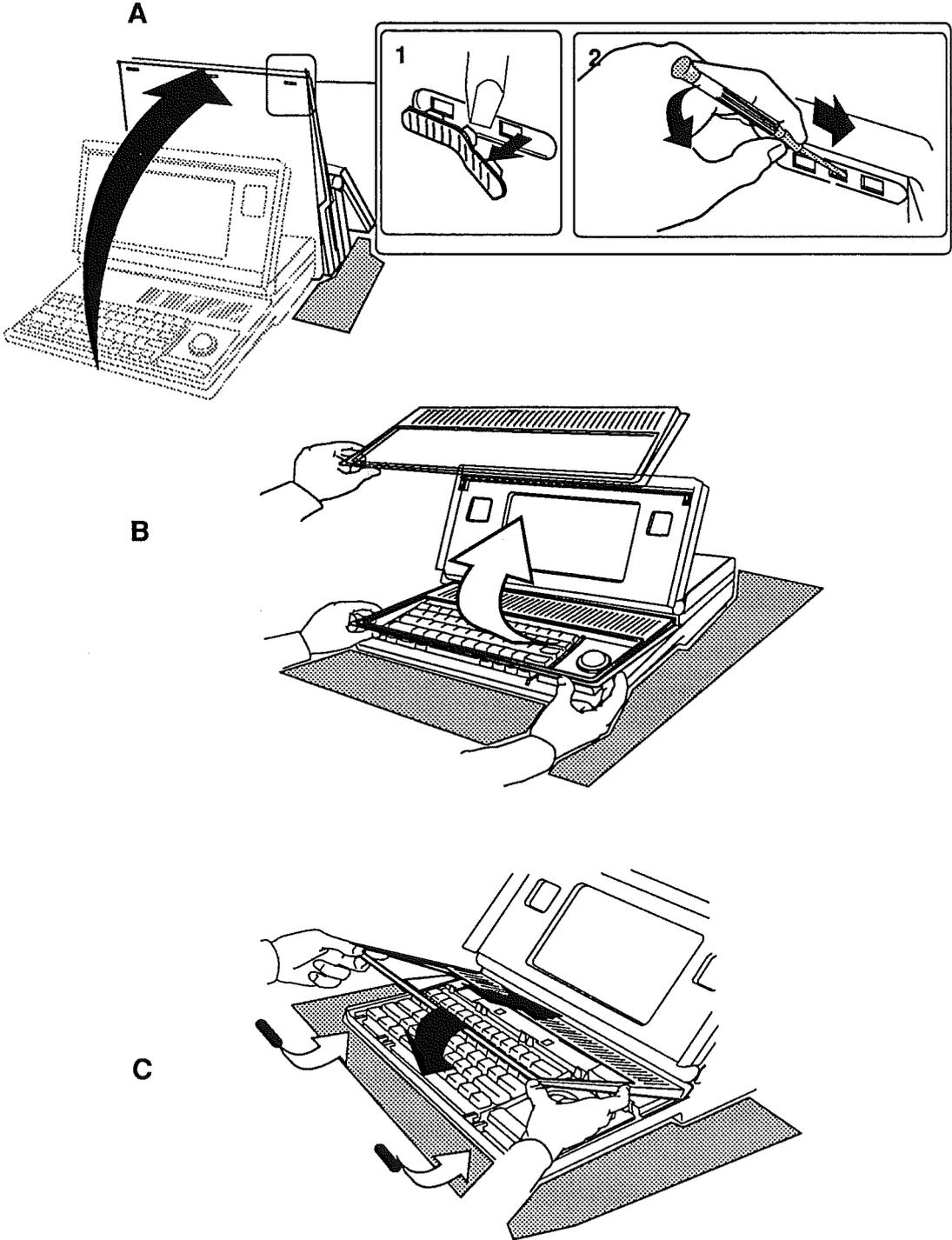


FIGURE 2

□ MAIN BATTERY

Remove

1. Remove the rear cover.
2. **Figure 3-A.** Press down on the two plastic tabs at the front of the battery cover and slide the battery cover toward the rear of the computer.
3. **Figure 3-B.** Lift off the battery cover.
4. **Figure 3-C.** Lift out the main battery.
5. **Figures 3-D, 3-E, and 3-F.** **If you are doing anything other than replacing the main battery,** replace the battery cover by placing the battery cover on the battery compartment and sliding it evenly toward the front of the computer until it snaps in place.

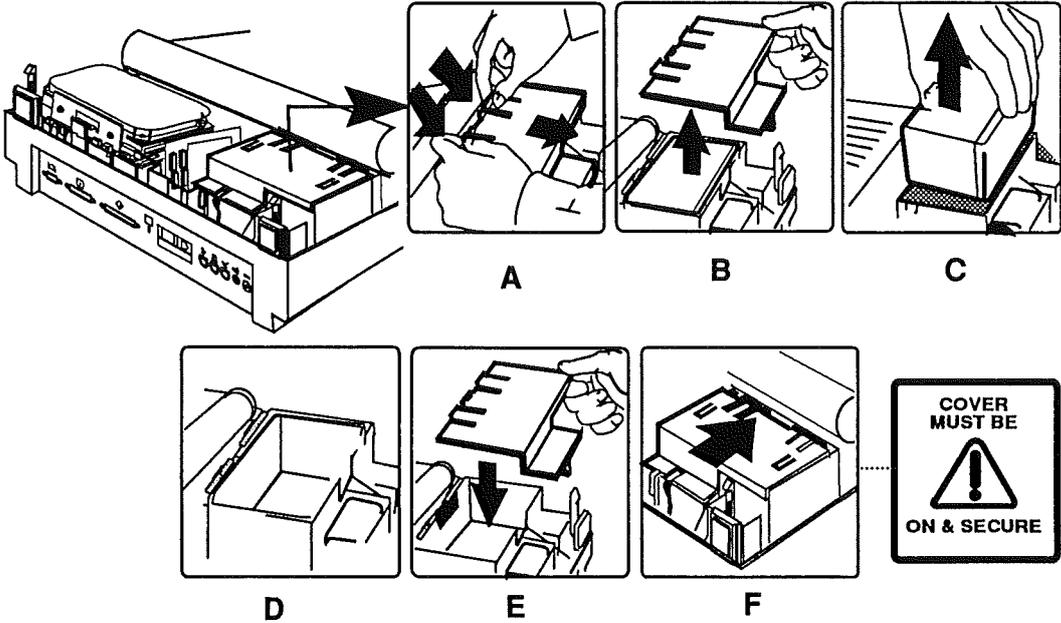


CAUTION: *Replacing the battery cover with the main battery removed disconnects the backup battery. Failure to put the battery cover on leaves power connected to the logic board. Removing and replacing modules with power available could cause damage to any module.*

Replace

1. **Figures 3-G and 3-H.** If the battery cover is on, remove it.
2. **Figures 3-I and 3-J.** Place the battery into the battery compartment. The tab on the battery should be facing toward the front of the computer.
3. **Figures 3-K and 3-L.** Place the battery cover on the battery compartment and slide it evenly toward the front of the computer until it snaps in place.
4. Replace the rear cover.

REMOVE



REPLACE

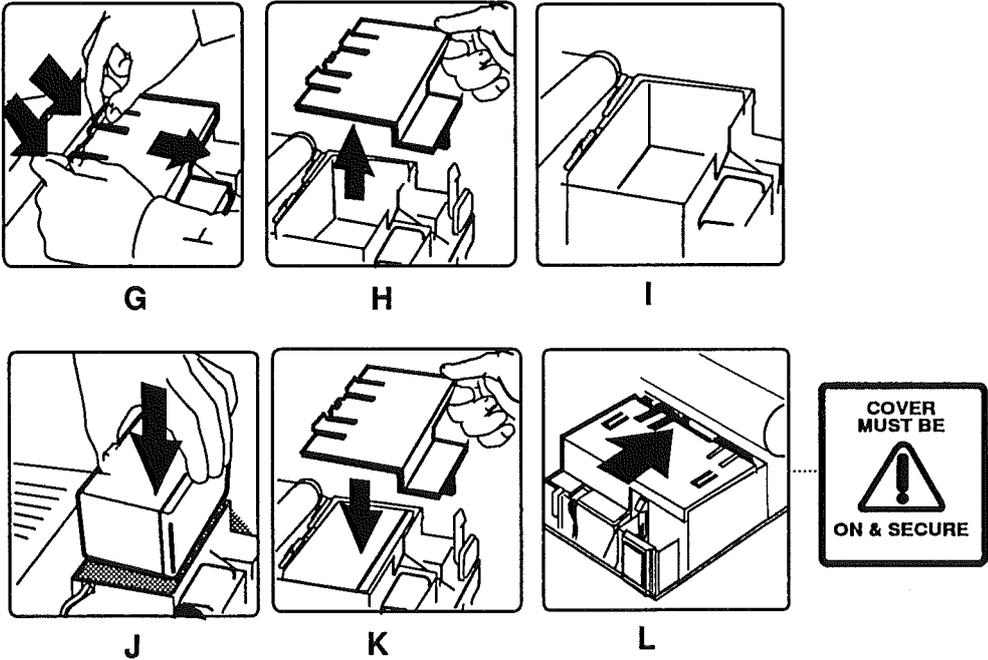


FIGURE 3

□ BACKUP BATTERY

Note: Removing the backup battery will erase the contents of parameter RAM. Before beginning this procedure, be sure to note all the Control Panel settings so they can be restored upon completion of your repairs. If you are unsure how to use the Control Panel desk accessory to modify these settings, refer to the *Macintosh Portable Owner's Guide*.

Remove

1. Remove the rear cover.
2. **Figure 4-A.** Press down on the two plastic tabs at the front of the battery cover and slide the battery cover toward the rear of the computer.
3. **Figure 4-B.** Lift the battery cover off.
4. **Figure 4-C.** Locate the backup battery. **Figure 4-D.** Use the tip of the jeweler's screwdriver to lift the edge of the backup battery far enough to grab the battery with your fingers and remove the battery from its compartment.
5. **Figure 4-E.** Disconnect the battery cable from the battery.

Replace

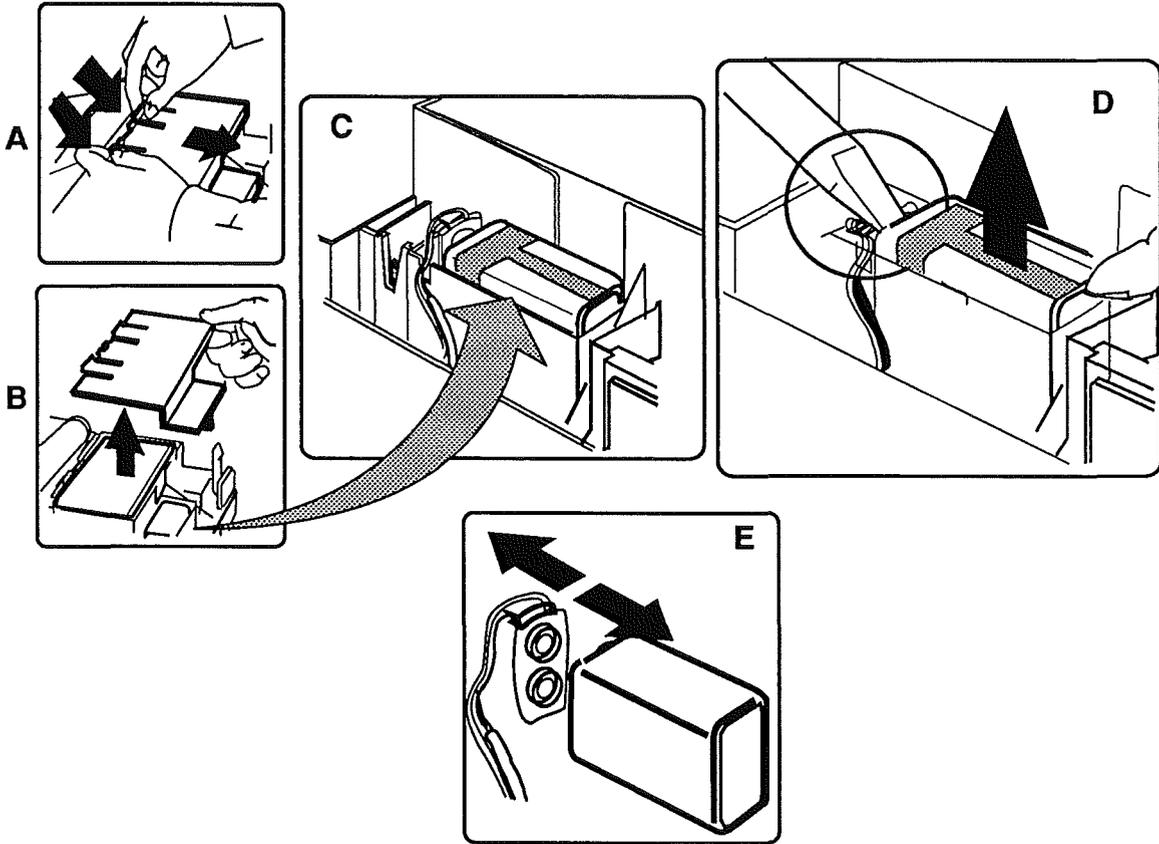
1. **Figure 4-F.** Connect the battery cable to the battery.
2. **Figure 4-G.** Place the battery into the battery compartment. The battery cable should be at the left side of the compartment.

Note: Figure 4-G. Make sure the backup battery wires are well seated in the slot in the battery compartment and are not being pinched when the battery cover is on.

3. **Figure 4-H and 4-I.** Place the battery cover on the battery compartment and slide it evenly toward the front of the computer until it snaps in place.
4. Replace the rear cover.

BACKUP BATTERY □

REMOVE



REPLACE

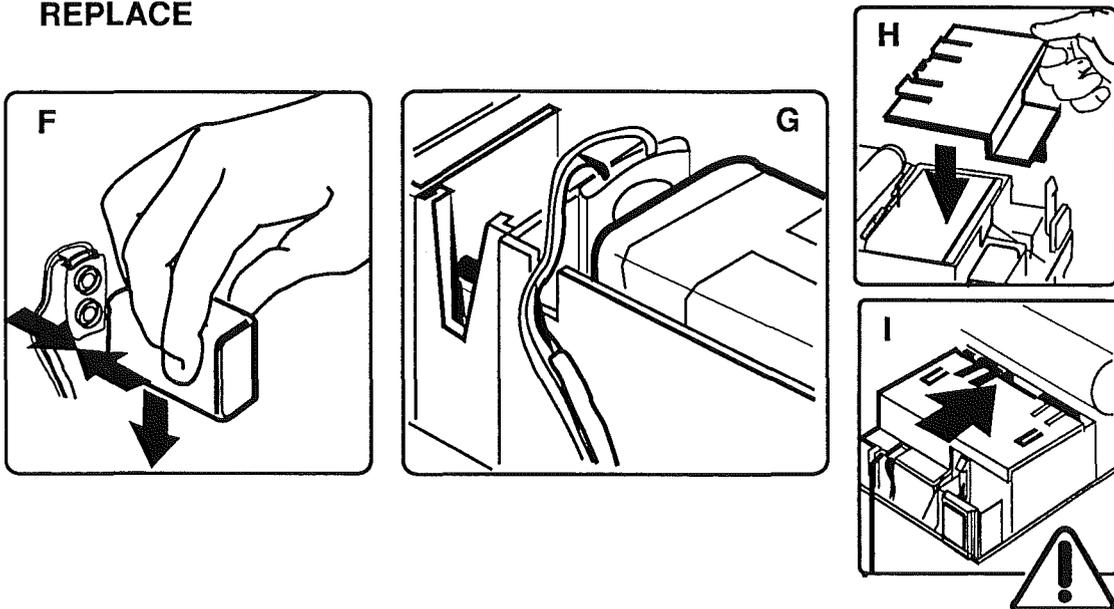


FIGURE 4

□ OPTION CARDS

Remove



1. Remove the rear cover and main battery.

CAUTION: Remember to replace the battery cover after removing the main battery and before you remove or replace any option cards. Failure to replace the battery cover can damage the computer.

2. **Figure 5-A.** Using the figure as a guide, locate the option card you wish to remove.
3. **Figure 5-B.** Lift the card straight up and out of the computer.

Note: To reduce the possibility of ESD damage, handle the card only by the edges.

Replace

1. **Figure 5-A.** Using the figure as a guide, determine which connector to install the option card in.
2. **Figure 5-C.** Position the option card over the correct connector and plug the card in.
3. Replace the main battery and rear cover.

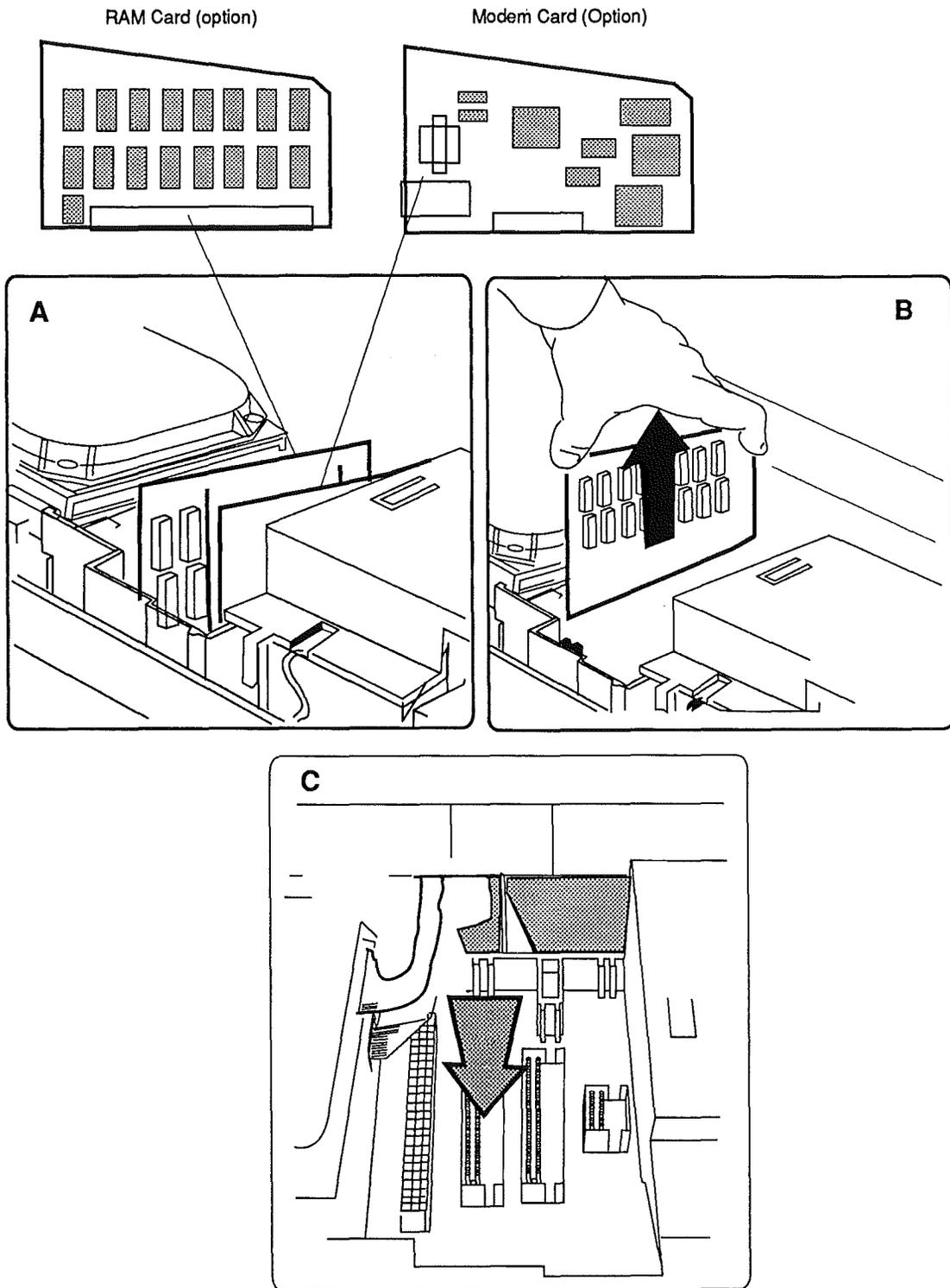


FIGURE 5

□ SCSI HARD DISK DRIVE

Remove

1. Remove the rear cover, main battery, and keyboard cover.

CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover or any modules. Failure to replace the battery cover can damage the computer.

2. Remove all option cards installed.
3. **Figures 6-A and 6-B.** Disconnect the display and hard disk drive cables from logic board connectors J19 and J18.
4. **Figure 6-C.** Close the display and slide the disk drive cable out toward the rear of the computer.
5. **Figure 6-D and 6-E.** Unsnap the plastic latches at the front and rear of the hard disk drive. Lift up and remove the hard disk from the subframe.

CAUTION: DO NOT loosen or remove any of the screws that attach the hard drive to the drive shield. Doing so can cause irreparable hard drive damage.

Replace

1. If the display is open, close it.
2. **Figure 6-F.** Lower the hard drive into the subframe, align the four metal tabs, and press down until the plastic latches at the front and rear snap in place.



CAUTION

CAUTION: Make sure the disk drive cable does not get caught under the disk drive shield. Otherwise, the cable could be damaged.

3. **Figure 6-G.** Slide the hard disk drive cable through the opening under the display assembly.
4. **Figure 6-H and 6-I.** Connect the hard drive cable and display cable to logic board connectors J18 and J19.
5. Replace any option cards removed.
6. Replace the keyboard cover, main battery, and rear cover.

SCSI HARD DISK DRIVE □

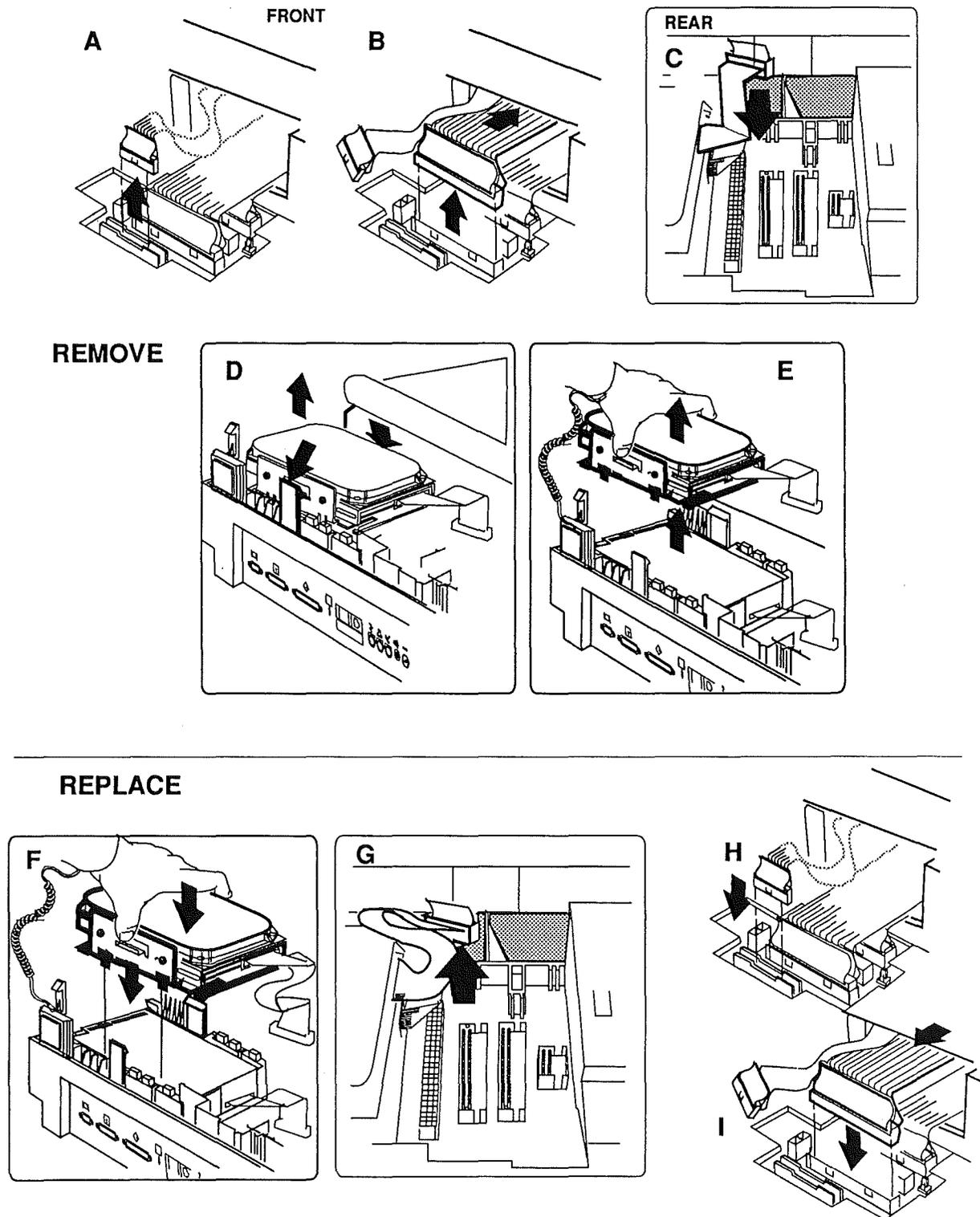


FIGURE 6

□ UPPER FLOPPY DISK DRIVE

Remove



1. Remove the rear cover and main battery.

CAUTION: Remember to replace the battery cover after removing the main battery and before you remove any modules. Failure to replace the battery cover can damage the computer.

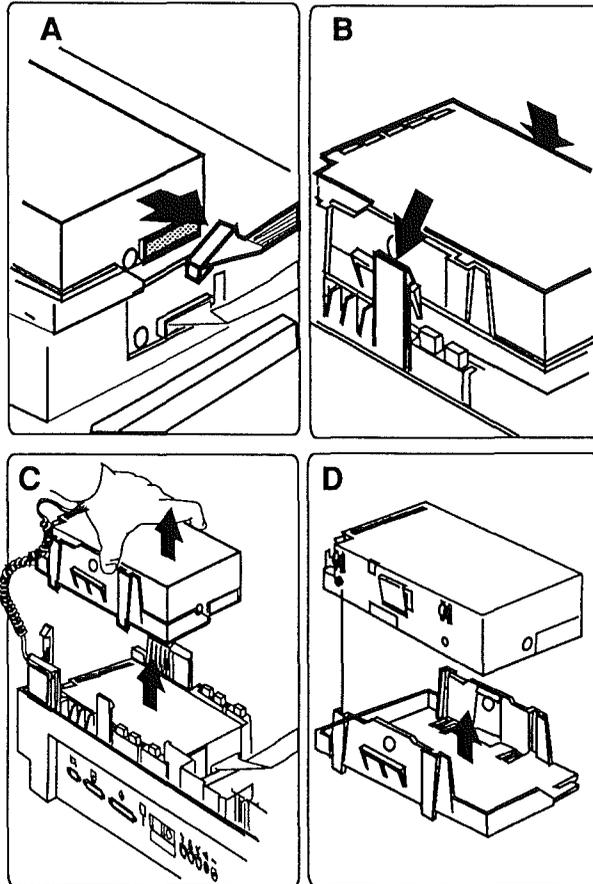
2. Remove any option cards installed.
3. **Figure 7-A.** Disconnect the floppy disk drive cable from the disk drive.
4. **Figure 7-B and 7-C.** Unsnap the plastic latches at the front and rear of the disk drive and lift up and remove the disk drive.
5. **Figure 7-D.** Remove the floppy drive mechanism from the floppy retainer by depressing the two metal tabs at the sides of the unit.

Replace

1. **Figure 7-E.** Place the floppy drive mechanism into the floppy retainer.
2. **Figure 7-F.** Lower the disk drive into the subframe, align the four metal tabs, and press down until the plastic latches at the front and rear snap in place.
3. **Figure 7-G.** Connect the floppy disk drive cable to the disk drive.
4. Replace any option cards removed.
5. Replace the main battery and rear cover.

