Macintosh LC II Computer

Developer Note

Developer Note

Developer Technical Publications
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Preface

About this note

This developer note provides technical information about the Apple Macintosh LC II computer. Chapter 1 describes the Macintosh LC II hardware, emphasizing only those features that are new or different from those of the Macintosh LC computer. Chapter 2 describes the Macintosh LC II software.

This document is written for hardware and software developers who are already familiar with both the functionality and programming requirements of Macintosh computers. If you are unfamiliar with Macintosh computers or would simply like additional information, you may want to obtain copies of related technical manuals listed in the following section, "Supplemental Reference Documents."

This developer note does not constitute a manual and is not complete in its present form. While every attempt has been made to verify the accuracy of the information presented, it is subject to change without notice. This developer note may contain information or specifications that are still under consideration by Apple Computer. The primary reason for releasing preliminary product information is to provide the development community with essential product specifications, theory, and application information for the purpose of stimulating work on compatible third-party products.

Supplemental reference documents

Because the Macintosh LC II computer shares many features of the Macintosh LC, you should refer to the *Macintosh LC Computer Developer Note* for information about features not described in detail here. The *Macintosh LC Computer Developer Note* is available from APDA (Apple Programmers and Developers Association) as part of *Macintosh IIsi, LC, and Classic Developer Notes,* APDA part number M0991LL/A.

In addition, the following books provide helpful information for anyone interested in designing hardware or software for Macintosh computers. All are available through APDA.

- *Guide to the Macintosh Family Hardware*
- *Designing Cards and Drivers for the Macintosh Family*
- *Inside Macintosh*
- *MC68030 Enhanced 32-Bit Microprocessor Users Manual*

Membership in APDA allows you to purchase Apple technical documentation, programming tools, and utilities. For more information, contact

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Chapter 1 **Macintosh LC II Hardware**

This chapter describes the major features of the Macintosh LC II computer and emphasizes the similarities and differences between it and the Macintosh LC.

△ **Important** Only the major differences between the Macintosh LC II and the Macintosh LC are described in detail here. For more information about features common to both models, refer to the Macintosh LC section of the *Macintosh IIsi, LC, and Classic Developer Notes*, APDA part number M0991LL/A. △

Introduction

The Macintosh LC II computer is an enhanced version of the Macintosh LC computer. The Macintosh LC II features a Motorola 68030 microprocessor instead of the 68020 used in the Macintosh LC. In addition to being more powerful, the 68030 in the Macintosh LC II supports the virtual memory features of System 7. Performance is slightly better than that of the Macintosh LC and about 3.5 times better than that of the Macintosh Classic computer. Like the Macintosh LC, the Macintosh LC II uses internal video circuitry to drive an external color or monochrome monitor. A sleek, lightweight case design makes the machine extremely easy to transport.

The Macintosh LC II is an ideal computer for business productivity, terminal replacement, creativity, animation, entertainment, teaching, and learning.

Major features

The Macintosh LC II includes these features:

- Microprocessor: 68030 running at 15.6672 MHz.
- Read-only memory (ROM): 512 KB socketed to main logic board. Optional expansion to 2 MB.
- Random-access memory (RAM): 4 MB soldered to main logic board; 2 SIMM (Single In-line Memory Module) sockets for expansion up to 10 MB.
- Floppy disk: one internal 20-pin floppy disk connector. One 1.4 MB Apple SuperDrive with Super Woz Integrated Machine (SWIM) interface is standard.
- Hard disk: one optional internal Small Computer System Interface (SCSI) hard disk can be installed. Additional SCSI hard disks can be attached to the external SCSI port.
- I/O: one Apple Desktop Bus (ADB) port, two mini-DIN 8 serial ports, one DB-25 SCSI port, one monophonic audio output jack (for headphone or external speaker), one monophonic audio input jack (for microphone or line input), and one DB-15 video connector.

- Video: built-in video support for Apple 12-inch and 13-inch RGB monitors. A color look-up table (CLUT) allows the selection of 256 colors from a palette of 16 million colors. The video interface is RS-343. An internal video connector facilitates development of video overlay cards for the expansion slot.

  Video data is stored in a video RAM (VRAM) SIMM. The Macintosh LC II can be configured with either 256 KB or 512 KB of VRAM. With 256 KB of VRAM installed, the following video modes are supported: 512 x 384 monochrome or 8-bit color on the 12-inch RGB monitor, and 640 x 480 monochrome or 4-bit color on the 13-inch RGB monitor. With 512 KB of VRAM installed, the Macintosh LC II also supports 16-bit color on the 12-inch monitor and 8-bit color on the 13-inch monitor.

◆ *Note:* Apple offers a card that allows users to run their Apple IIe software on the Macintosh LC and LC II computers. With this card installed in the expansion slot, the 12-inch color monitor will support a 560 x 384 x 4-bit color display mode for Apple IIe software.

