Developer Note

PowerBook Duo Dock II

Developer Note

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About This Note

This note is a supplement to the *Macintosh Developer Notes, Number 2: Macintosh Duo System,* APDA publication number R0457LL/A. It describes the design features of the PowerBook Duo Dock II, a docking station that provides PowerBook Duo portable computers with the capabilities of a desktop computer.

The note provides the hardware or software developer with additional information needed to design hardware and software elements for the PowerBook Duo Dock II. This publication assumes you are familiar with the functionality and programming requirements for Apple Macintosh computers.

Contents of This Note

The information is arranged in three chapters and an index:

- Chapter 1, "Introduction," gives a summary of the features of the PowerBook Duo Dock II.
- Chapter 2, "PowerBook Duo Dock II Hardware," describes the hardware modifications that make the PowerBook Duo Dock II different from the original Macintosh Duo Dock.
- Chapter 3, "PowerBook Duo Dock II Software," describes the software modifications that were made to support the new features of the PowerBook Duo Dock II.

Supplementary Documents

The following documents provide information that complements or extends the information in this developer note.

- *Macintosh Developer Notes, Number 2: Macintosh Duo System,* APDA publication number R0457LL/A
- *Designing Cards and Drivers for the Macintosh Family,* third edition.

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Conventions and Abbreviations

This developer note uses the following typographical conventions and abbreviations.

Typographical Conventions

A distinction is made between boards and cards. Boards are a permanent part of the PowerBook Duo Dock II, for example the main logic board. Cards may be inserted into the system and can be added or exchanged.

Hexadecimal numbers are preceded by a dollar sign ($). For example, the hexadecimal equivalent of decimal 16 is written as $10.

Special Elements

This developer note has two kinds of special paragraphs: Note and Important.

Note
A note like this contains information that is interesting but not essential for an understanding of the text. ◆

IMPORTANT
A note like this contains important information that you should read before proceeding. ▲

Standard Abbreviations

When unusual abbreviations appear in this book, the corresponding terms are also spelled out. Standard units of measure and other widely used abbreviations are not spelled out. Here are the standard units of measure used in Apple developer notes:

A	amperes	kg	kilograms
dB	decibels	kHz	kilohertz
Hz	hertz	kΩ	kilohms
in.	inches	lb.	pounds
K	1024	mA	milliamperes
KB	kilobytes	µA	microamperes
MB	megabytes	µs	microseconds
Mbit	megabits	sec.	seconds
MHz	megahertz	V	volts
min.	minutes	W	watts
mm	millimeters	Ω	ohms
ms	milliseconds		

Here are other abbreviations used in this developer note:

$*n*	hexadecimal value *n*
AC	alternating current
ADB	Apple Desktop Bus
AM	active matrix
AUI	auxiliary unit interface
bpp	bits per pixel
CLUT	color lookup table
CPU	central processing unit
DAA	data access adapter

DAC	digital-to-analog converter
DC	direct current
DMA	direct memory access
DRAM	dynamic RAM
DRQ	data request
DSACK	data transfer and size acknowledge
ENet	Ethernet
FPU	floating-point unit
IC	integrated circuit
ID	identification
I/O	input/output
MUX	multiplex
RAM	random-access memory
RGB	red-green-blue
rms	root mean square
SCC	Serial Communications Controller
SCSI	Small Computer System Interface
SRAM	static RAM
SVGA	super video graphics array
SWIM	Super Woz Integrated Machine (a custom IC that controls the floppy disk interface)
VDAC	video digital-to-analog converter
VGA	video graphics array
VRAM	video RAM

CHAPTER 1

Introduction

Introduction

The PowerBook Duo Dock II is an enhanced version of the original Duo Dock providing the docking capability that turns PowerBook Duo computers into fully functional desktop computers. It is completely compatible with the Macintosh Duo System and can accommodate existing PowerBook Duo computers. At the same time, it provides new features that improve performance and expandibility of the PowerBook Duo computers. For example, the PowerBook Duo Dock II main logic board includes built-in support for both Ethernet and 21-inch video displays. The original Duo Dock required NuBus™ cards to support these functions. By providing these features on the main logic board, the NuBus slots are freed up for other uses.