UPPER FLOPPY DISK DRIVE □

REMOVE



REPLACE

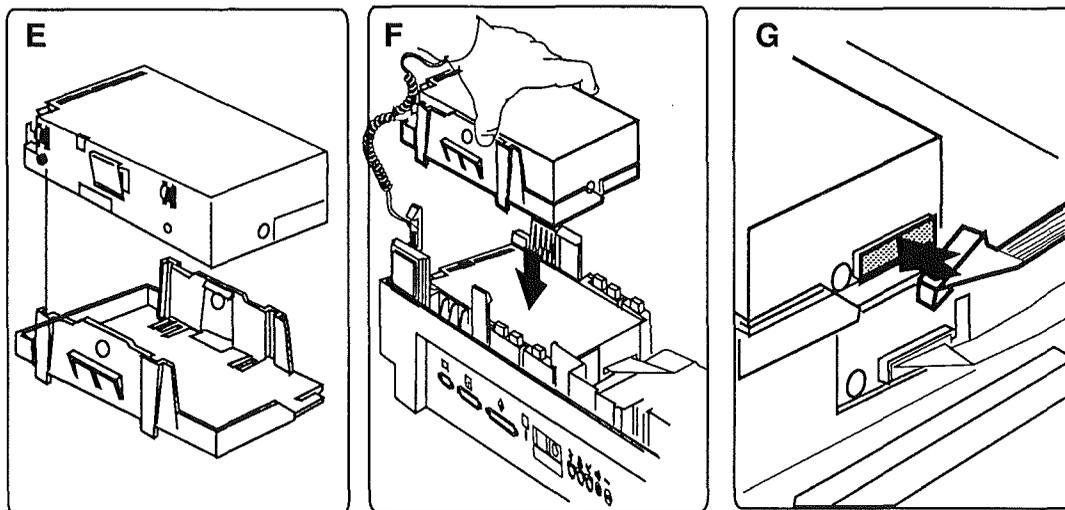


FIGURE 7

□ LOWER FLOPPY DISK DRIVE

Remove



1. Remove the rear cover and main battery.

CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover or any modules. Failure to replace the battery cover can damage the computer.

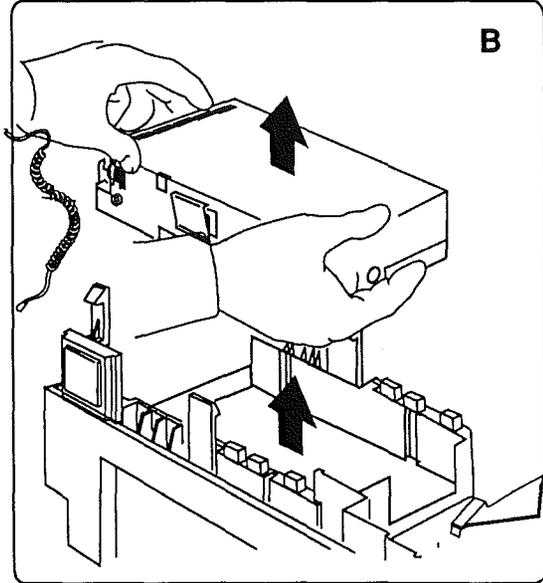
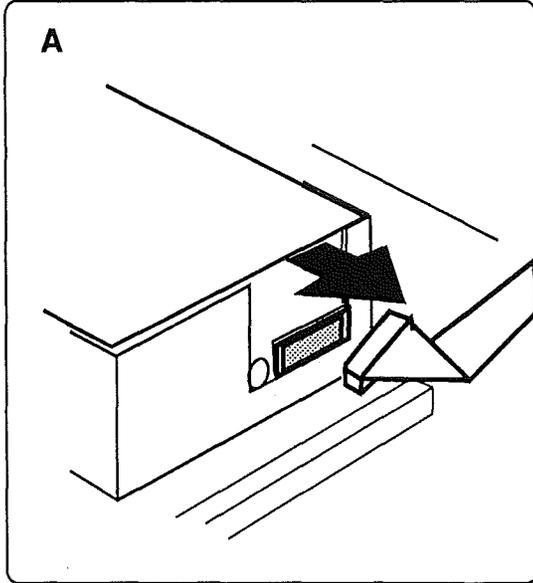
2. Remove any option cards installed.
3. Remove the upper floppy disk drive or SCSI hard disk, if installed.
4. **Figure 8-A.** Disconnect the disk drive cable from the disk drive.
5. **Figure 8-B.** Lift the disk drive up and out of the subframe.

Replace

1. **Figure 8-C.** Place the disk drive in the subframe.
2. **Figure 8-D.** Connect the disk drive cable.
3. Replace the upper floppy disk drive or SCSI hard disk drive, if removed.
4. Replace any option cards removed.
5. Replace the main battery and rear cover.

LOWER FLOPPY DISK DRIVE □

REMOVE



REPLACE

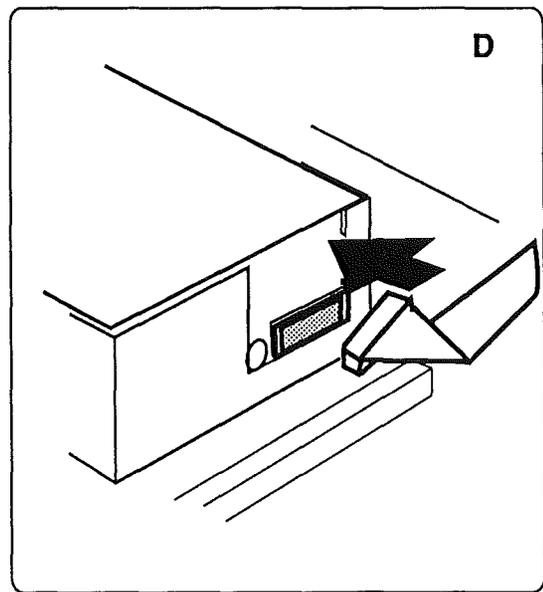
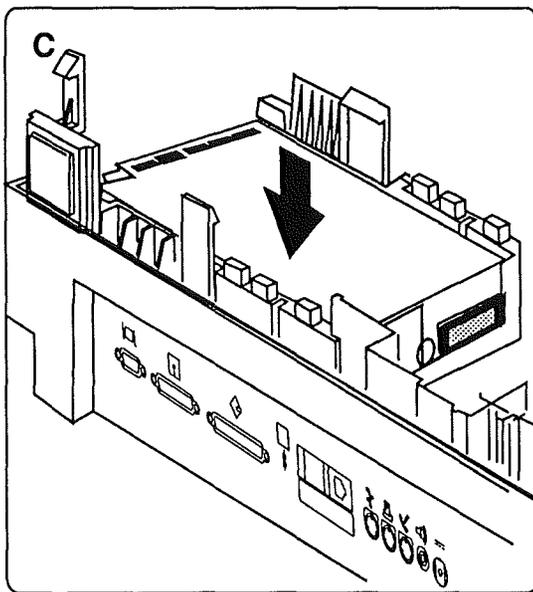


FIGURE 8

□ KEYBOARD, TRACKBALL, AND NUMERIC KEYPAD

The following procedures cover removing and replacing the keyboard, trackball, and optional numeric keypad. The procedures assume the standard configuration—keyboard on the right and trackball on the left. The system you're working on may have the devices reversed or may have a numeric keypad substituted for the trackball.

Remove



1. Remove the rear cover, main battery, and keyboard cover.

CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover or any modules. Failure to replace the battery cover can damage the computer.

2. **Figures 9-A1, 9-A2, and 9-A3.** Disconnect the flat cable from the device to be removed. The figures show the cable locations.
3. **Figures 9-B1, 9-B2, and 9B-3.** Starting at one side of the device, simultaneously press back on each plastic tab securing the device to the case and lift the device. The figures show the tab locations.
4. **Figures 9-C1, 9-C2, and 9-C3.** After all the tabs have been released, remove the device from the computer.

Replace

1. **Figures 9D-1, 9D-2, and 9D-3.** Place the front of the device in the guides at the front of the computer. Press down the rear of the device until it snaps in place.
2. **Figures 9E-1, 9E-2, and 9E-3.** Connect the flat cable to the device.
3. Replace the keyboard cover, main battery, and rear cover.

KEYBOARD, TRACKBALL, AND NUMERIC KEYPAD □

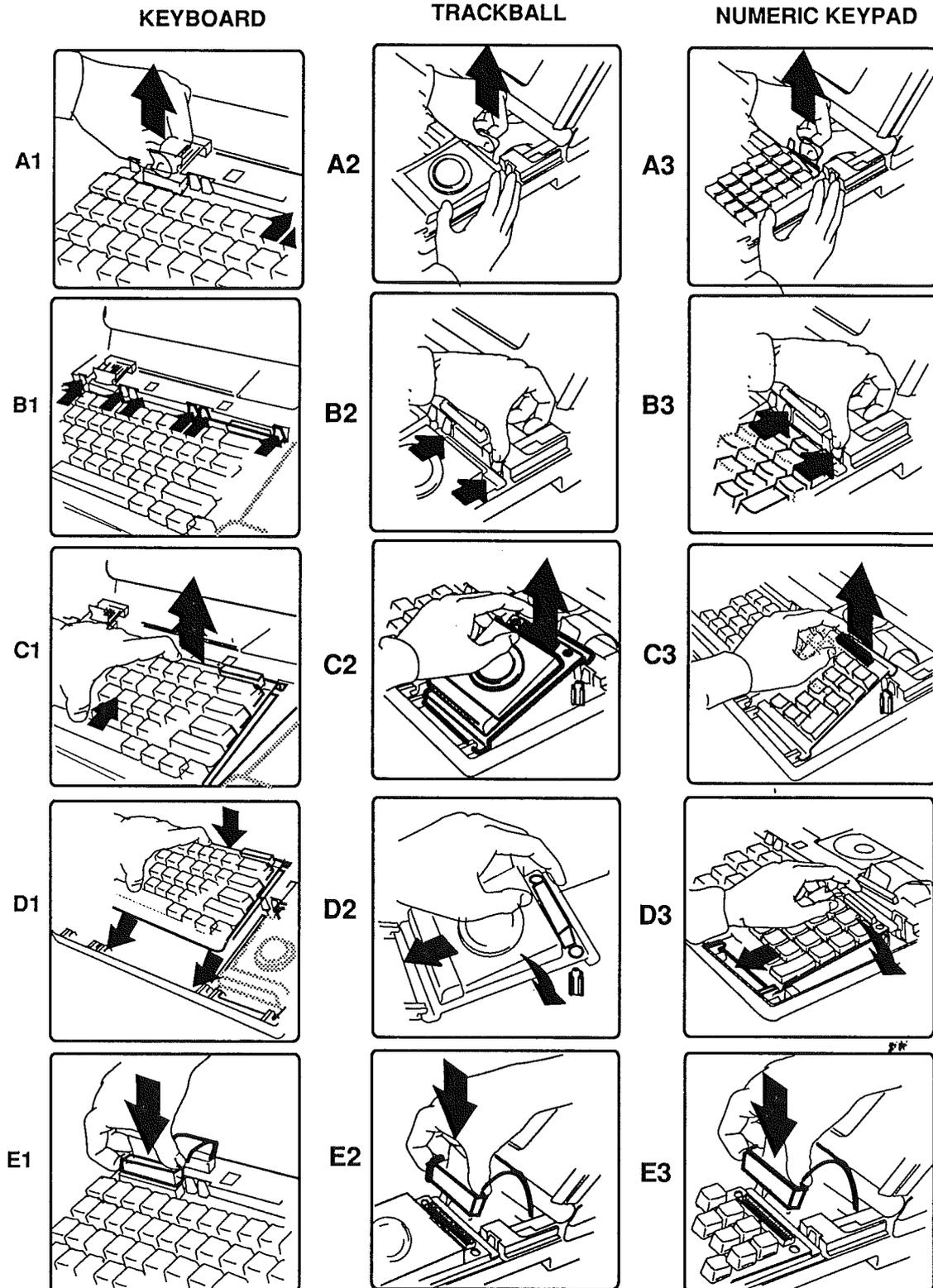


FIGURE 9

□ SPEAKER

Remove



1. Remove the rear cover, main battery, and keyboard cover.

CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover or any modules. Failure to replace the battery cover can damage the computer.

2. **Figure 10-A.** Disconnect the speaker cable from logic board connector J16.
3. **Figure 10-A.** Simultaneously press the two plastic tabs away from the speaker and lift the speaker from the subframe.

Replace

1. **Figure 10-B.** Place the speaker in position over its four positioning posts and snap the speaker in place.
2. **Figure 10-C.** Connect the speaker cable to logic board connector J16.
3. Replace the keyboard cover, main battery, and rear cover.

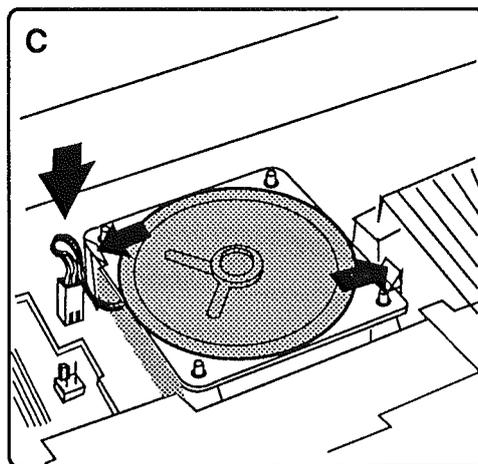
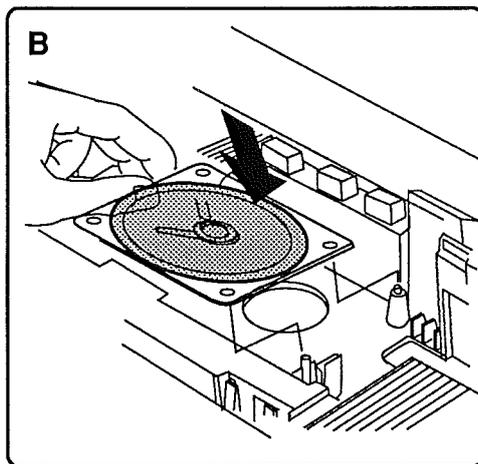
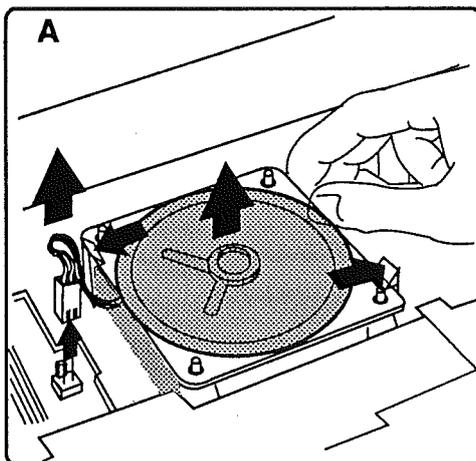


FIGURE 10

□ DISPLAY ASSEMBLY

Remove



1. Remove the rear cover, main battery, and keyboard cover.

CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover or any modules. Failure to replace the battery cover can damage the computer.

2. **Figure 11-A.** Disconnect the display cable from logic board connector J19.
3. **Figure 11-B.** Remove the left clutch cover by simultaneously gently twisting the cover back and forth and pulling the cover away from the display.
4. **Figure 11-C.** Lift up and remove the left clutch retainer.
5. **Figure 11-D.** Place your hands on either side of the display assembly. Push the display assembly to the left with your right hand while maintaining a slight pressure on the display with your left.
6. **Figure 11-E.** Remove the left clutch mechanism from the display.
7. Slide the display assembly up and to the left and disengage it from the right clutch mechanism.

DISPLAY ASSEMBLY □

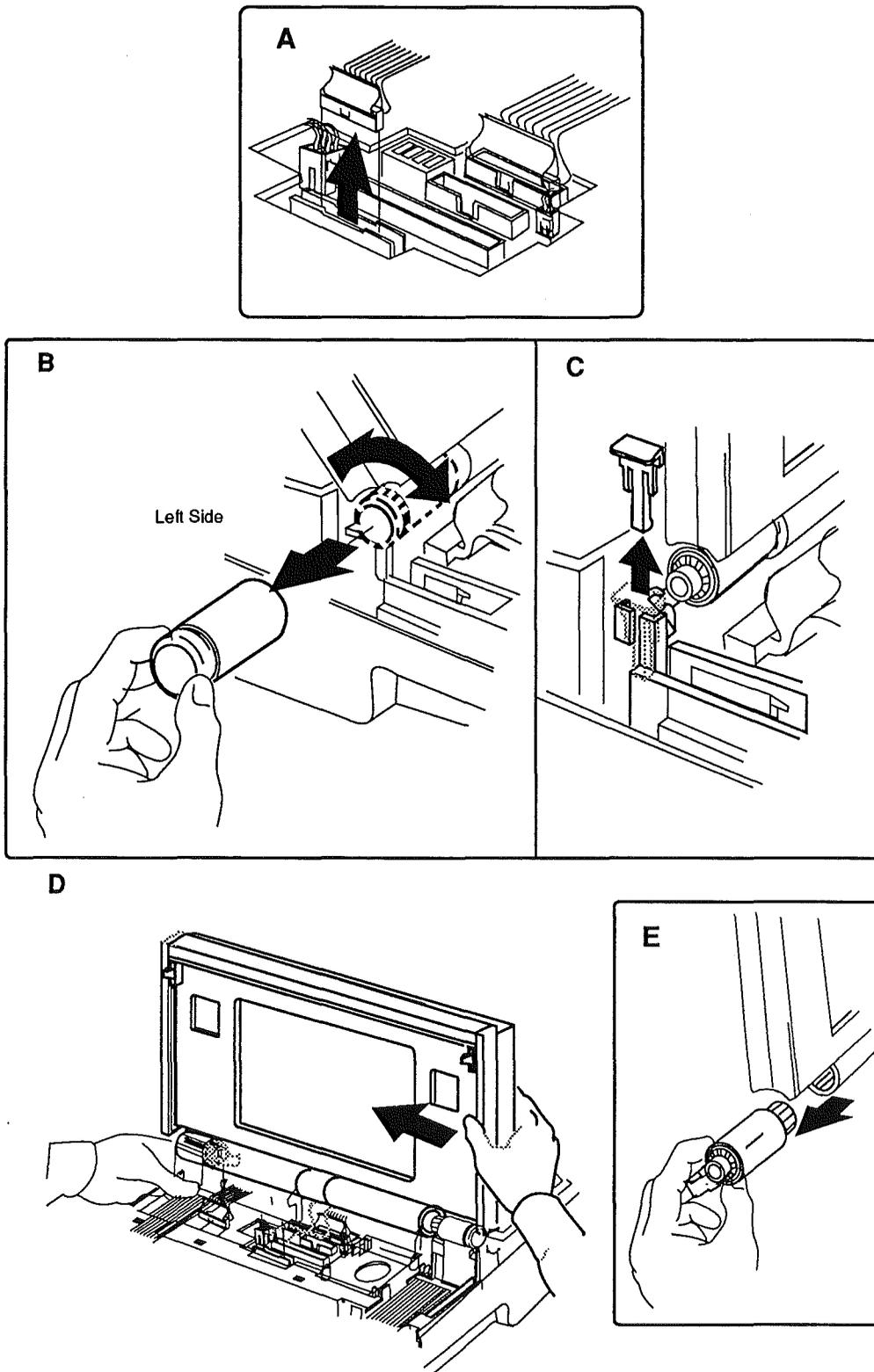


FIGURE 11

□ DISPLAY ASSEMBLY

Replace

1. **Figure 12-A.** Hold the display assembly upright and slide the assembly onto the right clutch mechanism. Note that the ridges in the clutch must mate with the grooves in the display housing.

Note: Make sure the display cable is to the right of the subframe upright.

2. **Figure 12-B.** While still holding the display assembly upright, slide the left clutch mechanism into place. Again the ridges in the clutch must mate with the grooves in the housing.
3. **Figure 12-C.** Slide the left clutch retainer into position.
4. **Figure 12-D.** Replace the left clutch cover.
5. **Figure 12-E.** Connect the display cable to logic board connector J19.
6. Replace the keyboard cover, main battery, and rear cover.

DISPLAY ASSEMBLY □

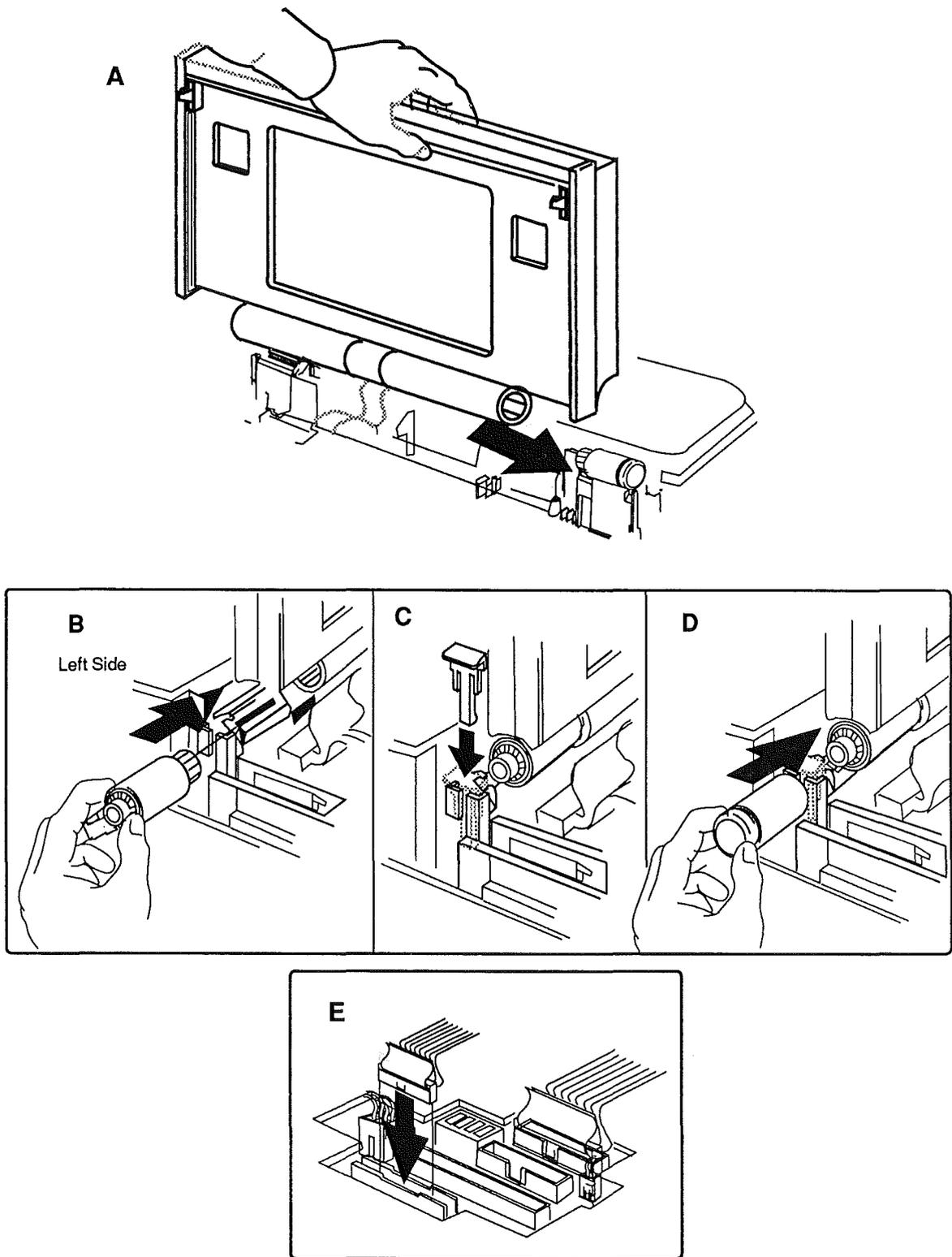


FIGURE 12

□ LCD DISPLAY



CAUTION: *The LCD display is extremely susceptible to ESD damage. As is always the case, make sure you are using a grounded workstation pad and grounding wriststrap when handling sensitive electronics. Handle the display only by the edges and DO NOT touch the component side or remove any of the tape.*

Remove



1. Remove the rear cover, main battery, keyboard cover, and display assembly.

CAUTION: *Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover or any modules. Failure to replace the battery cover can damage the computer.*

2. Place the display assembly on the workstation pad, display side up.
3. **Figure 13-A.** Remove the center pivot cover by turning the opening of the cover toward the display and then pulling the cover away from the display housing.
4. **Figure 13-B.** Slide the carrying handle to its fully extended position.
5. **Figure 13-C and 13-D.** Release the right side of the display bezel by inserting the jeweler's screwdriver into the display latch opening on the left side of the display housing as shown in Figure 13-D. Hold the screwdriver with your right hand. Push the screwdriver into the opening until you hear a click.
6. **Figure 13-C.** Place your left hand on the display as shown in the illustration. Simultaneously pull the display bezel toward you with your index and middle fingers while pushing the display housing away with your thumb. The two parts separate about 1/8 inch.
7. Repeat step 6 for the left side. This time, however, hold the screwdriver with your left hand and move the display bezel and housing with your right.

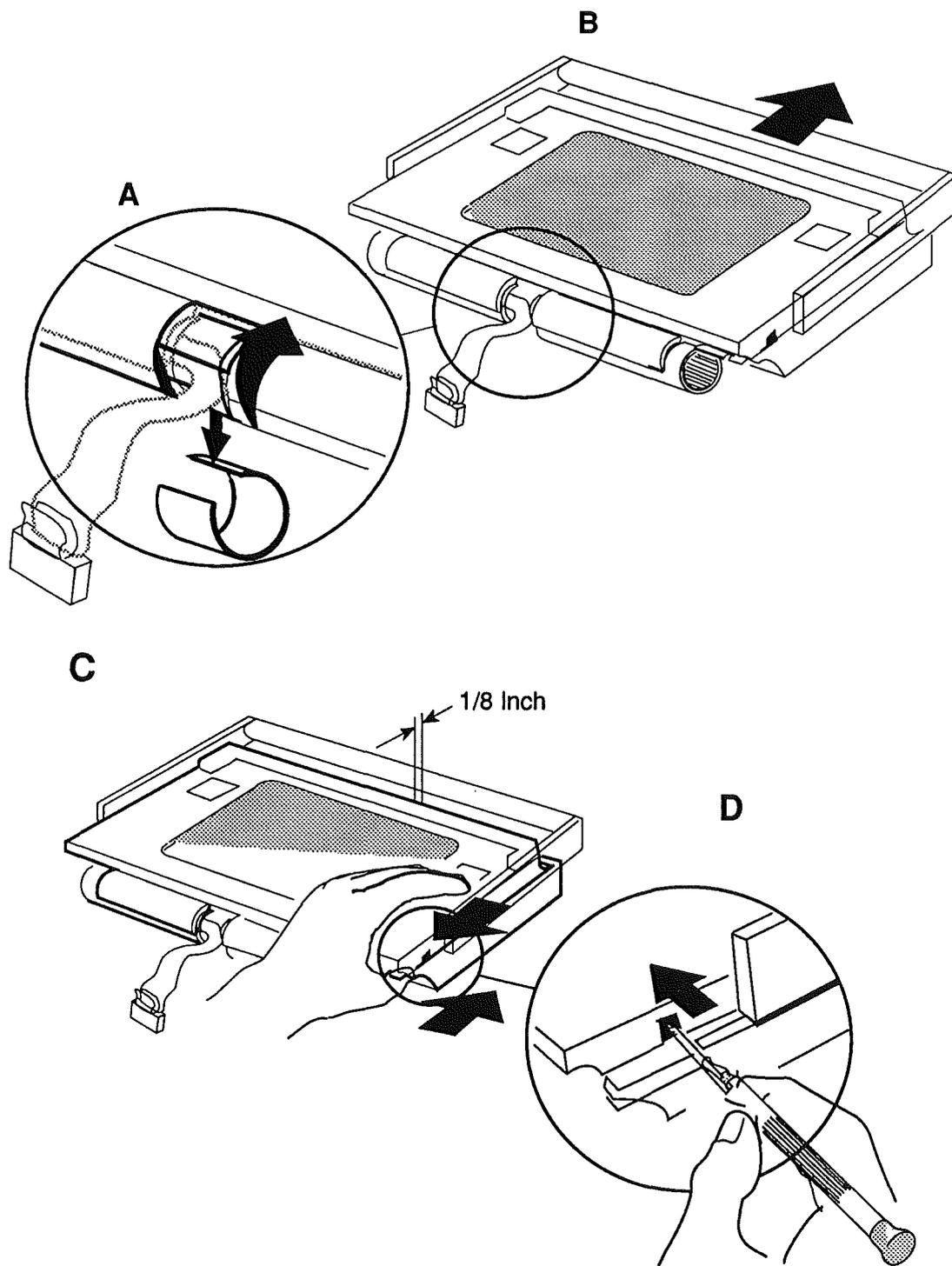


FIGURE 13

□ LCD DISPLAY

8. **Figure 14-A.** Lift the display bezel off the display housing.
9. **Figure 14-B.** Remove the carrying handle from the display housing.
10. **Figure 14-C.** With your thumbs, pull on the two plastic clips at the upper left and right sides of the display. Lift up the display with your index fingers.
11. **Figure 14-D.** Slide the display up and out of the housing.
12. **Figure 14-E.** Disconnect the display cable.