- Sound: monaural sound input and output system identical to that of the Macintosh LC. A microphone is included as standard equipment.
- Expansion: a Euro-DIN 96-pin processor-direct slot (PDS) connector on the main logic board provides direct access to the 68030 processor by an optional expansion card. Maximum power budget is 4 watts (800 mA at +5 volts). To maintain compatibility with the Macintosh LC, the 96-pin PDS connector is used instead of the 120-pin PDS connector used on other 68030-based Macintosh computers.
- Keyboard: a detached ADB keyboard with numeric keypad and ADB mouse.
- Networking: LocalTalk is standard; future support for network booting over LocalTalk, EtherTalk, and TokenTalk. Apple also offers an Ethernet card.

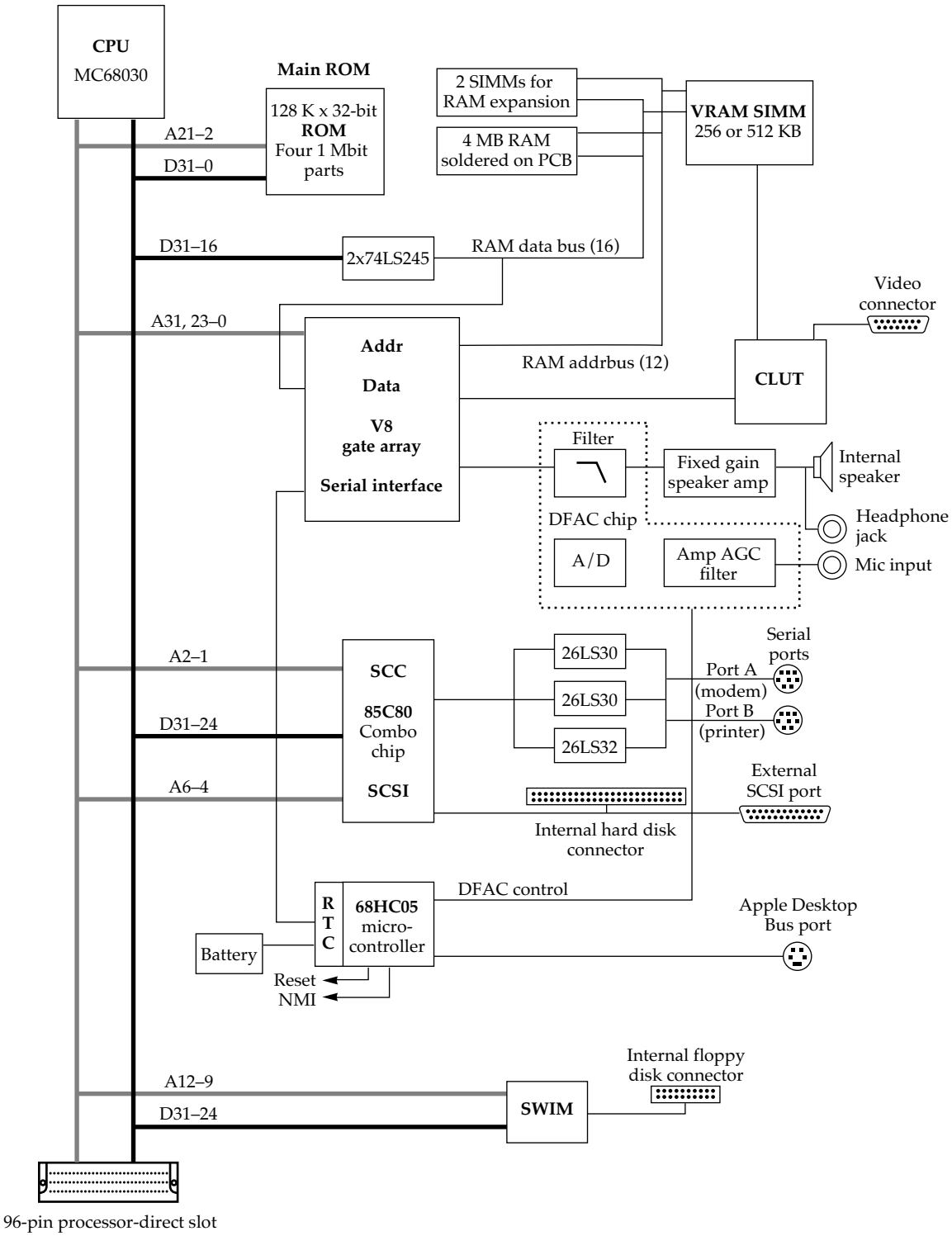
Design differences

The design of the Macintosh LC II is nearly identical to that of the Macintosh LC. The major differences between the Macintosh LC and LC II are:

- The Macintosh LC II uses a 68030 processor rather than the 68020 used in the Macintosh LC.
- The Macintosh LC II comes standard with 4 MB RAM soldered to the main logic board, while the Macintosh LC has 2 MB soldered down. Both computers support a maximum of 10 MB RAM.
- The Macintosh LC has a second internal floppy disk connector for the addition of a second (optional) 1.4 MB Apple SuperDrive. The Macintosh LC II does not support additional internal or external floppy disk drives.
- The Macintosh LC II microphone kit does not include a phonograph adapter plug.
- The Macintosh LC II uses a slightly modified version of the Macintosh LC case.