Features of the PowerBook Duo Dock II are listed below. Most of these features are discussed in detail in Part Three, "Macintosh Duo Dock," of *Macintosh Developer Notes, Number 2.* Those features that are new, and different from the original Duo Dock are described in more detail later in Chapters 2 and 3 of this note.

- Macintosh I/O: external HDI-30 SCSI connector, mini-DIN 4 ADB connector for mouse or external keyboard, two serial communication ports for modem and printer, monaural sound input and output, on/off switch
- built-in speaker
- 152-pin connector that connects to the PowerBook Duo's interface connector
- internal 1.4 MB Apple SuperDrive floppy disk drive, with auto-insert and auto-eject mechanism
- internal 50-pin SCSI connector for optional hard disk drive
- integral bay for optional 3.5-inch hard disk drive
- video port for external monitor: supports 12- to 16-inch displays at 16 bits per pixel; supports 21-inch displays at 8 bits per pixel
- VGA and SVGA support for color monitors
- 1 MB of VRAM standard for 16-bit video capability
- NuBus adapter card with slots for two full-sized 15 W NuBus card, or one 25 W card
- standard onboard FPU
- modified cover that supports up to 85-pound monitors
- larger CPU slot to accommodate taller versions of the PowerBook Duo computer
- 32 KB of direct-mapped CPU cache SRAM memory
- built-in Ethernet connector and supporting 33 MHz Sonic Ethernet master
- PowerLatch technology
- security key to lock the PowerBook Duo computer in the Duo Dock
- 75 W power supply with switched AC outlet for monitor power
- modem adapter card to connect the PowerBook Duo modem to a phone line

Chapter 2, "PowerBook Duo Dock II Hardware," describes the new features of the PowerBook Duo Dock II that make it different from the original Duo Dock. Chapter 3, "PowerBook Duo Dock II Software," describes the software differences between the two machines.

CHAPTER 2

PowerBook Duo Dock II Hardware

This chapter describes hardware modifications and new features that make the PowerBook Duo Dock II different from the original Macintosh Duo Dock. These modifications and features include

- enclosure changes
- standard onboard FPU
- standard 1 MB VRAM that supports 8-bit and 16-bit video capabilities
- 32-bit video pixel bus
- 32 KB SRAM cache for improved performance
- onboard Ethernet capability with Apple AUI

Features common to both the PowerBook Duo Dock II and the original Macintosh Duo Dock are described in Part Three, "Macintosh Duo Dock," of *Macintosh Developer Notes Number 2*.

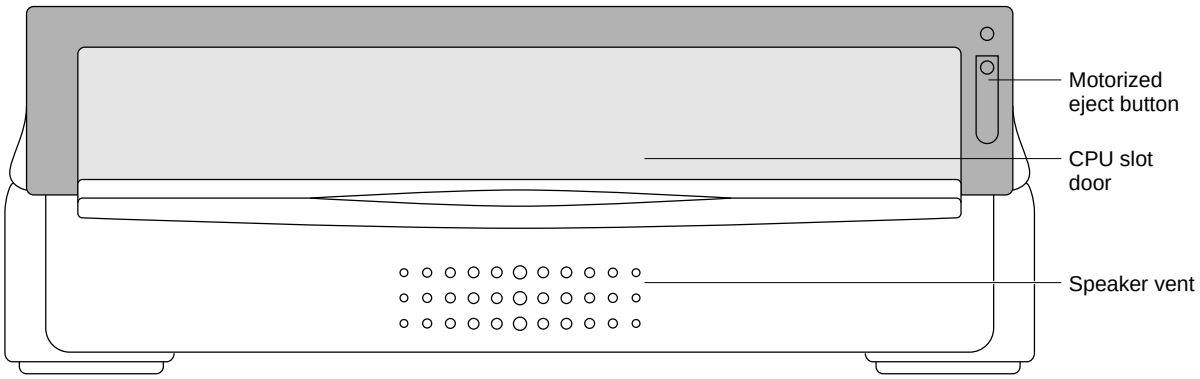
PowerBook Duo Dock II Enclosure

The PowerBook Duo Dock II enclosure looks basically the same as the original Duo Dock enclosure; however, the following changes have been made in the design:

- Height of the top cover has been increased 9 mm to accommodate future PowerBook models that are slightly thicker because of AM displays.
- A tracking mechanism in the top cover enables original PowerBook Duo computers to be reliably docked in the PowerBook Duo Dock II.
- A protective door covers the front slot.
- Housing has been reinforced to stand the weight of an 85-pound 21-inch monitor.
- Venting of the enclosure has been modified to improve airflow around NuBus cards.

Figure 2-1 shows a front view of the PowerBook Duo Dock II.

Figure 2-1 Front view of the PowerBook Duo Dock II



The increased height of the top cover makes the PowerBook Duo Dock II 9 mm (0.35 inch) taller than the standard Macintosh Duo Dock. As a result, there is a larger vertical opening (slot) that allows docking of future PowerBook models that that are slightly thicker than earlier models because of their active matrix screens. Enclosure specifications are listed in Table 2-1.

Table 2-1 Enclosure dimensions and weight

Specification	Measurements (inches or pounds)	Measurements (mm or kg)
Depth	16.37 inches	415.6 mm
Width	12.75 inches	323.8 mm
Height	6.22 inches	158 mm
Width of CPU opening	10.90 inches	277 mm
Height of CPU opening	1.89 inches	48 mm
Weight without hard disk	13.60 pounds	6.17 kg
Weight with hard disk	15.20 pounds	6.9 kg

Guide arms underneath the top cover act as a tracking mechanism to ensure reliable docking of different size PowerBook Duo computers. This feature lets you use the PowerBook Duo Dock II with the older PowerBook Duo computers, which are slightly thinner than some newer versions that have active matrix displays. The mechanism engages the upper-right and upper-left corners of the CPU housing and prevents the CPU from missing the inject motor alignment pins.

A door over the CPU slot, in the front of the enclosure, gives the Power Duo Dock II a more streamlined look and serves as a visually distinguishes the PowerBook Duo Dock II from the original Macintosh Duo Dock.

IMPORTANT

Although you can use earlier PowerBook Duo computers with the PowerBook Duo Dock II, you cannot insert certain later models of the PowerBook Duo computer into the original Macintosh Duo Dock unless you obtain an upgrade kit for the original Duo Dock enclosure. ▲

Internal support bars inside the enclosure have been redesigned to support the weight of heavier and larger monitors. The PowerBook Duo Dock II can support from 13-inch to 21-inch monitors weighing up to 85 pounds.

Air is drawn into the enclosure through three sets of vents: one on the bottom of the enclosure in the front right corner, one on the rear panel in the left corner, and one on the left panel in the front corner. Air is exhausted through a vent on the right side of the enclosure in the rear corner. This method of routing the airflow through the PowerBook Duo Dock II provides improved ventilation for any NuBus cards that are mounted in the NuBus slots, which are located at the right side of the enclosure.