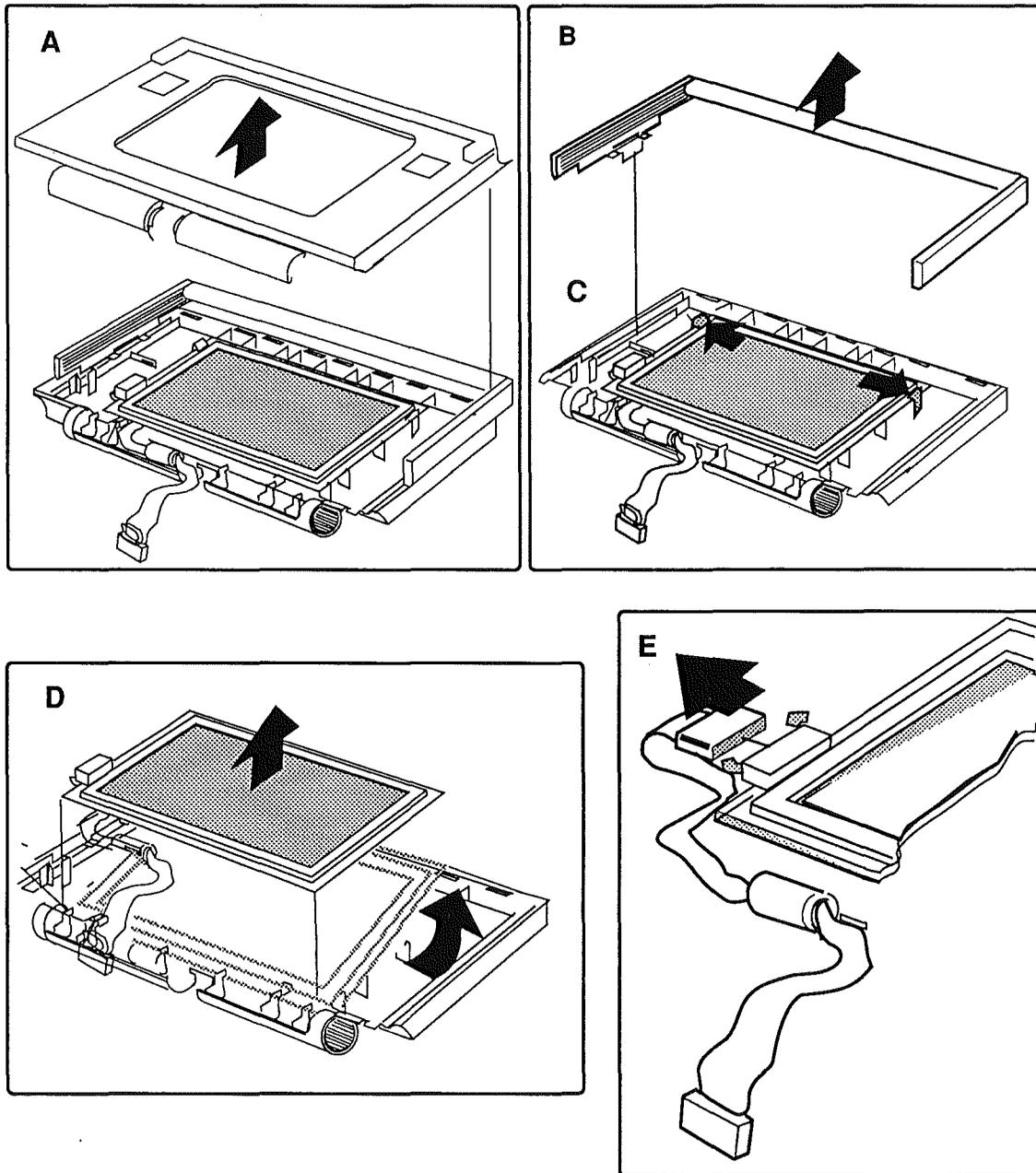


FIGURE 14

□ LCD DISPLAY

Replace

1. **Figure 15-A.** Connect the display cable to the display.
2. **Figure 15-B1.** Place the bottom edge of the display into the two plastic clips at the bottom of the display housing.

Note: Figure 15-B2. Make sure the display cable is placed as shown. The cable must lie flat under the display, and the cable and ferrite bead must be carefully placed in the channel.

3. Peel the protective plastic sheet from the display.
4. **Figure 15-B3.** Press down on the corners of the display with your thumbs until it snaps in place.
5. **Figures 15-C1.** Place the carrying handle in position in the display housing. The plastic clips should be in the channel at the edge of the housing..
6. **Figure 15-C2.** Place the display bezel on the housing as shown in the illustration. You'll need to hold the carrying handle in position while you do this.
7. **Figure 15-D.** Slide the bezel evenly toward the top of the housing as shown in the illustration.
8. **Figure 15-E.** Snap the center pivot cover back on the display pivot as shown in the illustration.
9. Replace the display assembly, keyboard cover, main battery, and rear cover.

LCD DISPLAY □

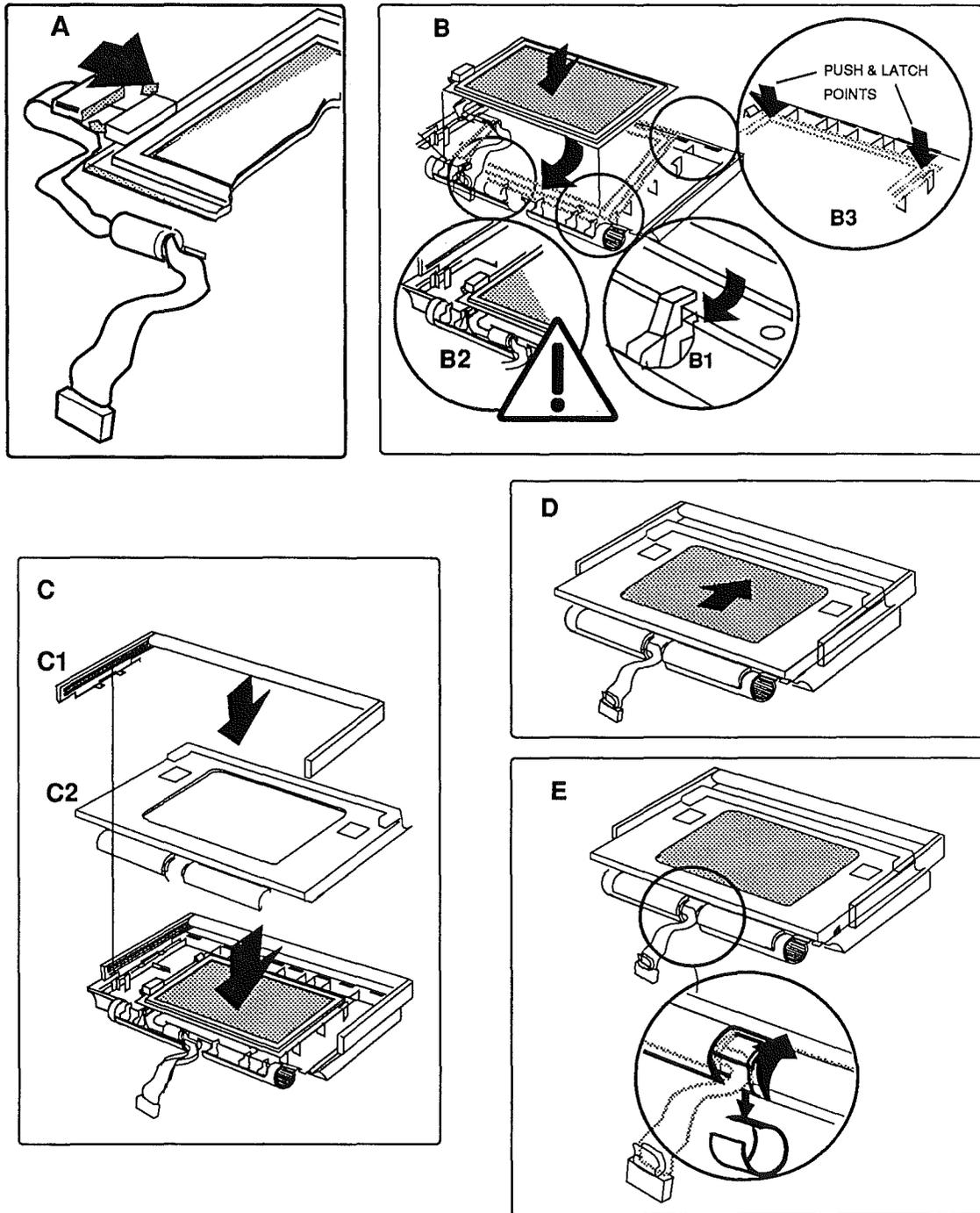


FIGURE 15

□ LOGIC BOARD

Remove



1. Remove the rear cover, main battery, keyboard cover, display assembly, keyboard, and trackball or numeric keypad.

CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover or any modules. Failure to replace the battery cover can damage the computer.

2. Remove any option cards installed.
3. **Figure 16-A.** Using the illustration as a guide, disconnect the following cables from the logic board:
 - a) Input device cables, J13 (left side) and J20 (right side)
 - b) Battery cable, J17
 - c) SCSI hard disk drive cable (if present), J18
 - d) Lower floppy disk drive cable, J14
 - e) Upper floppy disk drive cable (if present), J15
 - f) Speaker cable, J16



CAUTION: While performing steps 4 and 5, be careful not to lift the subframe too far. Doing so will put excess strain on the subframe and logic board and could cause damage.

4. **Figure 16-B1.** Locate the left subframe latch. Using the flat-blade screwdriver, pull the clip away from the subframe. When the clip is released, lift the left side of the subframe.
5. **Figure 16-B2.** While holding the left side of the subframe up—far enough to keep it from being held by the plastic clip—press on the clip at the right front of the subframe. Press the clip in far enough to release it. You can now lift the subframe a little farther.
6. **Figure 16-B3.** Use the flat-blade screwdriver to release the plastic clip at the right side of the subframe.

LOGIC BOARD □

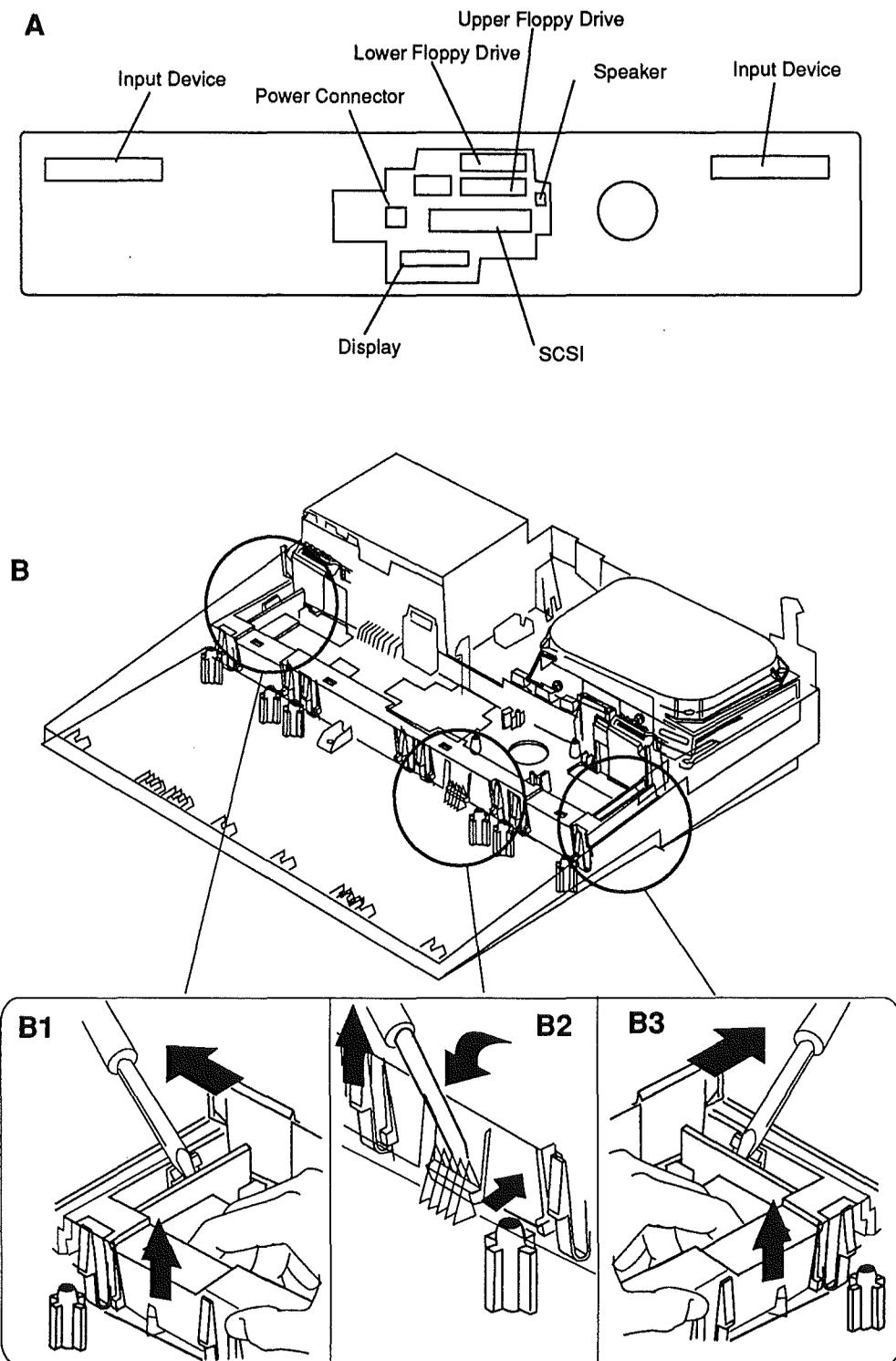


FIGURE 16

□ LOGIC BOARD

7. **Figure 17-A.** Lift up the front of the subframe and pull it toward you to remove it from the bottom case.
8. Place the subframe assembly upside-down on your grounded workstation pad.
9. **Figure 17-B.** Release each of the plastic clips securing the logic board to the subframe. As you release each clip, gently lift the logic board and proceed to the next clip. Release the clips in the order shown in the illustration.
10. Remove the logic board from the subframe.

LOGIC BOARD □

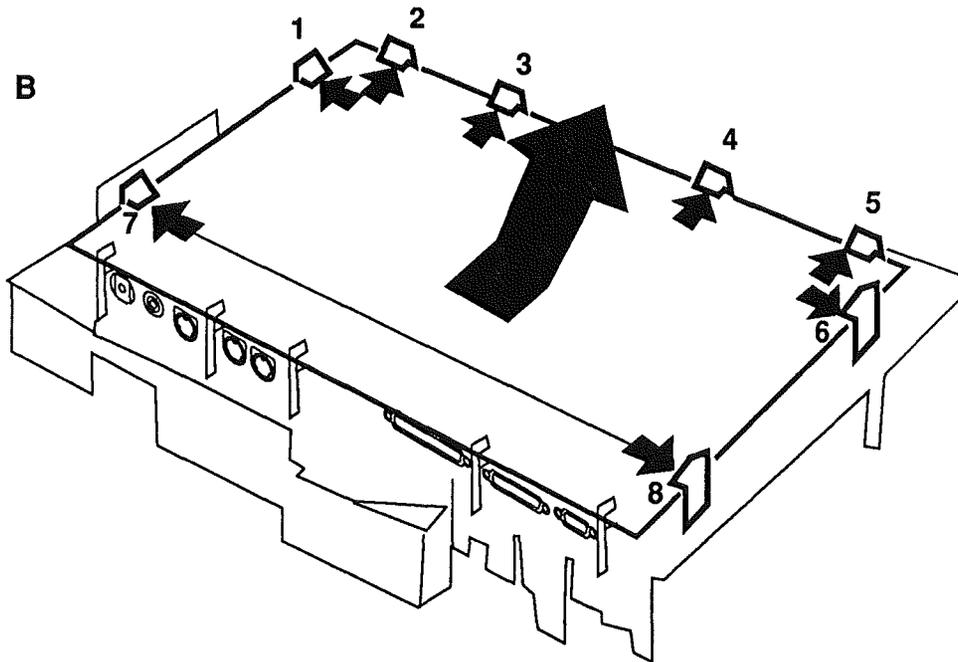
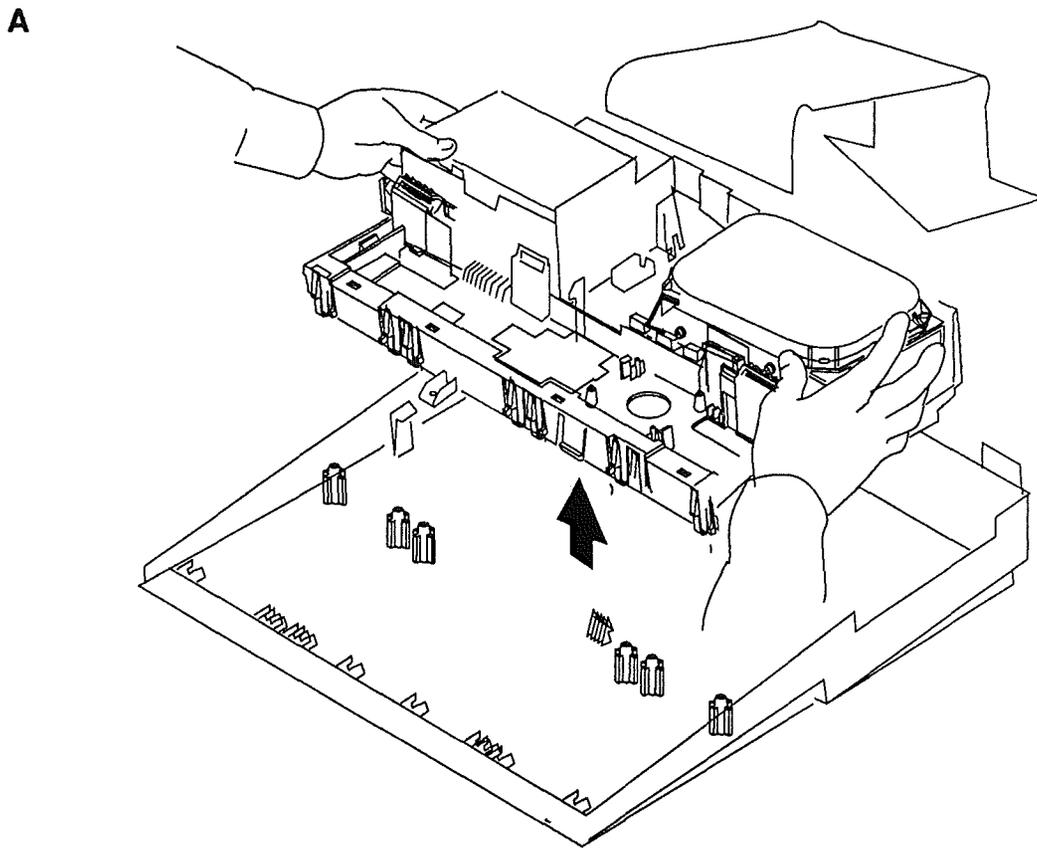


FIGURE 17

□ LOGIC BOARD

Replace

1. **Figure 18-A.** Holding the logic board at an angle, place the rear edge of the logic board into the plastic clips at the back of the subframe.
2. **Figure 18-A.** Lower the front of the logic board into the subframe and gently but firmly press the board into each plastic clip in the order shown in the illustration.
3. **Figure 18-B.** Place the subframe in position in the bottom case.
4. **Figure 18-C.** Press down on the subframe as shown in the illustration until the three plastic clips snap in place.
5. **Figure 18-D.** Using the illustration as a guide, connect the following cables to the logic board:
 - a) Input device cables, J13 (left side) and J20 (right side)
 - b) Battery cable, J17
 - c) SCSI hard disk drive cable (if present), J18
 - d) Lower floppy disk drive cable, J14
 - e) Upper floppy disk drive cable (if present), J15
 - f) Speaker cable, J16
6. Replace any option cards removed.
7. Replace the display assembly, keyboard, trackball/numeric keypad, keyboard cover, main battery, and rear cover.

LOGIC BOARD □

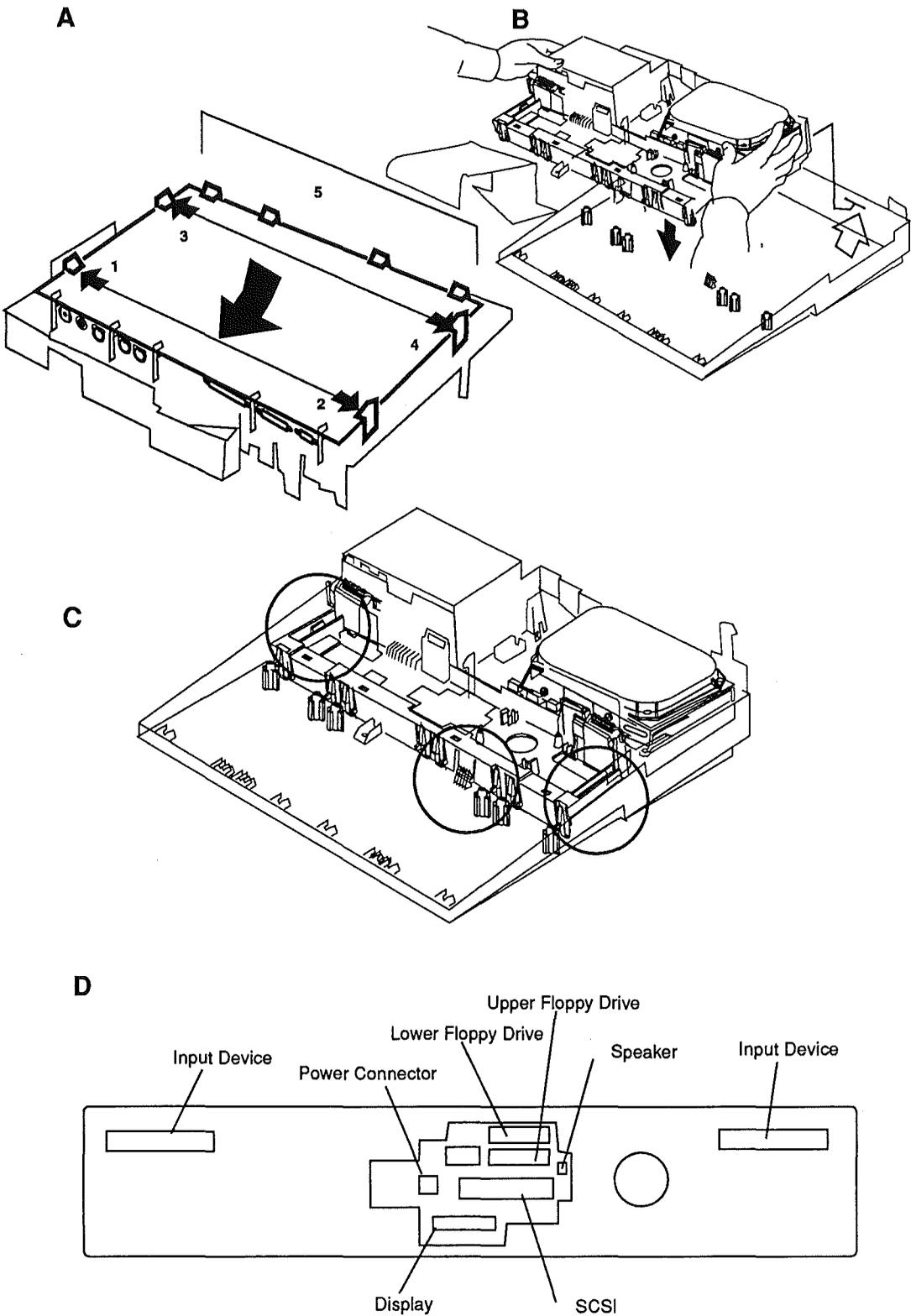


FIGURE 18



Macintosh Portable

Section 3 – Diagnostics

□ CONTENTS

3.2	Introduction
3.2	MacTest (Local)
3.3	AppleCAT (Remote)
3.4	Running the Tests from a Hard Disk
3.4	Using AppleCAT/MacTest Portable
3.4	Materials Required
3.4	MacTest Setup
3.6	AppleCAT Setup
3.8	Test Selections
3.10	Looping
3.11	Configuration
3.11	As the Tests Are Running
3.13	AppleCAT/MacTest Portable Menus and Keyboard Equivalents

□ INTRODUCTION

The *AppleCAT*[®]/*MacTest*[™] *Portable* diagnostic program is an integrated version of the separate MacTest and AppleCAT diagnostic programs available for the Macintosh SE and Macintosh II family of computers. These programs have been combined to provide a faster and easier method of diagnosing faults and confirming repairs. New features include greater control over which diagnostic tests are run and a **Test Log** (that can be saved or printed) indicating the tests run, the results of each test, and any modules that require replacement.

AppleCAT/MacTest Portable tests the following modules:

- Logic board
- LCD display
- Lower, upper, and external floppy disk drives
- Speaker
- Expansion RAM card

AppleCAT/MacTest Portable does not test hard disk drives. To test a hard disk, use the *Hard Disk Test* disk. Procedures for using *Hard Disk Test* can be found in Section 3, Diagnostics, in *SCSI Hard Disk Drives Technical Procedures*.

MacTest (Local)

When run on the computer being tested, *AppleCAT/MacTest Portable* functions as a pass/fail confidence test. This process, called MacTest (local) mode, is similar to the stand-alone version of MacTest for other Macintosh computers. Running the program locally requires the LCD display, one floppy disk drive, the trackball or mouse, and much of the logic board circuitry to be functioning. Therefore, it is recommended that *AppleCAT/MacTest Portable* in MacTest mode be used mainly for verifying the operation of the Portable after a repair or for checking a suspect system.

As *AppleCAT/MacTest Portable* progresses, messages on the screen indicate the test being performed and the results. When a failure is detected, the test stops and the failed module is indicated. The Test Log appears on the screen and can be printed or saved to disk for future reference.

AppleCAT (Remote)

When the Macintosh Portable is not able to boot or the LCD display is not working, it is helpful to have another computer look "inside" and see what's wrong. This look inside is done by running *AppleCAT/MacTest Portable* on a known-good Macintosh. This process, called AppleCAT (remote) mode, is similar to the stand-alone version of AppleCAT for other Macintosh computers. The known-good Macintosh (the test station) and the malfunctioning Portable (unit under test or UUT) are connected by their modem ports via a standard Apple peripheral-8 serial cable. The test station performs the following functions:

- Calls tests in the UUT ROM
- Downloads tests to the UUT
- Displays test results
- Identifies defective modules
- Produces a Test Log that can be saved or printed
- Displays the ROM checksum, amount of memory installed, power manager version, system voltage, and whether the power adapter is connected

With *AppleCAT/MacTest Portable* in AppleCAT mode, the unit under test does not have to be fully operational. By using a separate, known-good computer to do the diagnosis, *AppleCAT/MacTest Portable* depends very little on the unit under test (UUT). Using another computer is more reliable and thorough than MacTest mode and other traditional diagnostic methods.