The block diagram in Figure 1-1 shows how the major components of the Macintosh LC II computer are interconnected.

■ **Figure 1-1** Block diagram of the Macintosh LC II computer



Compatibility issues

This section discusses the hardware compatibility issues specific to the Macintosh LC II computer. Refer to the *Macintosh LC Computer Developer Note* for information about issues common to both models.

Expansion connector

The Euro-DIN 96-pin PDS expansion connector on the main logic board is physically and electrically identical to the 68020 Direct Slot used in the Macintosh LC. This slot provides direct access to all of the 68030/020 data and address signals, and a selection of control signals.

The expansion connector allows hardware developers to increase the functionality of the Macintosh LC and LC II computers by designing expansion cards such as coprocessors, video cards, networking cards, and so on. The features that you implement in your design are limited only by the size of the card (approximately 3 inches by 5 inches) and the available power (maximum 4 watts at +5 volts). Cards and drivers designed for the Macintosh LC will work equally well in the Macintosh LC II and vice versa, with the following considerations:

- Your card and software must be compatible with the 68030 microprocessor. For example, the memory management unit (MMU) in the 68030 generates a bus error when a bad address is encountered (such as attempting to access memory that does not exist), whereas these errors are not detected by the 68020. Refer to the *MC68030 Enhanced 32-Bit Microprocessor Users Manual* for compatibility guidelines.
- The FC3 function code signal on the expansion connector, which selects 24- or 32-bit memory addressing mode on the Macintosh LC, is always driven high in the Macintosh LC II. Expansion cards are always addressed in 32-bit mode on the Macintosh LC II. The MMU remaps all logical 24-bit expansion card addresses ($E0 0000–$EF FFFF) to their physical 32-bit equivalent ($FE00 0000–$FE0F FFFF).

◆ *Note:* The physical and electrical design guidelines for Macintosh LC II expansion cards are identical to those of the Macintosh LC. Refer to the *Macintosh LC Computer Developer Note* for specifications.

Mathematics coprocessor

Although the Macintosh LC II computer does not include a built-in mathematics coprocessor, the V8 gate array provides the necessary decoding for an optional Motorola 68882 floating point unit (FPU). Expansion card designers can include an FPU in their card design because the FPU select signal is supplied to the PDS expansion connector.

Application software should not assume that any Macintosh computer has an FPU simply because it uses a 68030 microprocessor. To ensure that your application is compatible with the Macintosh LC II, the Macintosh LC, and future Macintosh computers that may not have FPUs, use the Gestalt Manager (included in system software versions 6.0.4, and later). The Gestalt Manager allows you to determine the exact configuration of the machine on which your application is running. Chapter 2 explains how to identify the Macintosh LC II using the Gestalt Manager. Refer to Chapter 3 of *Inside Macintosh*, *Volume VI* for complete information about the Gestalt Manager.

Chapter 2 **Macintosh LC II Software**

This chapter summarizes the ROM changes necessary to support the Macintosh LC II computer, and describes how to use the Gestalt Manager to determine whether your software is running on the Macintosh LC II.

The Macintosh LC II ROM

The ROM used in the Macintosh LC II computer includes the following differences from the Macintosh LC ROM:

- An improved SANE package.
- Additional code to support the 68030 memory management unit (MMU).
- Changes to allow operation under virtual memory.
- Changes to correct a sound allocation problem.
- Changes to RAM sizing code to support 4 MB of permanent RAM on the main logic board and up to 6 MB of expansion RAM.
- Changes to the startup code to display the desktop immediately after startup, during the memory test phase. This provides visual confirmation that the computer is on.
- Changes to the SwapMMUMode code to support the 68030. SwapMMUMode does not toggle the FC3 function code signal on the expansion connector because the Macintosh LC II always uses 32-bit mode for expansion card addresses.

These ROM changes are effectively transparent to application software developers. Existing applications will work with the Macintosh LC II computer if they adhere to the toolbox routines and do not attempt to address the hardware directly.

Identifying the Macintosh LC II

The correct method for software to identify the Macintosh model it is running on is by using the Gestalt Manager routines described in *Inside Macintosh*, Volume VI. Under system software version 7.0, the Macintosh LC II returns a `gestaltMachineType` value of 19, the same as the Macintosh LC. If your software needs to differentiate between the Macintosh LC and LC II, you can use the `gestaltProcessorType` selector to determine whether the CPU is a 68020 or 68030.

Under system software version 7.1, the Macintosh LC II returns its own unique `gestaltMachineType` response value, 37.

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This Apple manual was written, edited, and composed on a desktop publishing system using Apple Macintosh computers and Microsoft Word software. Proof pages were created on an Apple LaserWriter IINTX printer. Line art was created using Adobe Illustrator. PostScript, the page-description language for the LaserWriter, was developed by Adobe Systems Incorporated.

Text type and display type are Palatino. Bullets are ITC Zapf Dingbats.