As *AppleCAT/MacTest Portable* progresses, messages on the screen indicate the test being performed and the results. When a failure is detected, the test stops and the failed module is indicated. The Test Log appears on the screen and can be printed or saved to disk for future reference.

□ INTRODUCTION

Running the Tests from a Hard Disk

AppleCAT/MacTest Portable can be run from a hard disk attached to the test station when operating in AppleCAT mode. If a Macintosh Portable or IICI is being used as a test station, the hard disk must contain version 6.0.4 or later of Macintosh System software. The Macintosh Plus, SE, II, and IIX require version 6.0.2 or later. The Macintosh SE/30 requires version 6.0.3 or later.

□ USING APPLECAT/MACTEST PORTABLE

Materials Required

AppleCAT/MacTest Portable diagnostic disk (backup)
Peripheral-8 serial interface cable
Blank 800K floppy disk (required for floppy drive tests)
Blank 1.4 MB floppy disk (required for floppy drive tests)

Note: Use the Finder to make a backup copy of the *AppleCAT/MacTest Portable* diagnostic disk before you begin! When testing a defective Macintosh Portable, it is possible to damage or erase the disk.

The following additional materials are required if you are using AppleCAT (remote) mode:

Known-good Macintosh Plus, SE family, II family, or Portable computer (test station)
Mini DIN-8 serial loopback plug

MacTest Setup

1. **Figure 1.** Plug in the power adapter, if available, and connect it to the Portable.
2. **Figure 1.** Connect the serial interface cable between the modem and printer ports.
3. Perform a power manager reset by simultaneously depressing and then releasing the reset and interrupt switches.

USING APPLECAT/MACTEST PORTABLE □

4. Insert the diagnostic disk into an internal floppy disk drive and press any key except <Caps Lock> to bring the computer out of system sleep.
5. When the desktop appears, double-click on the AppleCAT/MacTest Portable disk icon to open the disk.
6. Double-click on the AppleCAT/MacTest Portable application icon. The diagnostic defaults to MacTest (local) mode.
7. Proceed to the "Test Selections" section.

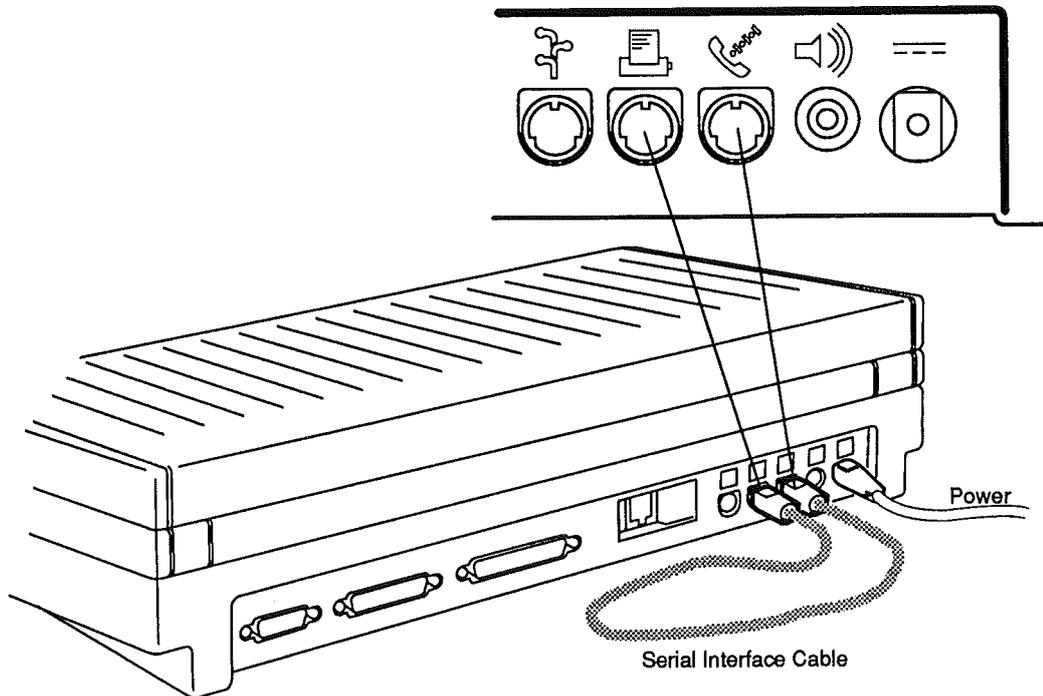


FIGURE 1

□ USING APPLECAT/MACTEST PORTABLE

AppleCAT Setup

1. Place the Portable to be tested next to the test station.
2. **Figure 2.** Plug in the power adapter and connect it to the Portable.
3. **Figure 2.** Connect one end of the serial interface cable to the modem port on the Portable to be tested (UUT).
4. **Figure 2.** Connect the other end of the serial interface cable to the modem port on the test station.
5. Connect the serial loopback plug to the printer port on the UUT.
6. Perform a power manager reset by simultaneously depressing and then releasing the reset and interrupt switches.
7. Press any key except <Caps Lock> to bring the computer out of system sleep.
8. When the arrow cursor appears, press the interrupt switch to place the Portable in test mode. The Portable must be in test mode to establish communications with the test station.
9. Insert the diagnostic disk into any available disk drive attached to the test station.
10. Turn on the test station.
11. When the desktop appears, double-click on the *AppleCAT/MacTest Portable* disk icon to open the disk.
12. Double-click on the *AppleCAT/MacTest Portable* application icon.
13. If the diagnostic is being run on a Portable, select **AppleCAT (Remote)**.
14. Proceed to the "Test Selections" section.

USING APPLCAT/MACTEST PORTABLE □

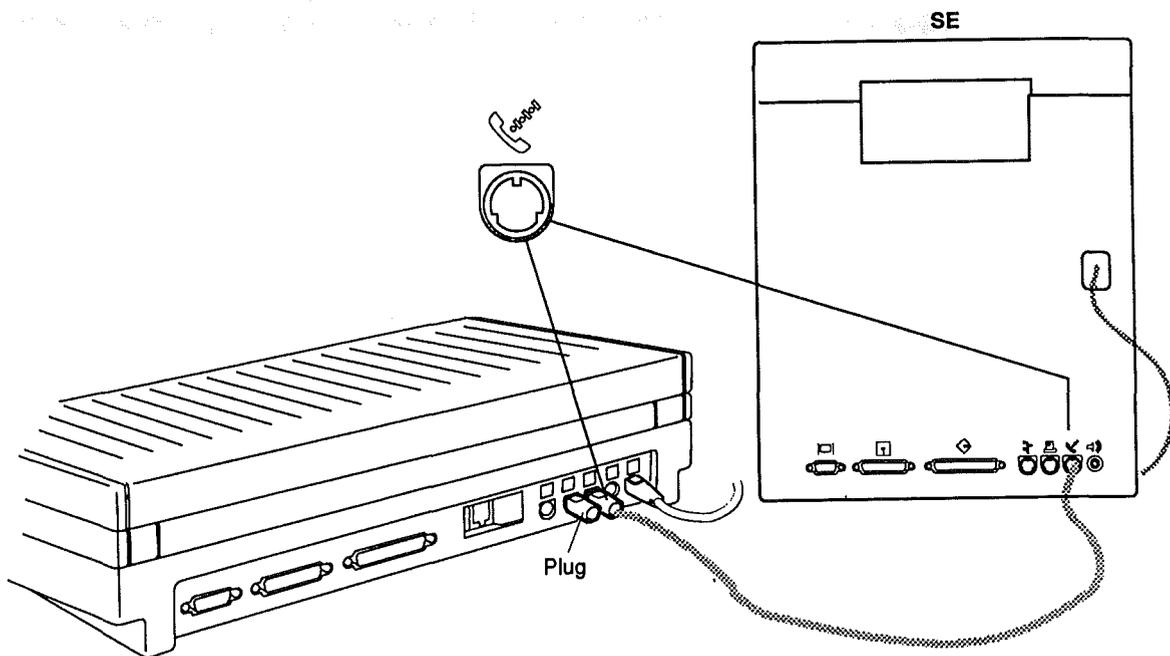


FIGURE 2

□ USING APPLECAT/MACTEST PORTABLE

Test Selections

Figure 3. Test Selections allows you to select the tests you wish to run. To select a test, click the box next to the name of the test to be run. An **X** appears in the box. To deselect the test, click the box again and the **X** disappears. When you have selected the tests to be run, press **<Return>** or click **Start Tests**. The tests are described below.

Configuration	Test Selections
Select one diagnostic: <input type="radio"/> MacTest (Local) <input checked="" type="radio"/> AppleCAT (Remote)	<input checked="" type="checkbox"/> Logic Board <input type="checkbox"/> Expansion RAM <input checked="" type="checkbox"/> Display <input checked="" type="checkbox"/> Speaker
ROM CheckSum: 96CA3846 Total Memory: 1M bytes PMGR version: 2B5 System Voltage: 7.01 Volts Charger: Connected	<input checked="" type="checkbox"/> Lower Drive <input type="checkbox"/> Upper Drive <input type="checkbox"/> External Drive
<input type="checkbox"/> Looping	<input type="button" value="Save Test Selections"/> <input type="button" value="Start Tests"/>

FIGURE 3

Logic Board

Performs a check of the following logic board circuitry:

- System ROM
- Video RAM
- System RAM (includes memory sizing and address and data line testing)
- Versatile Interface Adapter (VIA)
- Power Manager (PMGR)
- Serial Communications Controller (SCC)
- Apple Sound Chip (ASC)
- SCSI controller
- SWIM floppy disk controller
- Apple Desktop Bus interface

USING APPLECAT/MACTEST PORTABLE □

Note: An external loopback test is part of the SCC test. To perform this test, you must install a serial loopback plug on the printer port (AppleCAT mode) or a serial interface cable between the modem and printer ports (MacTest mode). If you run the logic board test without a loopback plug or serial cable installed, you will be given the option to skip the external SCC test. Skipping this test will not fully test the serial ports and is not recommended.

Expansion RAM

Tests the optional 1 MB Expansion RAM card if one is installed.

Note: If the Expansion RAM test is selected when no Expansion RAM card is installed, the diagnostic will report an Expansion RAM card failure.

Display

Displays the following series of patterns, which are useful in checking for LCD display problems:

- Crosshair – Used to spot pixel alignment problems.
- Diagonal Lines – Used to spot ghosting and pixel alignment problems.
- Black Screen (Half-contrast) – Used with the full-contrast Black Screen pattern to spot ghosting.
- Black Screen (Full-contrast) – See “Black Screen (Half-contrast).”
- White – Used with the Alternating Pattern to look for pixels that are stuck on.
- Alternating Pattern – Used to spot ghosting problems.

Speaker

Tests the Apple Sound Chip and sounds a series of eight tones at an increasing volume, followed by a C-scale to check the speaker.

□ USING APPLECAT/MACATEST PORTABLE

Lower Drive

Verifies the operation of the lower floppy disk drive. The drive is tested in GCR and low- and high-density MFM recording modes. The test requires blank 800K and 1.4 MB floppy disks. The disks do not need to be formatted.

Upper Drive

Verifies the operation of the upper floppy disk drive. The drive is tested in GCR and low- and high-density MFM recording modes. The test requires blank 800K and 1.4 MB floppy disks. The disks do not need to be formatted.

External Drive

Verifies the operation of an external Macintosh 800K, Apple 3.5 Drive, or Apple FDHD/SuperDrive™ floppy disk drive. The Apple SuperDrive is tested in GCR and low- and high-density MFM recording modes. The Macintosh 800K and Apple 3.5 drives are tested in GCR and low-density (800K) only. The test requires blank 800K and 1.4 MB (SuperDrive only) floppy disks. The disks do not need to be formatted.

Looping

Provides continuous running of all selected tests. To stop tests from running, click **Stop** or press <Command>-. (period).

Notes about looping:

- If disk drive looping is selected, no other tests, except another floppy drive test, can be selected.
- The display test cannot be looped since it requires pressing the mouse button to change test patterns.
- When looping on a disk drive test you must choose one type of media to loop on—either 800K or 1.4 MB.

Note: When looping on disk drive tests, the drive is not being completely tested since only one type of media is used.

USING APPLECAT/MACTEST PORTABLE

Configuration

AppleCAT/MacTest Portable displays a variety of information that can aid in troubleshooting.

- ROM Checksum – Used to determine the version of system ROM installed.
- Total Memory – Displays the total amount of system RAM installed. A minimum of 1 MB is installed on the Portable. The optional 1 MB Expansion RAM Card provides a total of 2 MB of RAM.
- PMGR Version – Displays the version of power manager microprocessor installed.
- System Voltage – Displays the voltage available to the Portable. If the power adapter is not connected the value displayed is equal to the main battery voltage. If the power adapter is connected, the reading is influenced by the higher voltage coming from the power adapter and is not a true battery reading.
- Charger – Indicates whether the power adapter is plugged in and connected to the computer.

As the Tests Are Running

While the program is running,

- The *Status Line* at the bottom of the window keeps you informed of the tests being performed and the test results.
- If the logic board test is selected and the serial loopback plug (AppleCAT) or serial cable (MacTest) is missing or improperly installed, testing will begin, but the test will stop and ask whether you want to skip the external loopback test. If you skip the external loopback test, the modem and printer port transceivers will not be tested. You should not skip this test.
- It is important to insert the requested low- or high-density disk. If the wrong disk is inserted, MacTest/AppleCAT will indicate that the disk drive is malfunctioning and should be replaced when it may not be malfunctioning.

□ USING APPLECAT/MACTEST PORTABLE

- You can stop testing by clicking **Stop** or **Pause** between tests:
 - Choose **Stop** to end testing and display the Test Log. Click **OK** to return to the Test Selections/Configurations window. Choose **Start** when you wish to begin the testing sequence again.
 - Choose **Pause** if you wish to discontinue testing temporarily. Choose **Continue** to resume the tests from the point of interruption. The program may ask you to re-insert the program disk so it can continue.

You may need click **Stop** or **Pause** several times before the program acknowledges the mouse click.

- If the test station fails to establish communication with the UUT (AppleCAT), you don't need to quit and restart the program. Selecting any of the items in the Illustrations menu will cause the program to try to establish communication again.
- Replace any module that the diagnostic indicates has failed. Removal and replacement procedures can be found in Section 2, Take-Apart.
- If all tests pass, the diagnostic displays the Test Log. The message **All selected test(s) passed** appears on the screen.
- If looping is selected, a counter displays the number of complete loops.

USING APPLECAT/MACTEST PORTABLE □

AppleCAT/MacTest Portable Menus and Keyboard Equivalents

AppleCAT/MacTest Portable has a number of features accessible using the menu bar and keyboard equivalents.

Apple Menu

The Apple (🍏) menu contains the following selection:

- **About Diagnostic** – Displays a dialog box containing the diagnostic name, version number, and release date.

File Menu

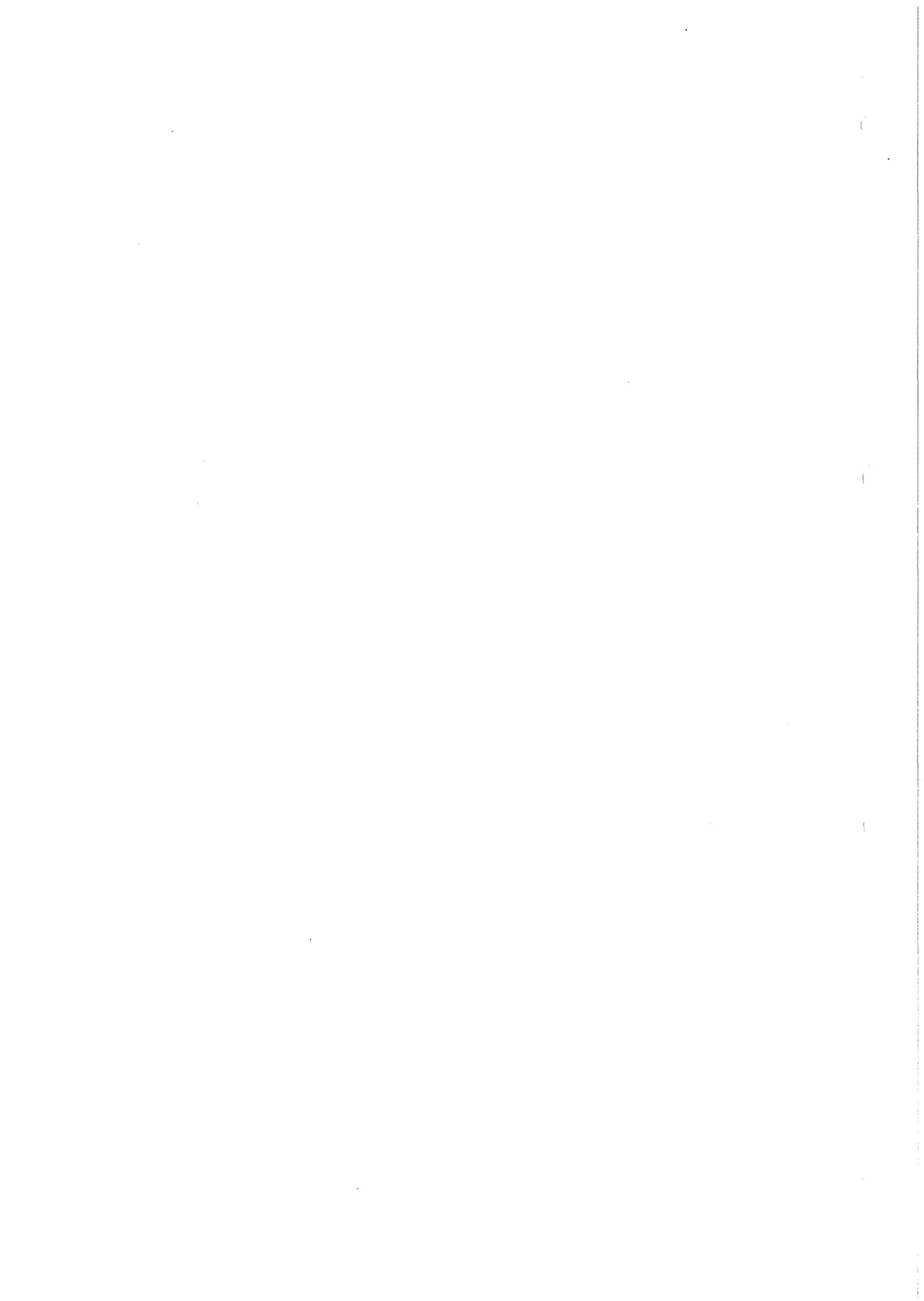
The File menu displays the following items:

- **Stop** (<Command>- ⌘) – Stops the diagnostic tests.
- **Quit** – Terminates the program and returns to the Finder (desktop).

Illustrations Menu

The Illustrations menu displays the following items:

- **Setup** – Displays instructions on setting up *AppleCAT/MacTest Portable*.
- **Expansion RAM** – Shows the location of the Expansion RAM card.
- **Main Battery** – Shows the location of the main battery.
- **Backup Battery** – Shows the location of the backup battery.



Macintosh Portable

Section 4 – Troubleshooting

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4.2	Before You Start
4.2	How to Use the Symptom Chart
4.2	How to Use the Troubleshooting Flowcharts
4.3	Things To Remember
4.4	Module Exchange Information
4.4	SCSI Hard Disk Drive
4.4	FDHD Floppy Disk Drive
4.4	LCD Display
4.5	Startup Chords
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4.6	Symptom Chart
4.6	Power Problems
4.7	Video Problems
4.8	Floppy Disk Drive Problems
4.8	SCSI Hard Disk Drive Problems
4.9	Peripheral Problems
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4.13	Troubleshooting Flowcharts
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Note: If a step is underlined, instructions for that step can be found in Section 2, Take-Apart.

□ INTRODUCTION

Before You Start

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

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 Portable are not listed in the symptom charts or if the system is not displaying a clearly defined problem, use the troubleshooting flowcharts.

How to Use the Troubleshooting Flowcharts

There are two numbered troubleshooting flowcharts for the Macintosh Portable computer. These flowcharts are useful in troubleshooting startup-related problems.

The troubleshooting flowcharts are designed to verify operation of the Macintosh Portable in its minimum configuration. Therefore, before using the troubleshooting flowcharts, remove any options installed and disconnect any external peripherals.

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

- Be sure to follow all electrostatic discharge precautions when working on the Macintosh Portable. Refer to the *You Oughta Know* tab in *Apple Service Technical Procedures* for additional information.
- To prevent possible damage to the computer, be sure to read the "Functional Overview" in Section 1, Basics prior to troubleshooting.
- Before you begin troubleshooting, remove all option cards and disconnect any external devices (printers, SCSI device, ADB devices, and disk drives).

After the Macintosh Portable is fully operational, each option card or peripheral should be installed and tested. Install one device and test the system before adding any others. Repeat the install-and-test process until all devices have been installed and tested.

- When running the *Hard Disk Test* diagnostic to test the hard disk, be sure to operate the computer from the power adapter and do not select looping.
- To ensure that customers get back the same system configuration that they bring in, record the following information before beginning:
 - Type and serial number of any option cards
 - Whether a SCSI hard disk or second FDHD floppy drive is installed
 - Position and types of input devices installed
- The Macintosh Portable requires System Software 6.0.4 or later. Earlier versions of system software do not support the Portable and may cause damage to the computer, reduce battery life, or cause a loss of data. If a system is installed with an earlier version, install the correct version and re-verify the failure **before** beginning troubleshooting. Many times problems that appear hardware related are actually caused by software. System software installation procedures are included in Section 1, Basics.

□ MODULE EXCHANGE INFORMATION

SCSI Hard Disk Drive

Do not attempt to remove the bracket attached to the SCSI hard disk drive. The four mounting screws are tightened at the factory to exact specifications. Tampering with these screws can cause loss of data or damage to the hard disk drive.

FDHD Floppy Disk Drive

The FDHD floppy disk drive module is shipped without the 20-pin flat cable. Be sure to keep the disk drive cable with the customer's system.

LCD Display

The LCD display module is shipped without the display cable. Be sure to keep the display cable with the customer's system.

STARTUP CHORDS □

Introduction

When any key except <Caps Lock> is pressed, the Macintosh Portable is either brought out of sleep mode or it begins a startup sequence, depending on whether the system was shut down or in system sleep. If the system was shut down, the computer begins a startup sequence. The system sounds a startup chord (tone), the screen goes to grey, ROM self-tests are executed, and the system looks for a startup device to load the Macintosh operating system from. If any part of the self-test fails, a sequence of chords sounds and the startup sequence aborts.

Startup Sequence

During a normal startup sequence, a medium-pitched chord sounds (the familiar tone that every Macintosh sounds when turned on); then a disk icon with a flashing question mark displays on the screen indicating the system is looking for a valid startup disk. If a hard disk is attached, powered on (if an external drive), and contains a valid system folder and boot tracks, then the system boots without displaying the question mark.

Error Chords

If a startup chord and additional chords sound, a failure has been detected during the system self-test. Three sequences (startup chord, error chord, and test monitor chord) play if an error is encountered during startup.

If any error chords sound during system startup, replace the logic board.

□ SYMPTOM CHART

Power Problems

Solutions

- *The screen is blank; computer not responding*
 1. If the computer is new, verify that the plastic sheet has been removed from between the battery and the contacts.
 2. Reset the power manager.
 3. Connect the power adapter and try the computer again in three or four minutes.
 4. Try a known-good, charged main battery. If the computer now works, replace the main battery.
 5. Verify that the keyboard cable is securely connected at both ends.
 6. Replace the keyboard.
 7. Replace the keyboard cable.
 8. Replace the logic board.

- *After removing the main battery, some Control Panel settings are different*
 1. Was the battery cover replaced with the main battery removed? If it was, power to the computer was interrupted and this is normal. Restore the contents of the Control Panel.
 2. Replace the backup battery.

- *Power adapter is plugged in and connected, but the battery DA does not indicate the charger is connected*
 1. Verify the charger is connected properly.
 2. Try a different main battery. If the battery now charges, replace the main battery.
 3. Replace the power adapter.
 4. Replace the logic board.

- *A low-power warning is displayed soon after starting to use the computer*
 1. The battery needs recharging. Attach the power adapter.
 2. Make sure peripherals being used display the low-power icon.
 3. Extensive use of floppy or hard disk, modem, sound, or other power-consuming device. Reduce usage of these devices or connect the power adapter.

SYMPTOM CHART □

Video Problems	Solutions
<ul style="list-style-type: none">• <i>Some pixels never come on (blacken); no pattern</i>	<ul style="list-style-type: none">– A maximum number of five permanently OFF pixels (voids) are considered acceptable. If the display contains six or more voids, <u>replace the LCD display.</u>
<ul style="list-style-type: none">• <i>Some pixels are always black; no pattern</i>	<ul style="list-style-type: none">– If any pixel remains on constantly, <u>replace the LCD display.</u>
<ul style="list-style-type: none">• <i>A row of pixels never blackens</i>	<ol style="list-style-type: none">1. <u>Replace the LCD display.</u>2. <u>Replace the display cable.</u>3. <u>Replace the logic board.</u>
<ul style="list-style-type: none">• <i>A row of pixels is always black (black streaks)</i>	<ol style="list-style-type: none">1. <u>Replace the LCD display.</u>2. <u>Replace the display cable.</u>3. <u>Replace the logic board.</u>
<ul style="list-style-type: none">• <i>No display, but the computer appears to be operating correctly</i>	<ol style="list-style-type: none">1. Verify that the display cable is securely connected.2. <u>Replace the LCD display.</u>3. <u>Replace the display cable.</u>4. <u>Replace the logic board.</u>
<ul style="list-style-type: none">• <i>The display looks blurred</i>	<ol style="list-style-type: none">1. Adjust the angle of the display.2. Adjust the screen contrast setting using the Control Panel.
<ul style="list-style-type: none">• <i>The display looks dark</i>	<ol style="list-style-type: none">1. Not enough light is available. Locate the computer closer to direct light or move light source closer to the computer.2. Adjust the screen contrast setting using the Control Panel.3. <u>Replace the LCD display.</u>4. <u>Replace the logic board.</u>
<ul style="list-style-type: none">• <i>The display is too light</i>	<ol style="list-style-type: none">1. Adjust the angle of the display.2. Adjust the screen contrast setting using the Control Panel.3. <u>Replace the LCD display.</u>

□ SYMPTOM CHART

Floppy Disk Drive Problems

Solutions

- *Audio and video present, but internal drive does not operate*
 1. Try a different floppy disk.
 2. Replace the floppy disk drive.
 3. Replace the floppy disk drive cable.
 4. Replace the logic board.

- *The disk ejects while booting; display shows Mac icon with blinking "X"*
 1. Try a known-good system disk.
 2. Replace the floppy disk drive.
 3. Replace the floppy disk drive cable.
 4. Replace the logic board.

- *Disk will not eject*
 1. Shut down the computer, press and hold down the trackball or mouse button, and switch on the computer.
 2. Eject the disk manually by pushing an opened paper clip into the hole in the bottom case located near the disk drive.
 3. Replace the floppy disk drive.
 4. Replace the floppy disk drive cable.
 5. Replace the logic board.

- *Disk initialization fails*
 1. Verify that Apple-certified media are being used.
 2. Try a different disk.
 3. Replace the floppy disk drive.
 4. Replace the logic board.

SCSI Hard Disk Drive Problems

Solutions

- *Internal hard disk will not operate*
 1. Verify that the SCSI hard drive cable is securely connected.
 2. Use HD SC Setup to see if the drive is visible. If it is, reinitialize the drive.
 3. Replace the hard disk drive.
 4. Replace the logic board.

Peripheral Problems
Solutions

- *After connecting an external SCSI device, the computer no longer boots*

 1. Turn on the external SCSI device before starting up the computer.
 2. Verify that proper cable termination is provided.
 3. Verify that no two SCSI devices have the same device address.
 4. Replace the logic board.

- *Cursor does not move when using the trackball*

 1. Reset the power manager.
 2. Check the cable connections between the trackball and the logic board.
 3. Replace the trackball cable.
 4. Replace the trackball.
 5. Replace the logic board.

- *Cursor intermittently does not move or moves erratically*

– Clean the trackball ball and internal rollers.

- *Cursor does not move when using the mouse*

 1. Check mouse connection to the ADB port.
 2. Reset the power manager.
 3. Clean the mouse ball and inside the mouse. (Procedures for cleaning the mouse are located in Cross Family Peripherals, Volume 1, *You Oughta Know.*)
 4. Replace the mouse.
 5. Replace the logic board.

- *Cursor moves, but clicking the button has no effect*

 1. If it's the trackball button that isn't working, replace the trackball cable. If it's the mouse button, replace the mouse.
 2. Replace the trackball.
 3. Replace the logic board.

...Continued on next page

□ SYMPTOM CHART

Peripheral Problems (continued)

Solutions

- *No response to any key on the keyboard*
 1. If the screen is blank and you are trying to bring the computer out of system sleep, try resetting the power manager.
 2. Check the keyboard connection to the logic board.
 3. Replace the keyboard.
 4. Replace the logic board.

- *Known-good ImageWriter, ImageWriter II, or LQ will not print*
 1. Make sure System 6.0.4 is being used.
 2. Make sure that the Chooser is set correctly.
 3. Replace the printer cable.
 4. Replace the logic board.

- *Known-good LaserWriter will not print*
 1. Make sure System 6.0.4 is being used.
 2. Make sure that the Chooser is set correctly.
 3. Try another printer. If that printer works, the computer is ok. Refer to the *Networks* tab in *Apple Service Technical Procedures* for further assistance.
 4. Replace the logic board.

- *Device connected to the modem port doesn't work*
 1. Verify that **External Modem** is selected in the Portable CDEV.
 2. Replace the logic board.

Internal Modem Problems

Solutions

- *Internal modem options do not appear in the Portable CDEV when the modem is installed*
 1. Try removing and reseating the card.
 2. Replace the modem card.
 3. Replace the logic board.

- *Modem does not respond properly to AT command set instructions*
 1. Verify that the baud rate and data format settings of the communications application are compatible with the Portable Data Modem 2400 and the remote modem.
 2. Replace the modem card.

Internal Modem Problems (continued)

Solutions

- *Modem interferes with system sound*
 - 1. Replace the modem card.
 - 2. Replace the logic board.

- *Modem does not respond to incoming call*
 - 1. If the system doesn't respond to an incoming call during sleep mode, verify that the **When Phone Rings** option in the Automatic Wake-up section of the Portable CDEV is selected.
 - 2. Replace the modem card.
 - 3. Replace the logic board.

- *Modem has no sound output*
 - Replace the modem card.

Miscellaneous Problems

Solutions

- *Screen goes blank and computer shuts down every few minutes*
 - The computer is going into system sleep to conserve battery power. If the computer is going into system sleep too often, adjust the sleep delays in the Control Panel or connect the power adapter.

- *Some applications seem to run slower after running for a few seconds*
 - Computer is switching to system rest. If system rest is interfering with the operation of an application, refer to Section 1, Basics, "System Software" for instructions to disable system rest.

- *The hard disk is slow to respond, or the screen goes blank too often*
 - The computer is powering down the hard disk or going into system sleep to conserve battery power. If the hard drive is shutting down or the system is going into system sleep too often, adjust the sleep delays in the Control Panel or connect the power adapter.

...Continued on next page

□ SYMPTOM CHART

Miscellaneous Problems (continued)

Solutions

- *No sound from speaker*
 1. Verify that the volume setting in the Control Panel is 1 or above.
 2. Check the speaker connection to the logic board.
 3. Replace the speaker.
 4. Replace the logic board.

- *Screen suddenly goes blank*
 - The computer has gone into system sleep to conserve battery power.

TROUBLESHOOTING FLOWCHARTS □

Introduction

Before beginning troubleshooting using the flowcharts, you should perform a quick inspection to eliminate any obvious problems. Perform a check of the following items:

- Verify that the main battery is installed and is charged. To check the battery voltage, refer to the "Battery Verification" procedure later in this section.
- Make sure the battery cover is installed.
- Remove the keyboard cover and verify that all the connectors to the logic board are securely attached.

□ TROUBLESHOOTING FLOWCHARTS

Troubleshooting Flowchart 1

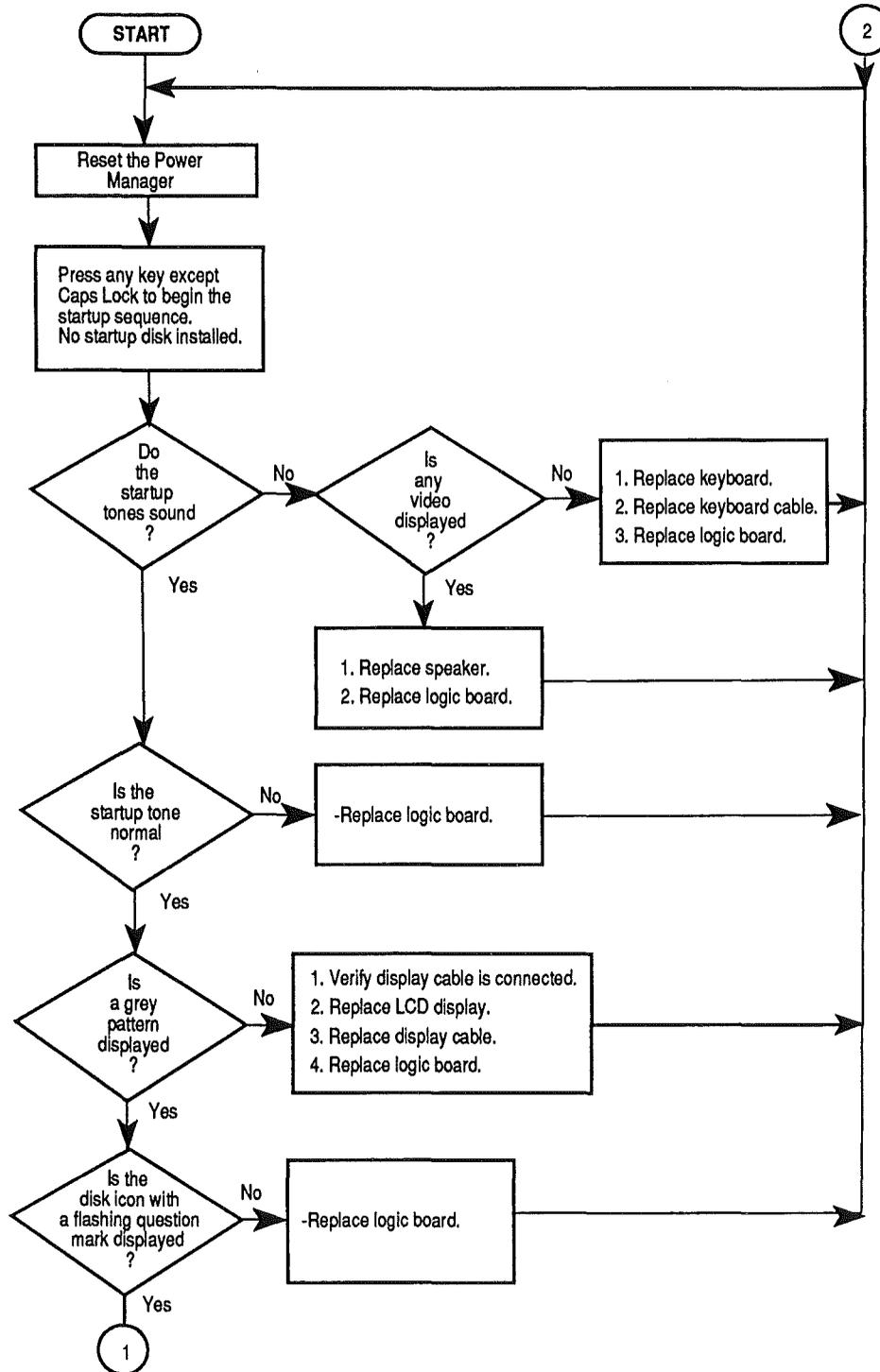


FIGURE 1

Troubleshooting
Flowchart 2

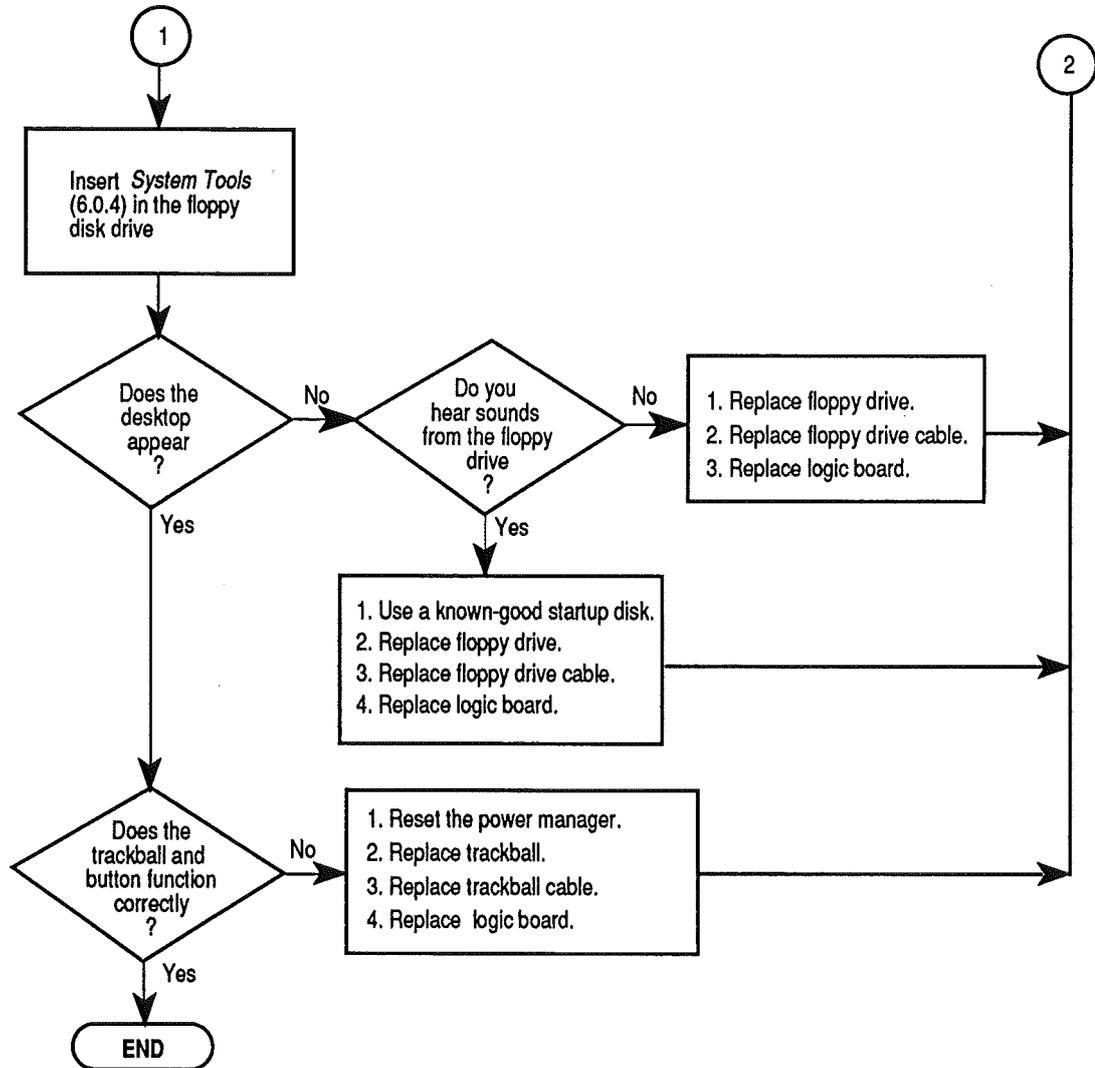


FIGURE 2

□ BATTERY VERIFICATION

Materials Required

Digital voltmeter

Procedure

1. Disconnect the power adapter.
2. Remove the main battery.
3. Set the voltmeter range to measure 10 volts DC.
4. Touch and hold the **positive probe** of the voltmeter to the **positive side** of the battery.
5. Touch and hold the **ground probe** of the voltmeter to the **negative side** of the battery.
6. The reading for a good battery should be **above 5.7 volts**. If the battery falls below 5.7 volts, try recharging it. If the battery will not recharge, replace it.

Macintosh Portable

Section 5 – Additional Procedures

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



CAUTION

CAUTION: *Be sure to read the "Power Information" section prior to beginning Take-Apart. This section contains important information necessary to preventing possible damage to the Macintosh Portable.*

□ INTRODUCTION

Power Information

Prior to removing or replacing any modules within the Macintosh Portable, you must unplug the power adapter, remove the main battery, and replace the battery cover. By replacing the battery cover you prevent the computer from attempting to operate using the 9-volt battery. **Failure to replace the battery cover can cause damage to the computer.**



CAUTION

CAUTION: *If a RAM disk is present, be sure to save its contents before removing the main battery and replacing the battery cover. Otherwise, RAM disk contents will be lost.*

Electrostatic Discharge (ESD) Precautions

The Macintosh Portable makes extensive use of low-power CMOS devices. These devices 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. Complete information on ESD prevention and workstation setup can be found in *You Oughta Know*.

□ SCSI HARD DISK INSTALLATION

The minimum configuration of the Macintosh Portable includes a single Apple FDHD floppy disk drive. This configuration can be upgraded to include a 40 MB, 3.5-inch low-power SCSI hard disk. These procedures cover the installation and check-out of the hard disk. Troubleshooting information is located in Section 4, Troubleshooting.

Materials Required

Jeweler's screwdriver
Grounded workstation pad
Grounding wriststrap
40 MB low-power SCSI hard drive
Macintosh Hard Disk Test (version 1.0 or later)
Macintosh System software (version 6.0.4 or later)
HyperCard version 1.2.3

Installation

1. Disconnect the power adapter.
2. Remove the rear cover, main battery, and keyboard cover.



CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover. Failure to replace the battery cover can damage the computer.

3. Remove any option cards installed.
4. **Figures 1-A and 1-B.** Release the floppy retainer from the subframe by pulling the two plastic tabs away from the retainer and then lifting the holder from the subframe.
5. **Figure 1-C.** Lower the hard drive into the subframe, align the four metal tabs, and press down until the plastic latches at the front and rear snap in place.



CAUTION: Make sure the disk drive flat cable does not get caught under the metal disk drive bracket. Otherwise, the cable could be damaged.

SCSI HARD DISK INSTALLATION □

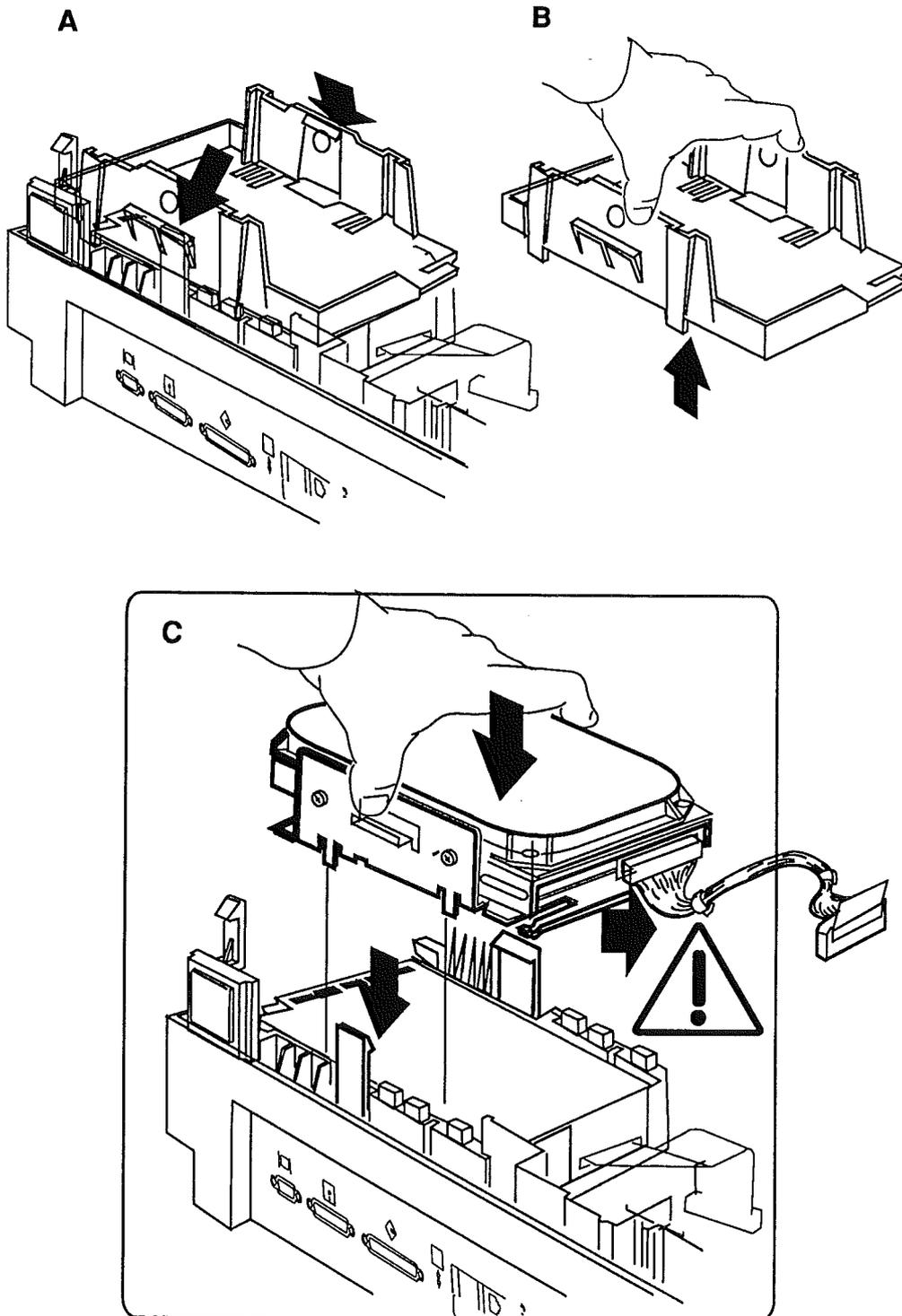


FIGURE 1

□ SCSI HARD DISK INSTALLATION

6. **Figure 2-A.** Disconnect the display cable from logic board connector J19.
7. **Figure 2-B.** Slide the hard drive cable through the opening under the display assembly.
8. **Figure 2-C.** Connect the hard drive cable to logic board connector J18.
9. **Figure 2-D.** Connect the display cable to logic board connector J19.
10. Replace any option cards removed.
11. Replace the keyboard cover, main battery, and rear cover.

Check-out

After installing the hard drive, you should run *Macintosh Hard Disk Test* (version 1.0 or later) to verify that the drive is operating properly. If you are unfamiliar with running *Hard Disk Test*, procedures can be found in the *SCSI Hard Disk Drives* section of *Apple Service Technical Procedures*.



CAUTION: *If you are using version 1.0 of the Macintosh Hard Disk Test, be sure to operate the computer with the power adapter connected. Do not select the "Loop on selected tests" option or damage to the LCD display could result.*

System Software and HyperCard

After installing and testing the hard disk, proceed to Section 1, Basics, "System Software" for procedures to install System software and HyperCard.

SCSI HARD DISK INSTALLATION □

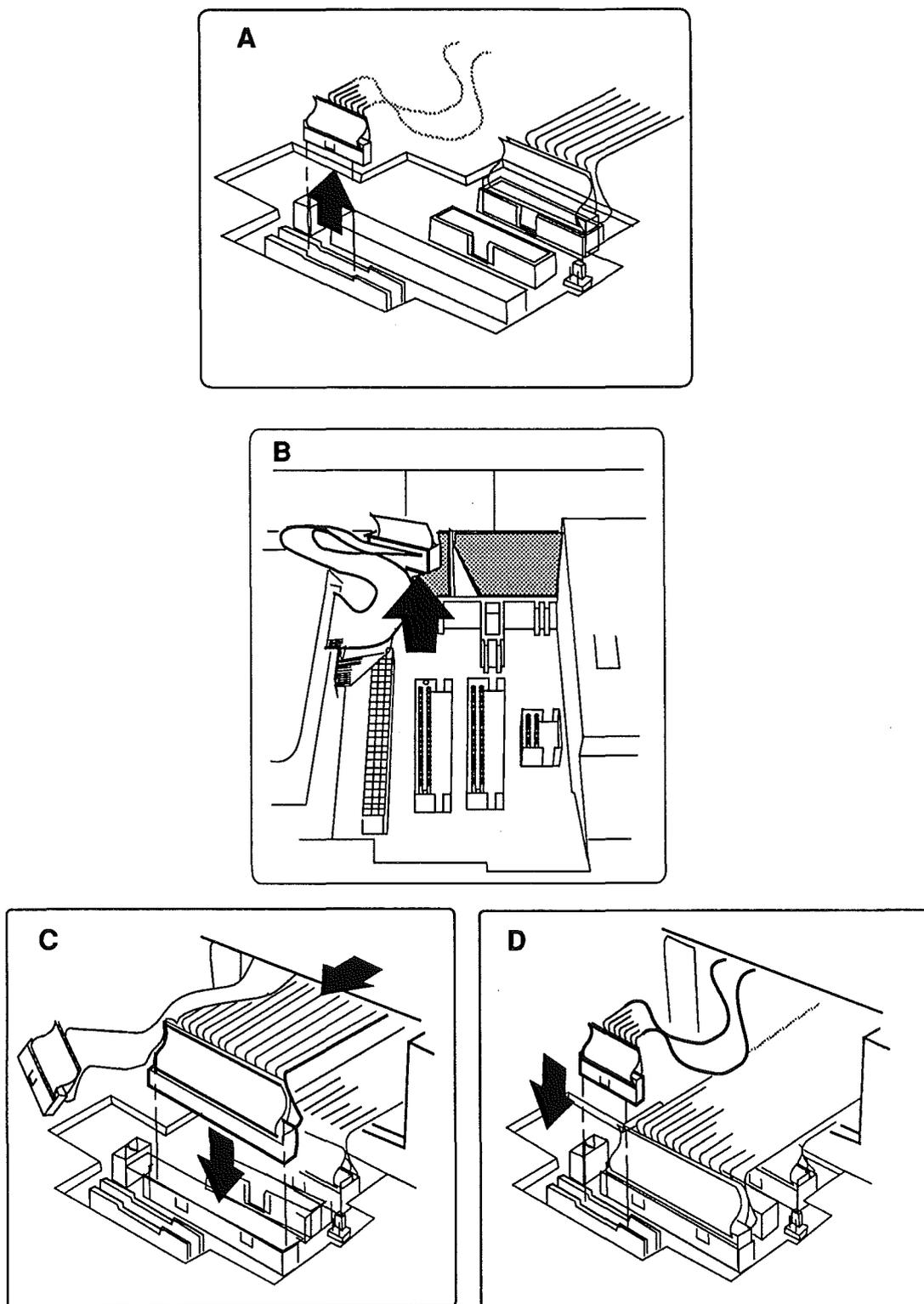


FIGURE 2

□ UPPER FDHD FLOPPY DISK DRIVE INSTALLATION

The minimum configuration of the Macintosh Portable includes a single Apple FDHD floppy disk drive. This configuration can be upgraded to include a second internal FDHD disk drive. These procedures cover the installation and check-out of the FDHD drive. Troubleshooting information is located in Section 4, Troubleshooting.

Materials Required

Jeweler's screwdriver
Grounded workstation pad
Grounding wriststrap
Apple FDHD floppy disk drive option kit
Macintosh System Tools version 6.0.4 or later
Blank, unformatted, high-density floppy disk

Installation

1. Disconnect the power adapter.
2. Remove the rear cover, main battery, and keyboard cover.



CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover. Failure to replace the battery cover can damage the computer.

3. Remove any option cards installed.
4. **Figures 3-A and 3-B.** Hold the rear cover with the underside facing up. Remove the standard bezel from the rear cover by releasing the three plastic snaps as shown. Release the snaps in the order indicated. Then pull the bezel away from the cover.
5. **Figure 3-C.** Install the new floppy bezel as shown.
6. **Figures 3-D and 3-E.** Release the floppy retainer from the subframe by pulling the two plastic tabs away from the retainer and then lifting the holder from the subframe.
7. **Figure 3-F.** Place the floppy drive mechanism into the floppy retainer.

UPPER FDHD FLOPPY DISK DRIVE INSTALLATION □

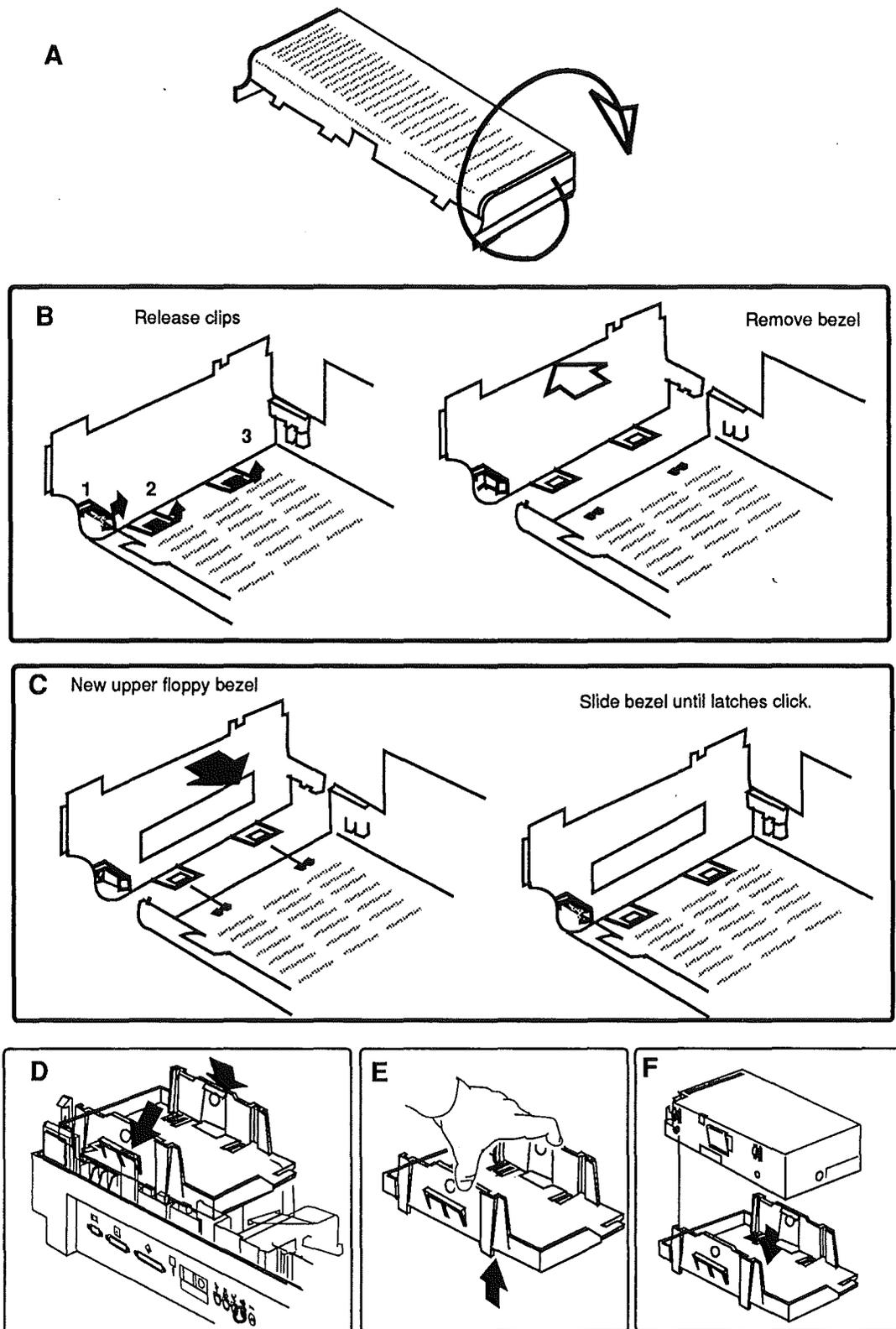


FIGURE 3

□ UPPER FDHD FLOPPY DISK DRIVE INSTALLATION

8. **Figure 4-A.** Lower the disk drive into the subframe, align the four metal tabs, and press down until the plastic latches at the front and rear snap in place.
9. **Figure 4-B.** Disconnect the display cable from logic board connector J19.
10. **Figure 4-C.** Route the floppy drive cable under the display assembly as shown.
11. **Figure 4-D.** Connect the floppy drive cable to logic board connector J15.
12. **Figure 4-E.** Connect the display cable to logic board connector J19.
13. **Figure 4-F.** Connect the other end of the floppy drive cable to the upper disk drive.
14. Replace any option cards removed.
15. Replace the keyboard cover, main battery, and rear cover.

Check-out

1. Insert the *System Tools* disk in the lower floppy drive.
2. Turn on the computer by pressing any key except <Caps Lock>.
3. When the desktop appears, place the blank high-density disk in the upper drive.

Follow the prompts and format the disk.

4. When the disk is formatted, click on the *System Tools* disk icon and drag it on top of the icon for the blank disk.

If you have any problems formatting or copying the *System Tools* disk, refer to Section 4, Troubleshooting.

UPPER FDHD FLOPPY DISK DRIVE INSTALLATION □

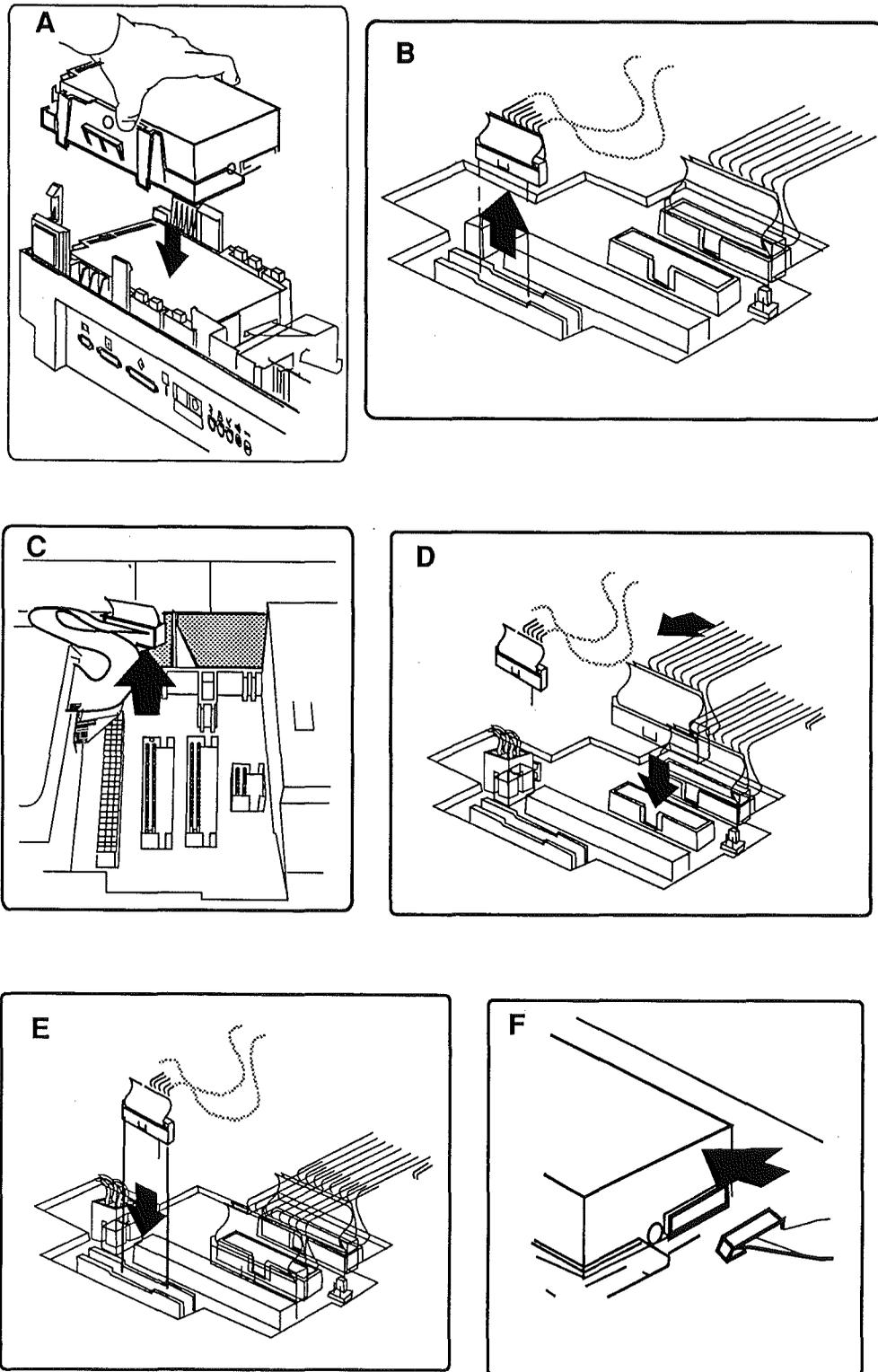


FIGURE 4

□ MACINTOSH PORTABLE DATA MODEM 2400

Product Description

These procedures provide an overview and installation, check-out, and troubleshooting procedures for the Macintosh Portable Data Modem 2400.

The Portable Data Modem 2400 (US) and the INTL XP 2400 (International) are optional internal 2400 bps modems for the Macintosh Portable computer. Features of the modem include:

- Auto dialing and auto/manual answering
- Automatic restoration of previous configuration after return from system sleep
- Dual-tone modulated-frequency (DTMF—Touch-Tone™) dialing and pulse dialing
- Supports a subset of the Hayes® AT command set
- Low-power design to conserve battery power
- Local and remote self-test
- Support of the Bell 103 (300 bps), Bell 212A (1200 bps), CCITT V.22A/B (1200 bps), and CCITT V.22bis (2400 bps) communication standards
- External DAA adapters to support various telephone standards around the world.

The US version is shown in **Figure 5-A**, the international version is shown in **Figure 5-B**, and a DAA is shown in **Figure 5-C**.

Theory of Operation

The modem is designed around three main components. (Refer to **Figure 5-D** while reading the Theory of Operation.)

- A N83C51FA single-chip microcontroller
- A TMS320C15 digital signal processor (DSP)
- A MSM6950B analog front end (AFE)

The 83C51FA microcontroller provides overall control of the modem. It manages the serial interface and processes the AT commands sent from the computer. The microcontroller programs and controls the analog front-end chip.

MACINTOSH PORTABLE DATA MODEM 2400 □

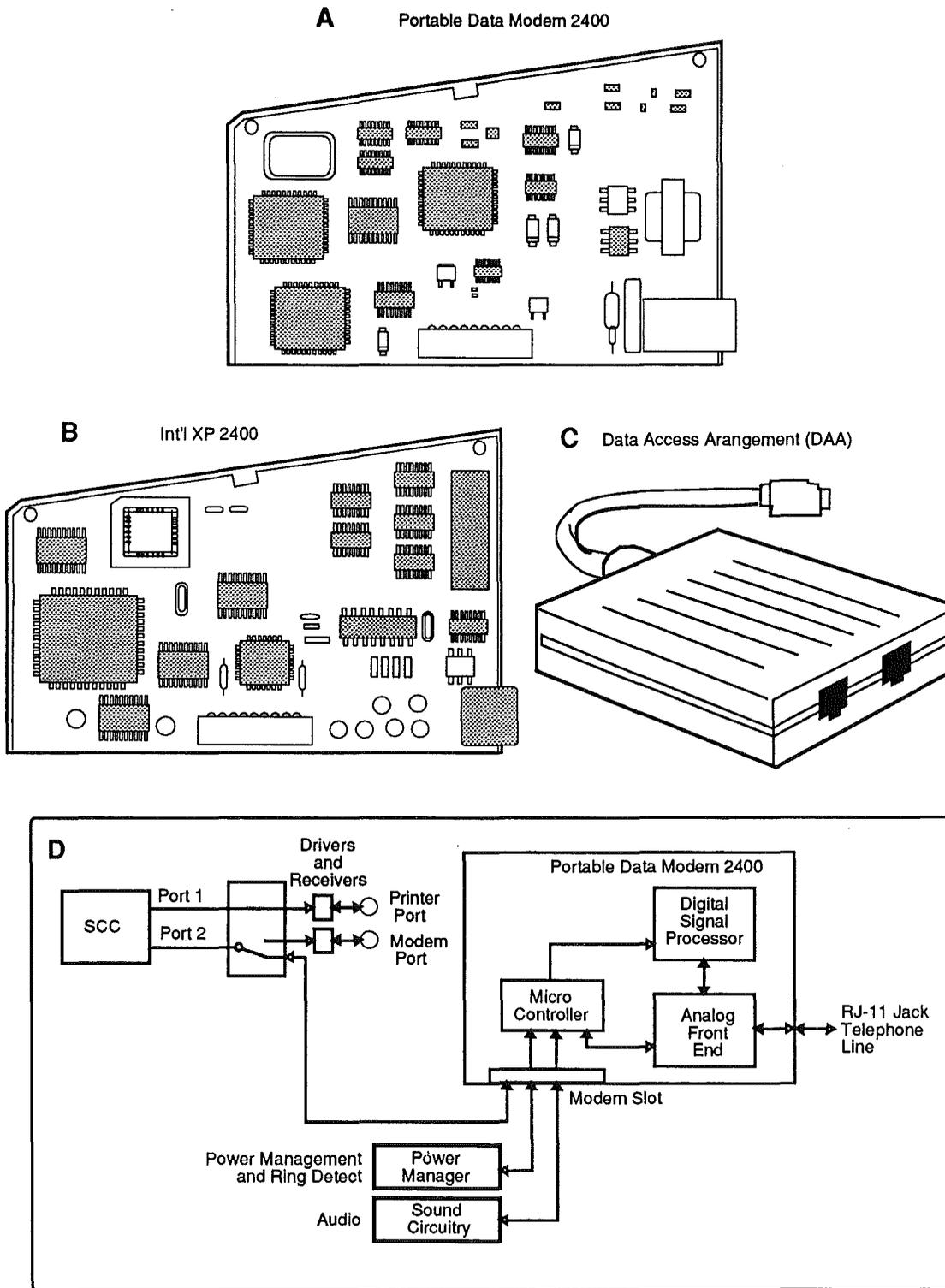


FIGURE 5

□ MACINTOSH PORTABLE DATA MODEM 2400

The 6950 provides the analog functions of the modem. It includes 8-bit digital-to-analog (D/A) and analog-to-digital (A/D) converters for translating the analog signals of the telephone line to the digital signals within the computer and digital signals to analog.

The TMS320 digital signal processor handles all high-speed signal processing for the modem. This includes all modulation, demodulation, encoding, decoding, and adaptive equalization. The DSP also performs the scrambling and descrambling required for Bell 212A, V.22, and V.22bis. Finally, the DSP handles DTMF (Touch-Tone™) dialing, answer-tone generation, and call-process signal monitoring.

Computer Interface

The modem card and the external modem port share Port 1 of the serial communications controller. Switching between the two devices is handled by the Utah chip. If the internal modem is installed and enabled (through the Portable CDEV in the Control Panel), then the external modem port is unusable. To use the external port again, either remove the internal modem or select the external modem port through the Control Panel.

Sleep Mode

While the computer is in sleep mode, the modem consumes significantly less power—only the microcontroller and ring detect circuitry are active. Maintaining power to the microcontroller and ring detect circuitry allows the modem to alert the computer when the telephone line is ringing and a call is coming in.

Resetting the Modem

Resetting the modem is accomplished by removing all power to the system, typing the command ATZ, and pressing the reset and interrupt switches.

MACINTOSH PORTABLE DATA MODEM 2400 □

Specifications	The following specifications apply to the US and Canadian version of the Macintosh Portable Data Modem 2400.	
Regulatory	FCC registration number:	BCGM0250
	Canadian load number:	11
	Jack type:	USOC RJ-11 (US) CA 11 (Canada)
Communication	Transmission rates:	300 bps (Bell 103) 1200 bps (Bell V.22A/B and Bell 212A) 2400 baud (V.22bis)
	Data formats:	7 data bits with 1 stop bit and odd, even, or no parity 7 data bits with 2 stop bits and no parity 8 data bits with 1 stop bit and no parity
Telephone Interface	Tone:	Dual-tone multifrequency (DTMF)
	Frequency tolerance:	±1%
	Pulse:	
	Duty cycle:	39%/61% mark/break ratio
	Dialing rate:	10 pps
Miscellaneous	Receiver dynamic range:	-10 dBm to -43 dBm full-duplex
	Frequency tolerance:	± 7 Hz
	Operating modes:	Auto-dial and manual/auto answer
Electrical	Power consumption:	525 milliwatts typical 750 milliwatts maximum 3 milliwatts in sleep mode
Environmental	Operating environment:	
	Ambient temperature:	10-50° C
	Relative humidity:	95% (noncondensing)

□ MACINTOSH PORTABLE DATA MODEM 2400

Installation

The following procedure covers the installation of the Macintosh Portable Data Modem 2400.

Materials Required

Grounded workstation pad
Grounding wriststrap
Portable Data Modem 2400 card

Procedure



CAUTION

1. Unplug the power adapter from the computer.
2. Remove the rear cover and main battery.

CAUTION: Remember to replace the battery cover after removing the main battery. Failure to replace the battery cover can damage the computer.

3. **Figure 6-A.** Remove the modem cap by pushing it out through the rear of the computer.
4. **Figure 6-B.** Locate the modem card connector.
5. **Figure 6-C.** Position the card over the connector and plug in the card. Make sure the card is on the right side of the modem gasket.
6. Remove the battery cover and replace the main battery.
7. Replace the rear cover.

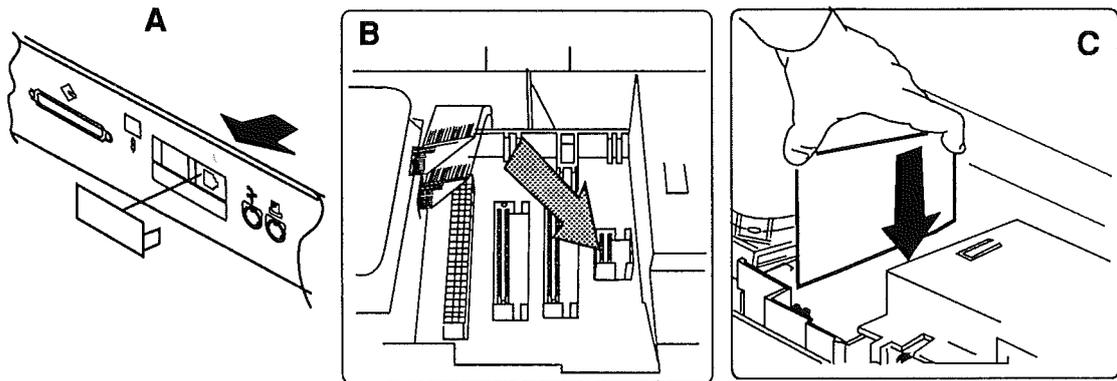
Check-out

1. Turn on the computer by pressing any key except <Caps Lock>.
2. **Figure 6-D.** Open the Control Panel and select the Portable CDEV.

Verify that the internal/external modem selection portion is shown. **If it is not**, proceed to "Troubleshooting."

3. Verify operation of the modem card by performing the Communications and Loopback Tests described in "Troubleshooting."

MACINTOSH PORTABLE DATA MODEM 2400 □



D

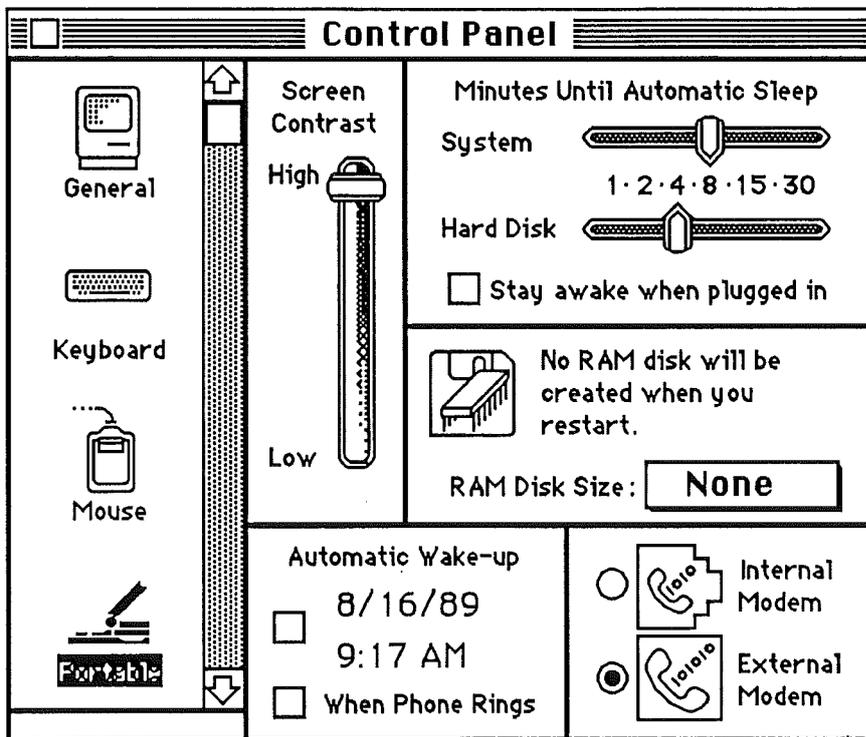


FIGURE 6

□ MACINTOSH PORTABLE DATA MODEM 2400

Troubleshooting

Most of the problems with the internal modem will occur during installation. Other problems may occur only with certain baud rates or modes of operation. These procedures provide a step-by-step process to verify the operation and fault resolution of the Macintosh Portable Data Modem 2400.

Note: The modem is software, not hardware, configurable. The baud rate, parity, data word length, and duplex settings for the modem are software controlled. Also, the modem is analog and cannot be used with digital telephone systems.

Refer to the *Macintosh Portable Data Modem 2400 Owner's Guide* for additional information.

Materials Required

The following materials are needed to complete the Communications and Loopback tests:

Macintosh Portable with a Portable Data Modem 2400 installed

Macintosh Portable Data Modem 2400 Owner's Guide

MacTerminal

Analog telephone line with an RJ-11 jack (US and Canada)

DAA unit (outside the United States and Canada)

RJ-11 telephone cable

Communications Test

To see if the modem and computer are communicating, do the following:

1. Turn on the computer by pressing any key except <Caps Lock>.
2. Double-click on the MacTerminal icon.
3. Type AT and press <Return>. If everything is working, the screen will display **OK**.

If you don't get an **OK**, refer to **Figure 7**.

4. Continue to the Loopback Test.

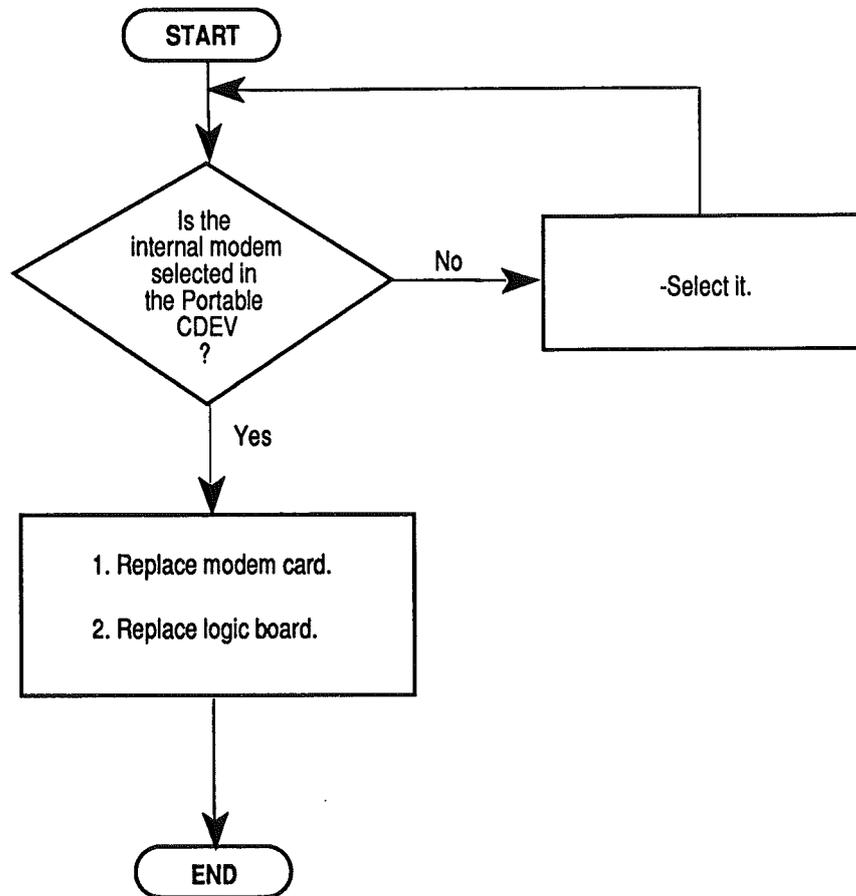


FIGURE 7

□ MACINTOSH PORTABLE DATA MODEM 2400

Loopback Test

You can run a combination self-test and **analog loopback test** on the modem by following these instructions.

Note: The modem must be connected to a known-good telephone line to perform the following test.

1. Load your communications software and enter terminal mode.
2. Type the modem command string AT&T8 and press <Return>.

The modem will execute a self-test. When the self-test is finished, the cursor will move to the beginning of the next line.

3. Type a short test message—anything at all.

As you type, the modem directs the characters to loop back to the computer screen. If you can see what you're typing, the modem is functioning. Don't worry if the <Return> key doesn't advance the cursor to the next line.

4. Type ATZ and press <Return>.

This command will restore the modem's factory settings and return the modem to command mode. An **OK** response appears on the display.

If the modem fails the self-test or loopback test, refer to **Figure 8**.

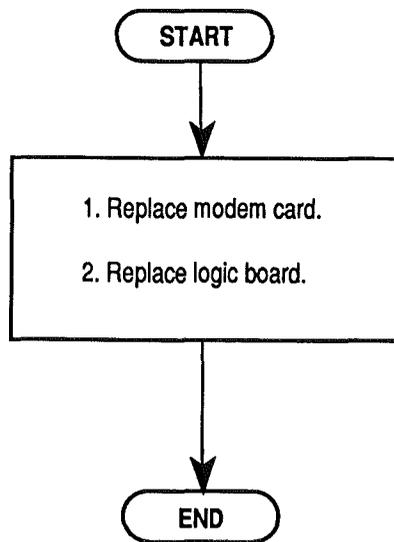


FIGURE 8

□ 1 MB RAM EXPANSION CARD

Product Description

The RAM Expansion Card is a 1 MB RAM card for the Macintosh Portable computer. The card uses 100-nsec low-power CMOS static RAMs to reduce power requirements for operation in a battery-powered system.

The 1 MB RAM Expansion Card is shown in **Figure 9**.

Theory of Operation

The card uses thirty two 32K x 8-bit static RAMs with an access time of 100 nsec. During system sleep, the battery backs up this memory as well as system RAM.

An Apple-designed application-specific integrated circuit (ASIC) provides interface logic between the RAM expansion connector and the card.

1 MB RAM EXPANSION CARD □

1 MB RAM Expansion Card

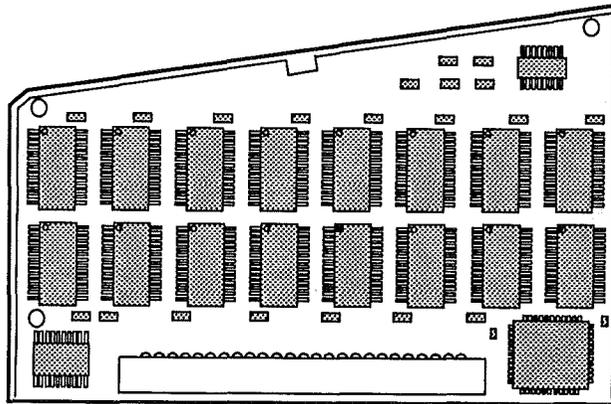


FIGURE 9

□ 1 MB RAM EXPANSION CARD

Installation

The following procedure covers the installation and check-out of the memory expansion card.

Materials Required

Grounded workstation pad
Grounding wriststrap
1 MB RAM Expansion Card

Procedure

1. Disconnect the power adapter.
2. Remove the rear cover, main battery, and keyboard cover.



CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover. Failure to replace the battery cover can damage the computer.

3. **Figure 10-A.** Locate the RAM expansion connector.
4. **Figure 10-B.** Position the card over the connector and plug the card in.
5. Remove the battery cover and replace the main battery.
6. Replace the rear cover.

Check-out

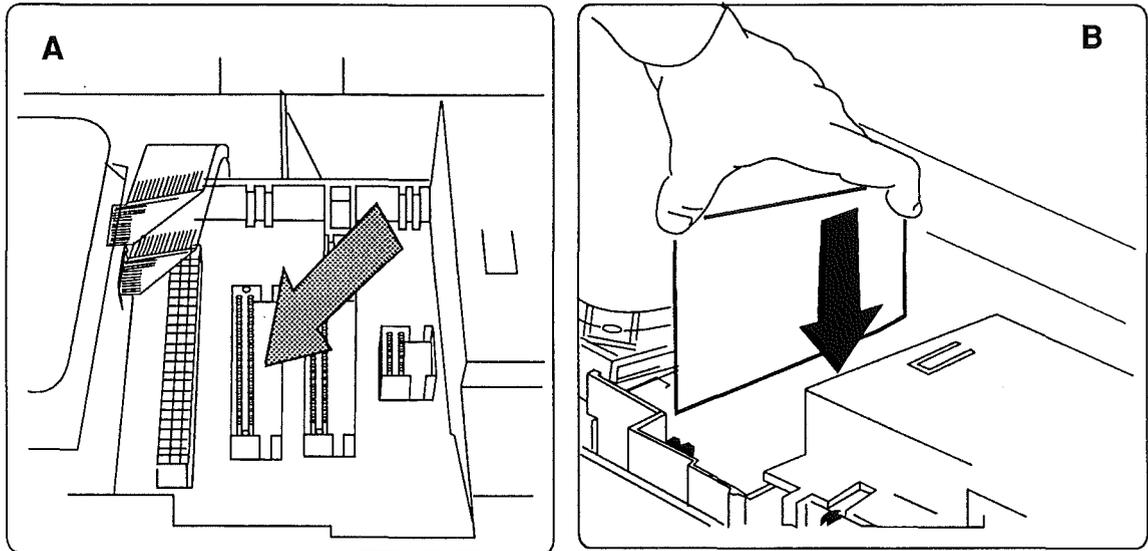
1. Turn on the computer by pressing any key except <Caps Lock>.
2. **Figure 10-C.** Pull down the Apple menu and select **About the Finder**.
3. Check that the amount of RAM indicated is 2048K.

If the amount of RAM is not 2048K, proceed to "Troubleshooting."

Troubleshooting

1. **If the amount of RAM indicated is not correct, replace the card.**
2. If the amount of RAM indicated is still not correct, replace the logic board.

1 MB RAM EXPANSION CARD □



C

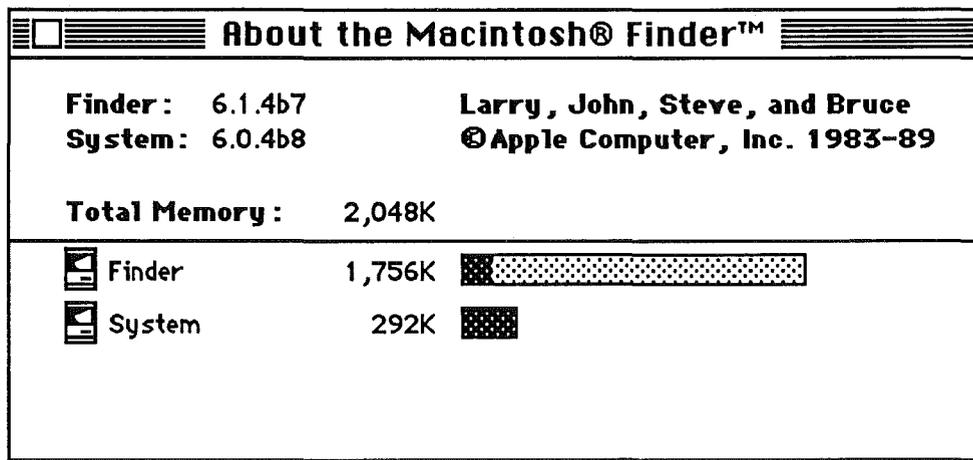


FIGURE 10

□ RECONFIGURING INPUT DEVICES

A unique feature of the Macintosh Portable is the ability to reconfigure the various input devices—the keyboard, trackball, and optional numeric keypad. You can change both the combination and position of the input devices.

When the Macintosh Portable is shipped from Apple, it is set up with a keyboard and trackball. The keyboard is on the left side and the trackball is on the right.

Figure 11-A shows the various ways the computer can be configured.

Materials Required

Jeweler's screwdriver
Grounded workstation pad
Grounding wriststrap
Numeric keypad, if the trackball is being replaced by a numeric keypad

Procedure

1. Disconnect the power adapter.
2. Remove the rear cover, main battery, and keyboard cover.



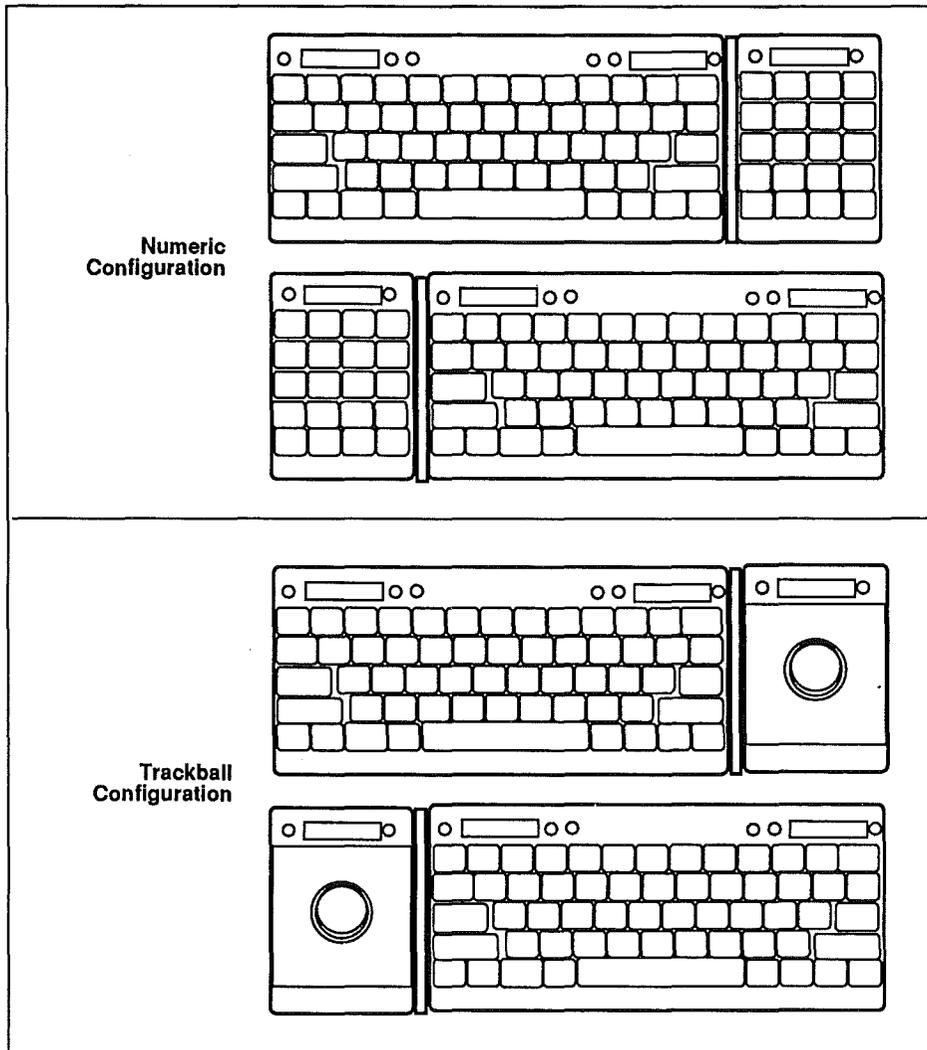
CAUTION: Remember to replace the battery cover after removing the main battery and before you remove the keyboard cover. Failure to replace the battery cover can damage the computer.

3. **Figures 11-B1, 11-B2, and 11-B3.** If you are exchanging the trackball and numeric keypad, disconnect the flat cable of the input device you are exchanging.

If you are changing the positions of two input devices, disconnect the flat cable of both devices.

RECONFIGURING INPUT DEVICES □

A



KEYBOARD

TRACKBALL

NUMERIC KEYPAD

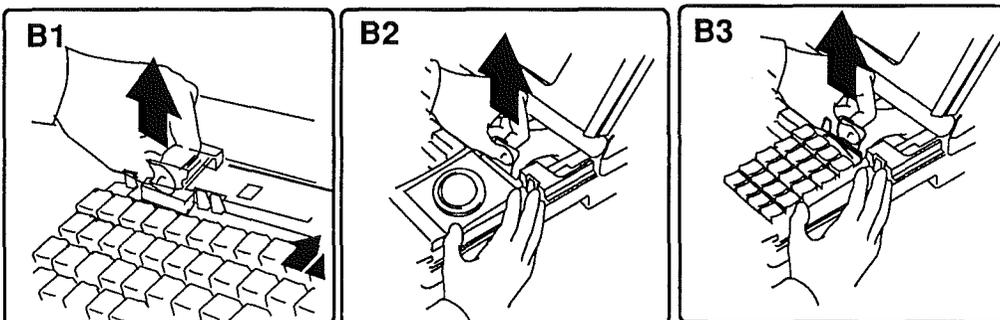


FIGURE 11

□ RECONFIGURING INPUT DEVICES

4. **Figures 12-A1, 12-A2, and 12-A3.** Starting at one side of the input device to be removed, simultaneously press back on each plastic tab securing the device to the case and lift the device. When all the tabs are released, remove the device from the computer.
5. **If you are changing input device positions,** repeat step 4 for the other device.
6. **If you are changing device positions,** reverse the position of the keyboard spacer.
 - a) **Figure 12-B1.** The **keyboard spacer** is on the **right** when the **keyboard** is on the **left**.
 - b) **Figure 12-B2.** The **keyboard spacer** is on the **left** when the **keyboard** is on the **right**.
7. **Figures 12-C1, 12-C2, and 12-C3.** Place the front of the device in the guides at the front of the computer. Press down the rear of the device until it snaps in place.
8. **Figures 12-D1, 12-D2, and 12-D3.** Connect the flat cable to the device.
9. **If you changed device positions,** repeat steps 7 and 8 for the other device.
10. Replace the keyboard cover, main battery, and rear cover.

RECONFIGURING INPUT DEVICES □

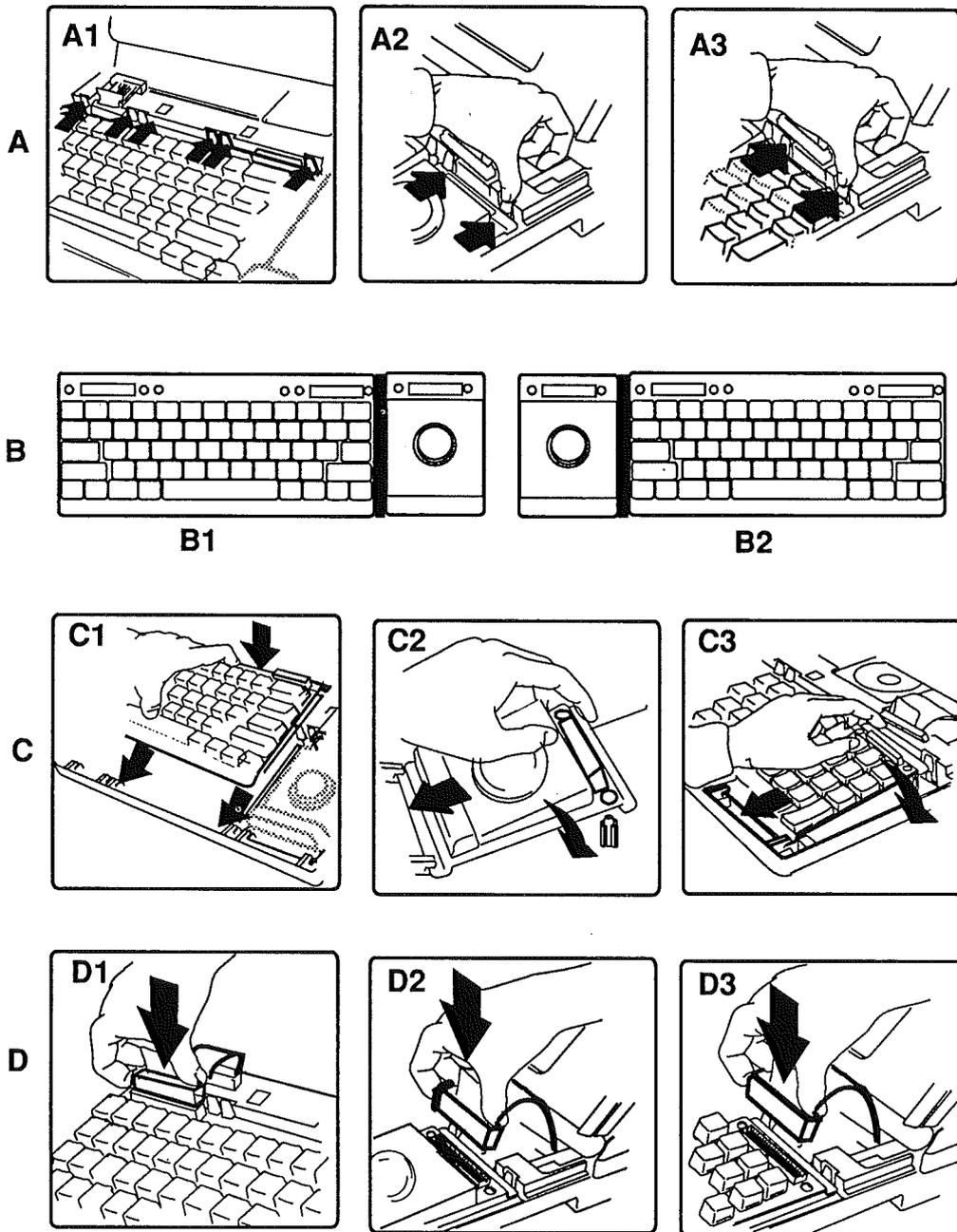


FIGURE 12

□ BATTERY RECHARGER

Product Description

The Battery Recharger is an optional external battery recharger. With the purchase of a second battery, the user can charge a second battery while using the first battery in the computer. This option provides a fully charged battery whenever required.

Operation

The battery recharger is set up as shown in **Figure 13-A**.

LED

An LED is provided to indicate the progress of charging the battery. See the inset of **Figure 13-B**.

- **Yellow** – the battery is charging
- **Green** – the battery is charged to at least 80% of capacity and is ready to use
- **Off** – the charger is unplugged, the battery is bad, or the charger is defective

Troubleshooting

Figure 13-C. Use the flowchart to troubleshoot problems with the battery recharger.

BATTERY RECHARGER □

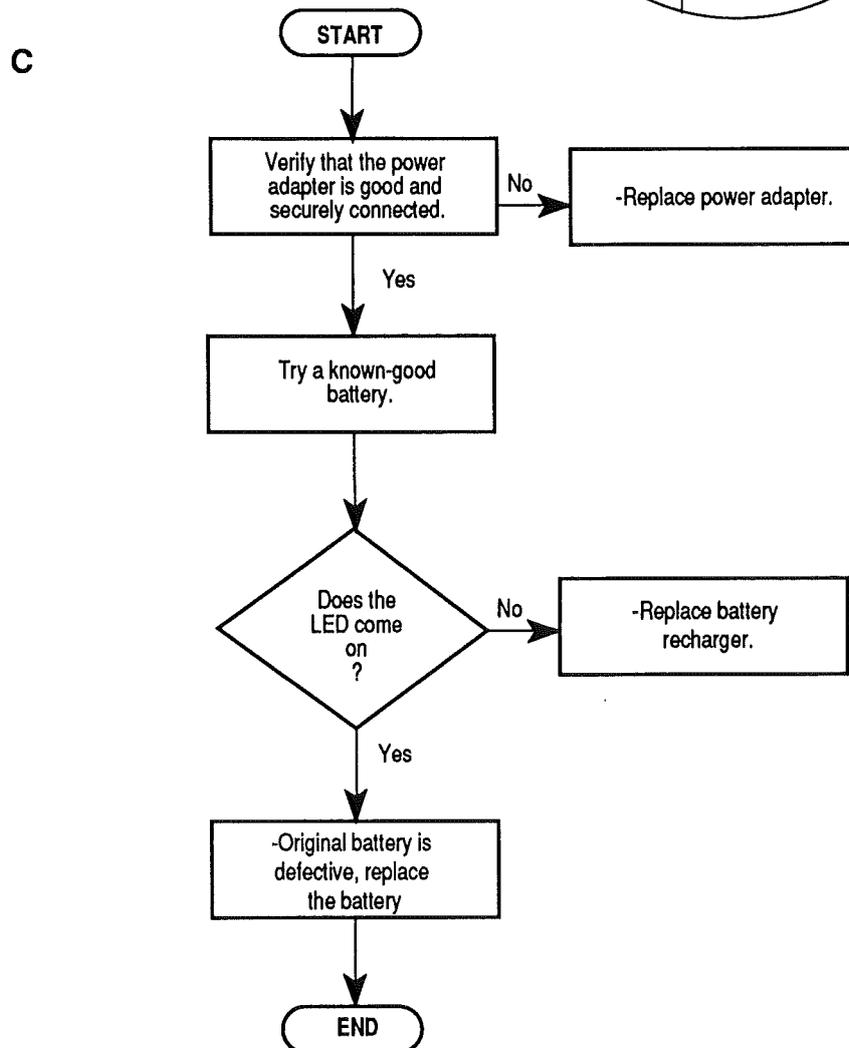
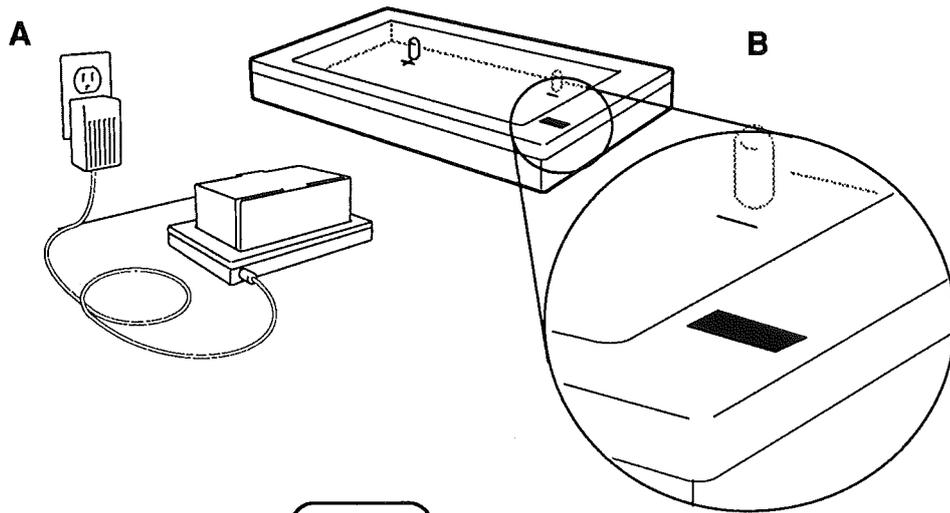


FIGURE 13



Macintosh Portable

Illustrated Parts List

□ CONTENTS

- IPL.3 Macintosh Portable—System Exploded
View: Part 1 (Figure 1)
- IPL.5 Macintosh Portable—System Exploded
View: Part 2 (Figure 2)
- IPL.7 Power Adapter (Figure 3)
- IPL.7 Carrying Case (Figure 4)
- IPL.9 Mouse (Figure 5)
- IPL.11 Option Cards/Internal Modem (Figure 6)
- IPL.13 Numeric Keypad (Figure 7)
- IPL.15 Upper FDHD/SuperDrive (Figure 8)
- IPL.17 SCSI Hard Disk Drive (Figure 9)
- IPL.19 Required Service Packaging (Figure 10)
- IPL.21 Data Access Arrangement (DAA)
(Figure 11)
- IPL.23 DAA Cables (Figure 12)

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

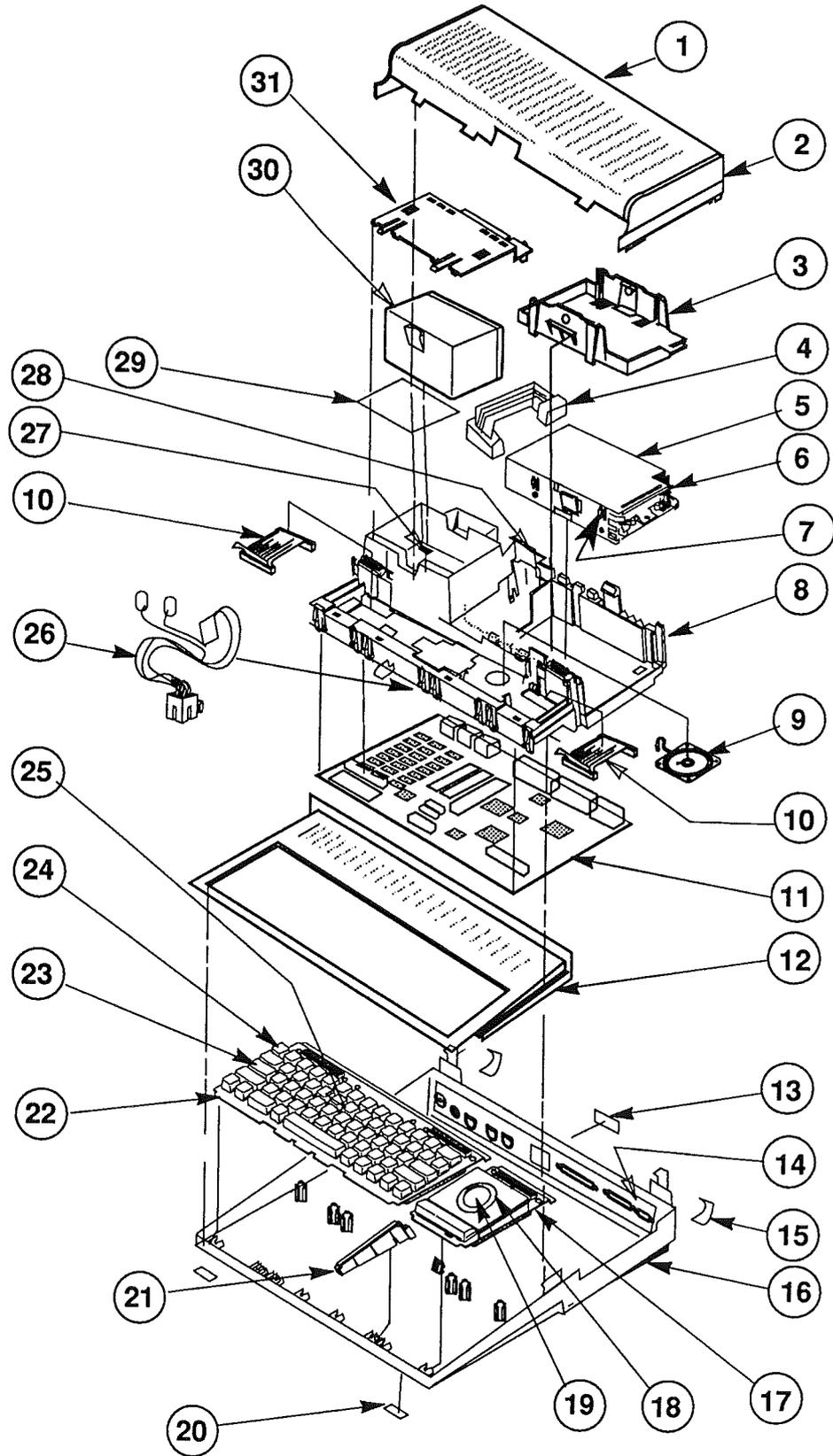


FIGURE 1

□ MACINTOSH PORTABLE—SYSTEM EXPLODED VIEW: PART 1
(Figure 1)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5687	Rear Cover
2	810-1096	Standard Bezel
3	815-1110	Floppy Retainer
4	590-0501	Internal 1.4 MB Drive Cable
5	805-0961	1.4 MB Drive Shield
6	661-0474	1.4 MB Disk Drive
7	844-0018	FDHD Screw
8	630-5684	Subframe Assembly
9	600-0406	Speaker
10	590-0507	Keyboard/Trackball Cable
11	661-0470	Logic Board
12	815-1059	Keyboard Cover
13	815-1111	Modem Cap
14	805-0973	RFI Foam Gasket
15	865-0060	Corner Foot
16	630-5418	Bottom Case
17	661-0475	Trackball Assembly
18	815-1134	Trackball Retainer
19	815-1133	Trackball Ball
20	865-0054	Flat Foot
21	815-1093	Keyboard Spacer
22	661-0476	Keyboard
	B661-0476	British Keyboard
	C661-0476	French Canadian Keyboard
	D661-0476	German Keyboard
	E661-0476	Spanish Keyboard
	F661-0476	French Keyboard
	S661-0476	Swedish Keyboard
	T661-0476	Italian Keyboard
23	815-1132	Locking Keyswitch
24	076-0226	Keyswitch Set (10/pk)
25	658-7136	Keycap Set
26	600-0425	Wire Harness Assembly
27	805-0970	Battery Connector
28	805-0976	Modem RFI Gasket
29	865-0068	Battery Insulator
30	076-0376	Battery Pack (6V)
31	630-5723	Battery Cover

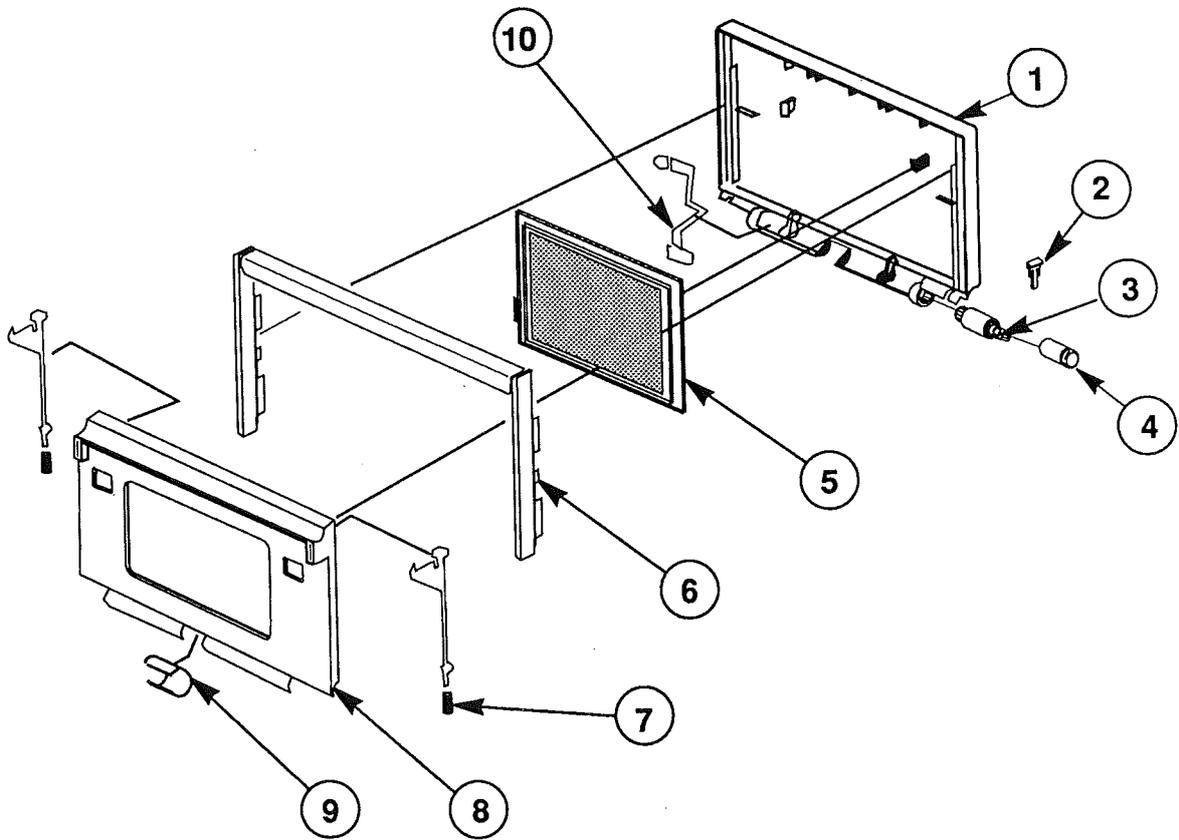


FIGURE 2

□ MACINTOSH PORTABLE—SYSTEM EXPLODED VIEW: PART 2
(Figure 2)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5642	Display Housing
2	815-1109	Clutch Retainer
3	699-5070	Clutch Mechanism
4	815-1098	Clutch Cover
5	661-0473	LCD Display
6	630-5071	Case Handle
7	805-1120	Latch Spring
8	630-5416	Display Bezel
9	815-1108	Center Pivot Cover
10	590-0502	Display Cable

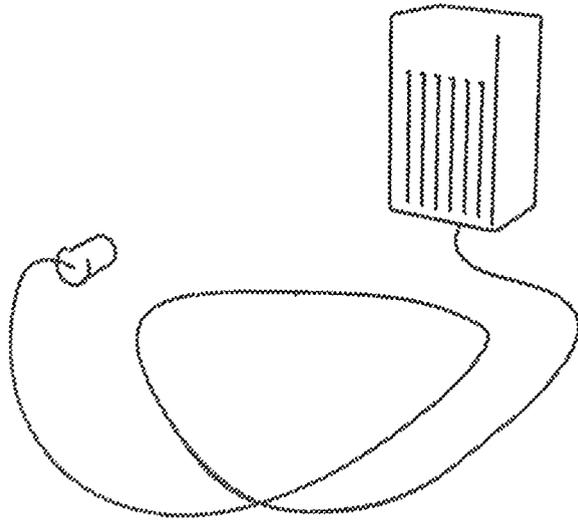


FIGURE 3

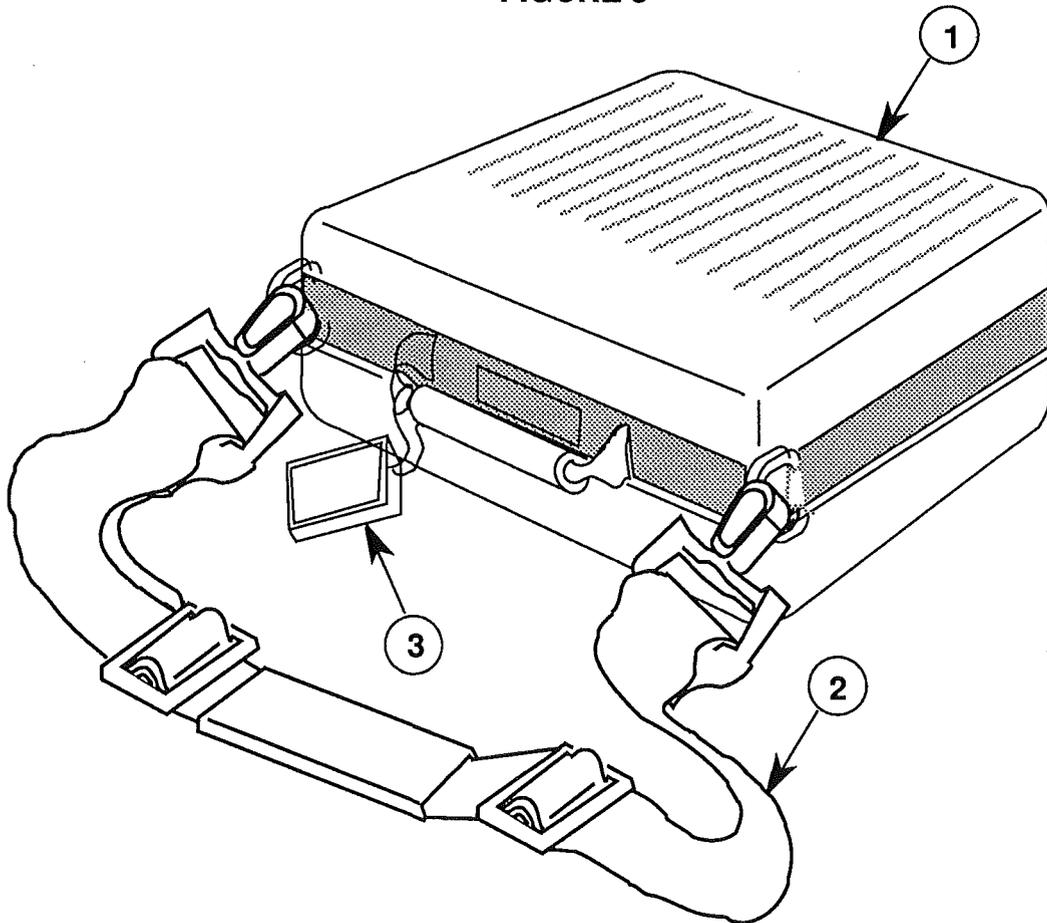


FIGURE 4

POWER ADAPTER (Figure 3)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	699-0505	Power Adapter/Charger

CARRYING CASE (Figure 4)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	630-5574	Carrying Case
2	699-0508	Carrying Case Strap
3	699-0142	Luggage Tag

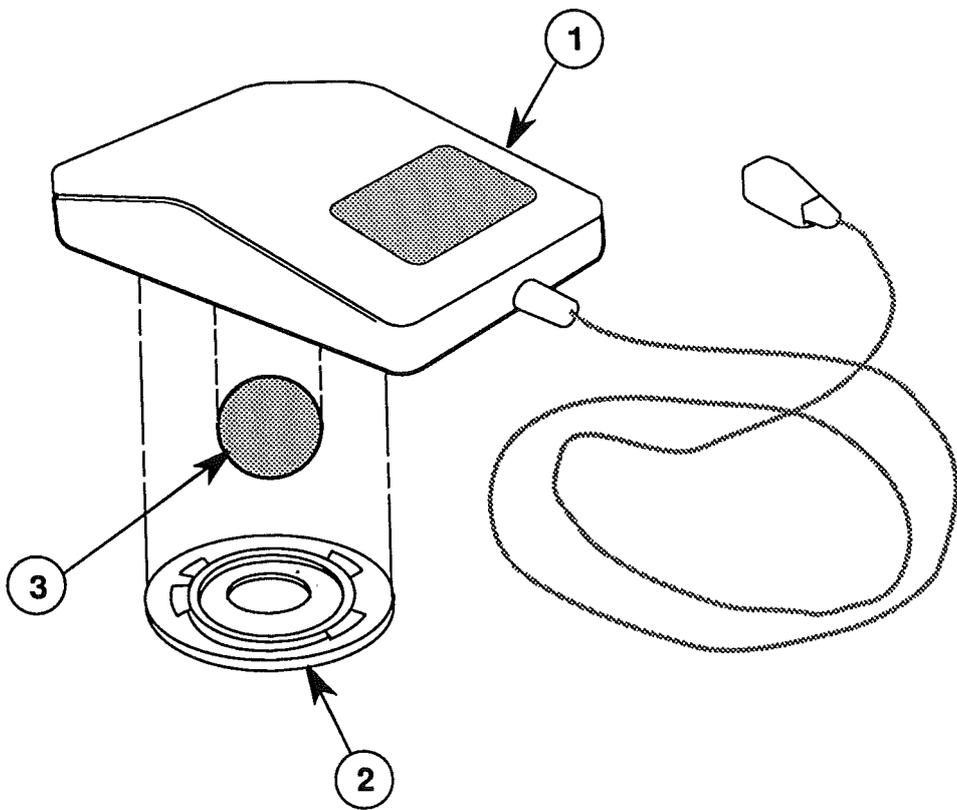


FIGURE 5

□ **MOUSE (Figure 5)**

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0585	Low-Power Mouse
2	076-0231	Retainer, ADB Mouse Ball (38 mm diameter)
3	699-8038	Mouse Ball (21.9 mm diameter)

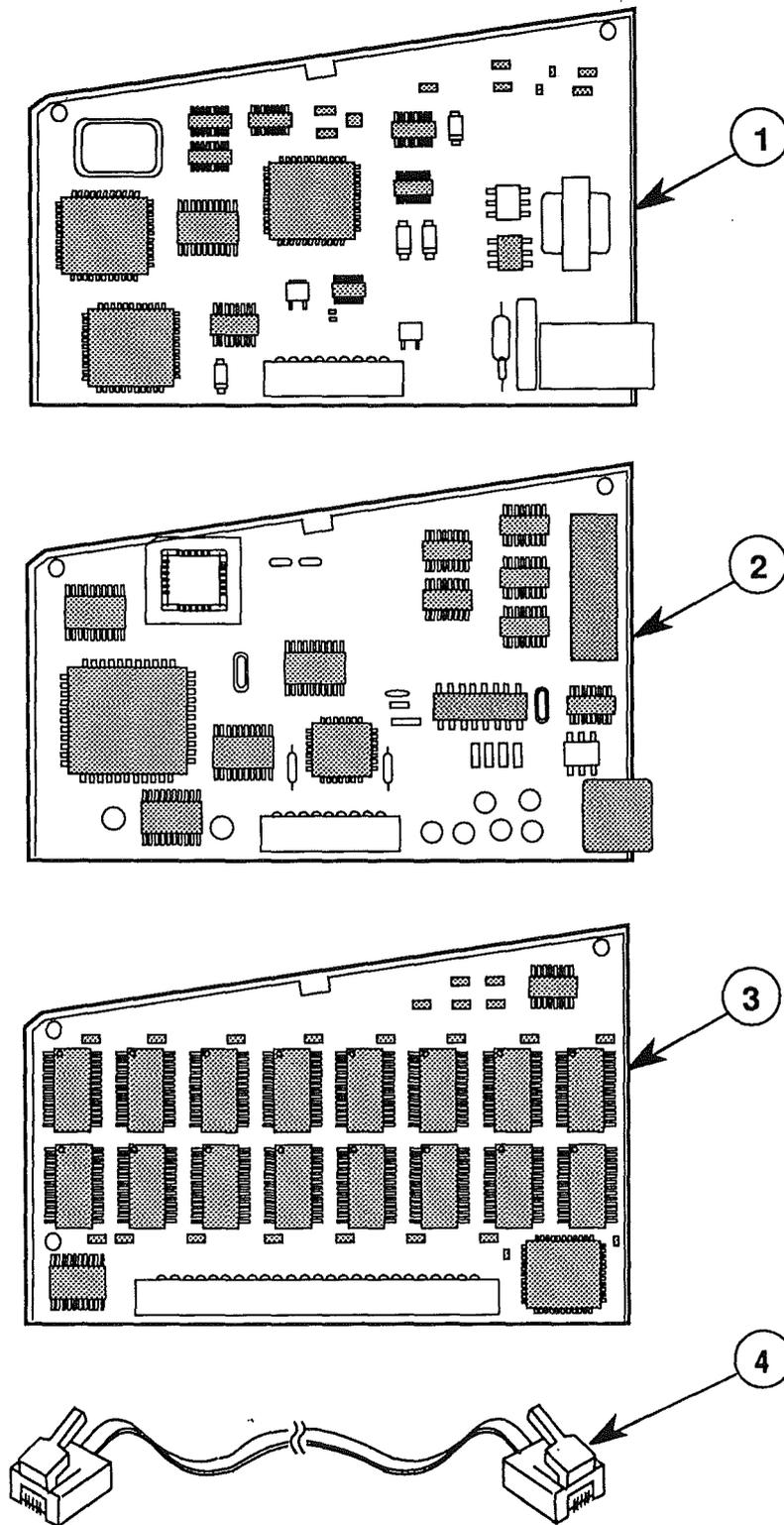


FIGURE 6

□ OPTION CARDS/INTERNAL MODEM (Figure 6)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	661-0468	Data Modem 2400
2	661-0465	International XP 2400 Internal Modem*
	D661-0465	International XP 2400 Internal Modem, Germany
3	661-0480	RAM Card, 1 MB
4	590-0590	Telephone Cable, U.S.

***Note:** The Data Access Arrangement and cables for the Internal Modem can be found at the end of this section.

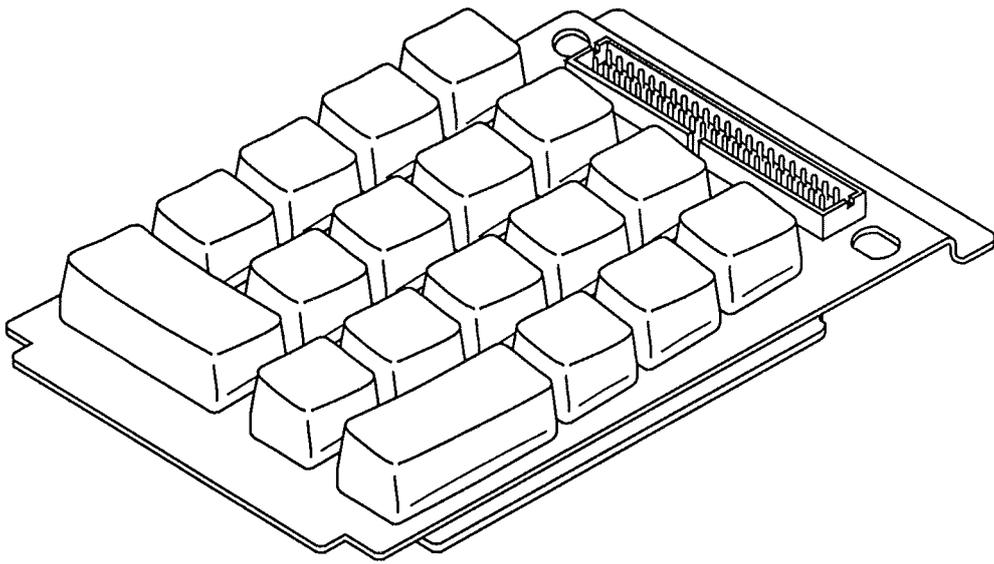


FIGURE 7

□ NUMERIC KEYPAD (Figure 7)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0477	Numeric Keypad
	PA661-0477	Numeric Keypad, International PA Version
	Z661-0477	Numeric Keypad, International Z Version

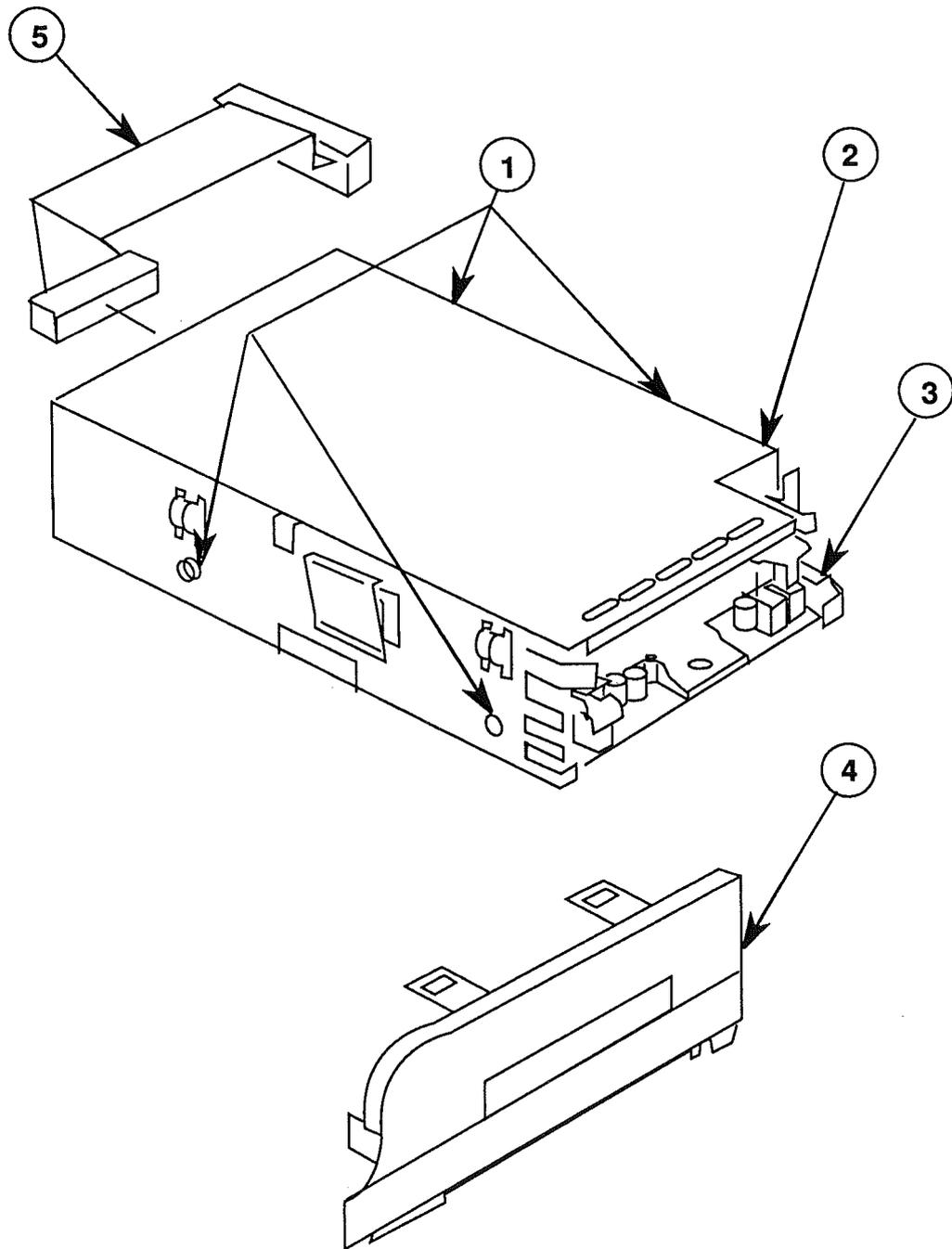


FIGURE 8

□ UPPER FDHD FLOPPY DISK DRIVE (Figure 8)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	844-0018	FDHD Screw (4)
2	805-0961	1.4 MB Drive Shield
3	661-0474	1.4 MB Disk Drive
4	815-1092	Floppy Bezel
5	590-0501	1.4 MB Drive Internal Cable

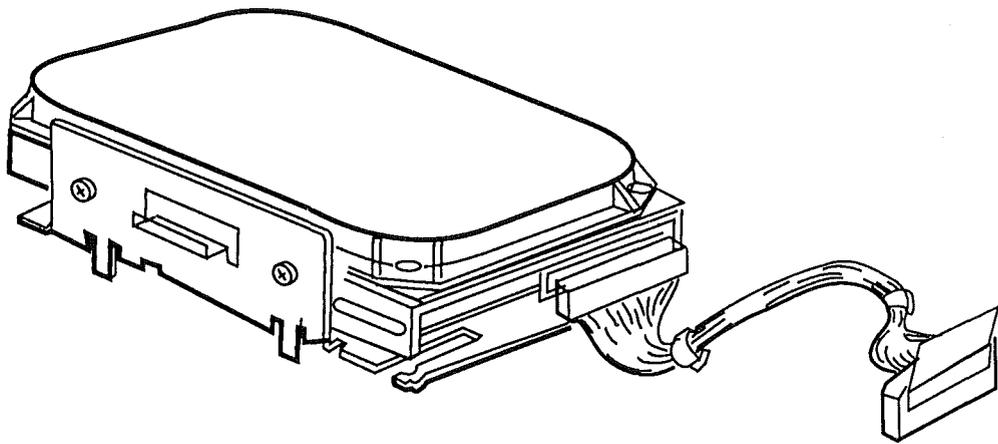


FIGURE 9

□ SCSI HARD DISK DRIVE (Figure 9)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	661-0540	HDA, 3.5, 40 MB, SCSI

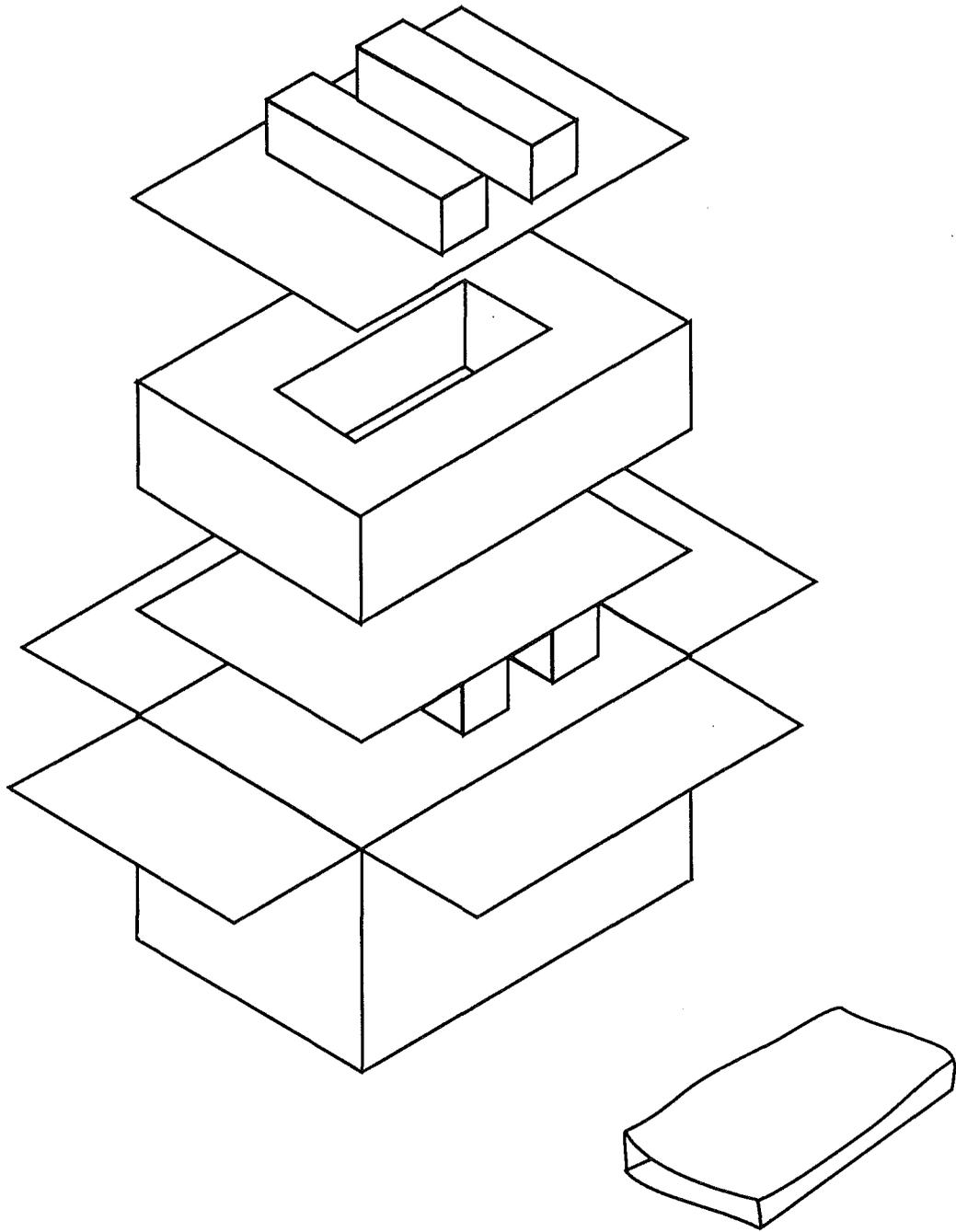


FIGURE 10

□ REQUIRED SERVICE PACKAGING (Figure 10)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	602-0210	Packaging, 800K/FDHD/SuperDrive
	805-5050	Shipping Fixture, FDHD/SuperDrive Mechanism
	602-0208	Packaging, Battery (6 V)

||

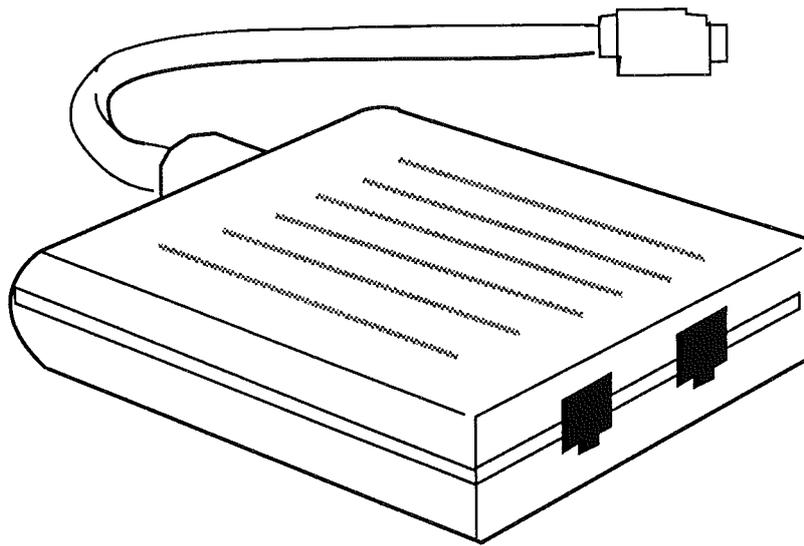


FIGURE 11

□ DATA ACCESS ARRANGEMENT (DAA) (Figure 11)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
-	AU077-0235	DAA, Austria, International XP 2400
	FN077-0235	DAA, Belgium, International XP 2400
	DK077-0235	DAA, Denmark, International XP 2400
	K077-0235	DAA, Finland, International XP 2400
	F077-0235	DAA, France, International XP 2400
	D077-0235	DAA, Germany, International XP 2400
	N077-0235	DAA, Holland, International XP 2400
	EI077-0235	DAA, Ireland, International XP 2400
	T077-0235	DAA, Italy, International XP 2400
	H077-0235	DAA, Norway, International XP 2400
	Y077-0235	DAA, Spain, International XP 2400
	S077-0235	DAA, Sweden, International XP 2400
	SD077-0235	DAA, Switzerland, International XP 2400
	B077-0235	DAA, United Kingdom, International XP 2400

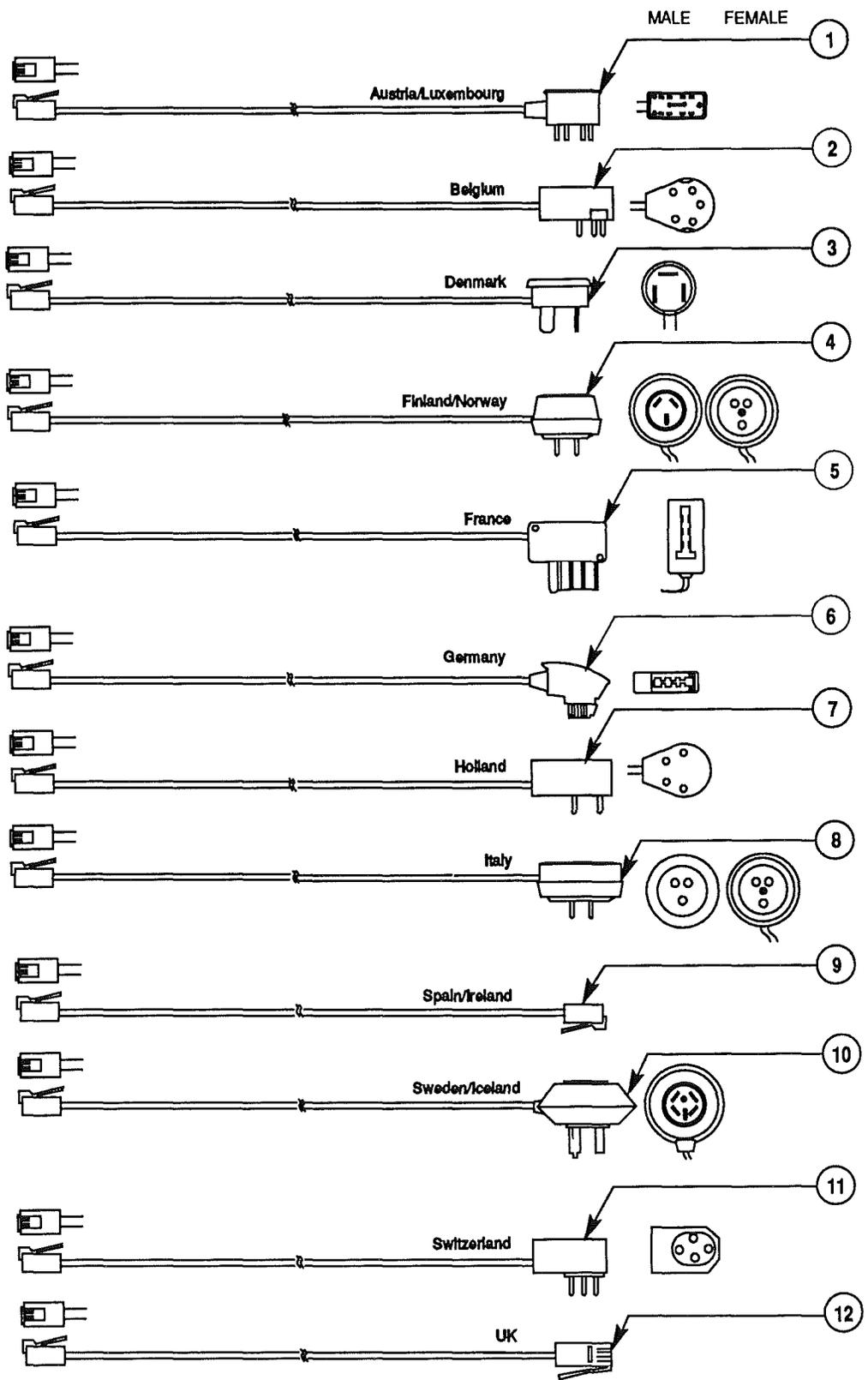


FIGURE 12

□ DAA CABLES (Figure 12)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	AU076-8369	DAA Cable, Austria/Luxembourg
2	FN076-8369	DAA Cable, Belgium
3	DK076-8369	DAA Cable, Denmark
4	H076-8369	DAA Cable, Finland/Norway
5	F076-8369	DAA Cable, France
6	D076-8369	DAA Cable, Germany
7	N076-8369	DAA Cable, Holland
8	T076-8369	DAA Cable, Italy
9	Y076-8369	DAA Cable, Spain/Ireland
10	S076-8369	DAA Cable, Sweden/Iceland
11	SD076-8369	DAA Cable, Switzerland
12	B076-8369	DAA Cable, United Kingdom