IMPORTANT
The spatial orientation of the PowerBook Duo Dock II assumes that you are standing in front of the unit. The panel designated the right panel is the one on your right as you face the unit. The left panel is the one on your left. ▲

Main Logic Board

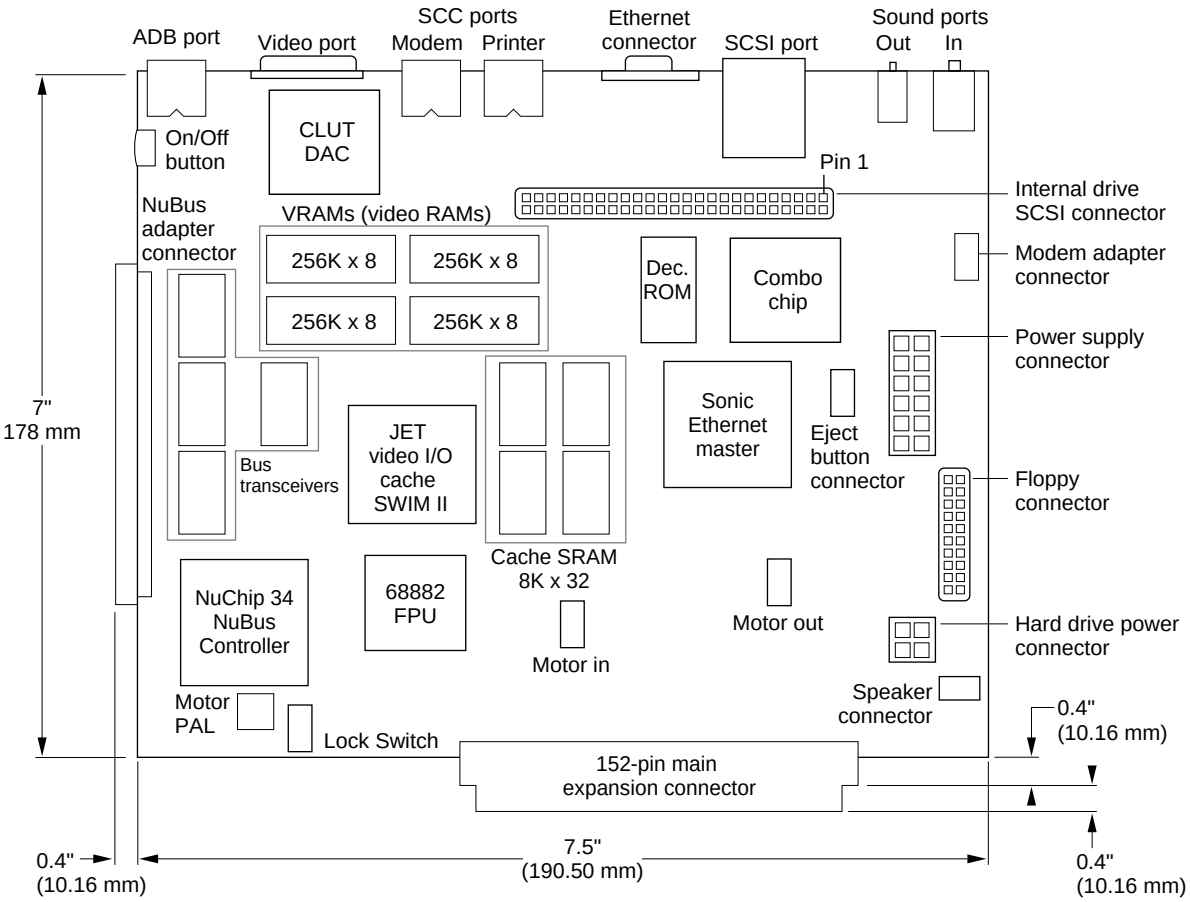
Except for the front-to-back length, which has been increased by 1 mm, the PowerBook Duo Dock II main logic board has the same dimensions and outline as the Macintosh Duo Dock main logic board. However, there are some changes in the component configuration. Figure 2-2 shows the outline of the board with dimensions. The items that differ are

- a new custom IC that controls I/O, cache, floppy disk drives, and Apple AUI
- Ethernet connector
- SRAMs used for direct-mapped cache
- 1 MB of standard VRAM (no expansion VRAM slot)
- standard FPU
- 100 MHz video CLUT DAC
- smaller NuBus transceivers

These features are described later in this chapter.

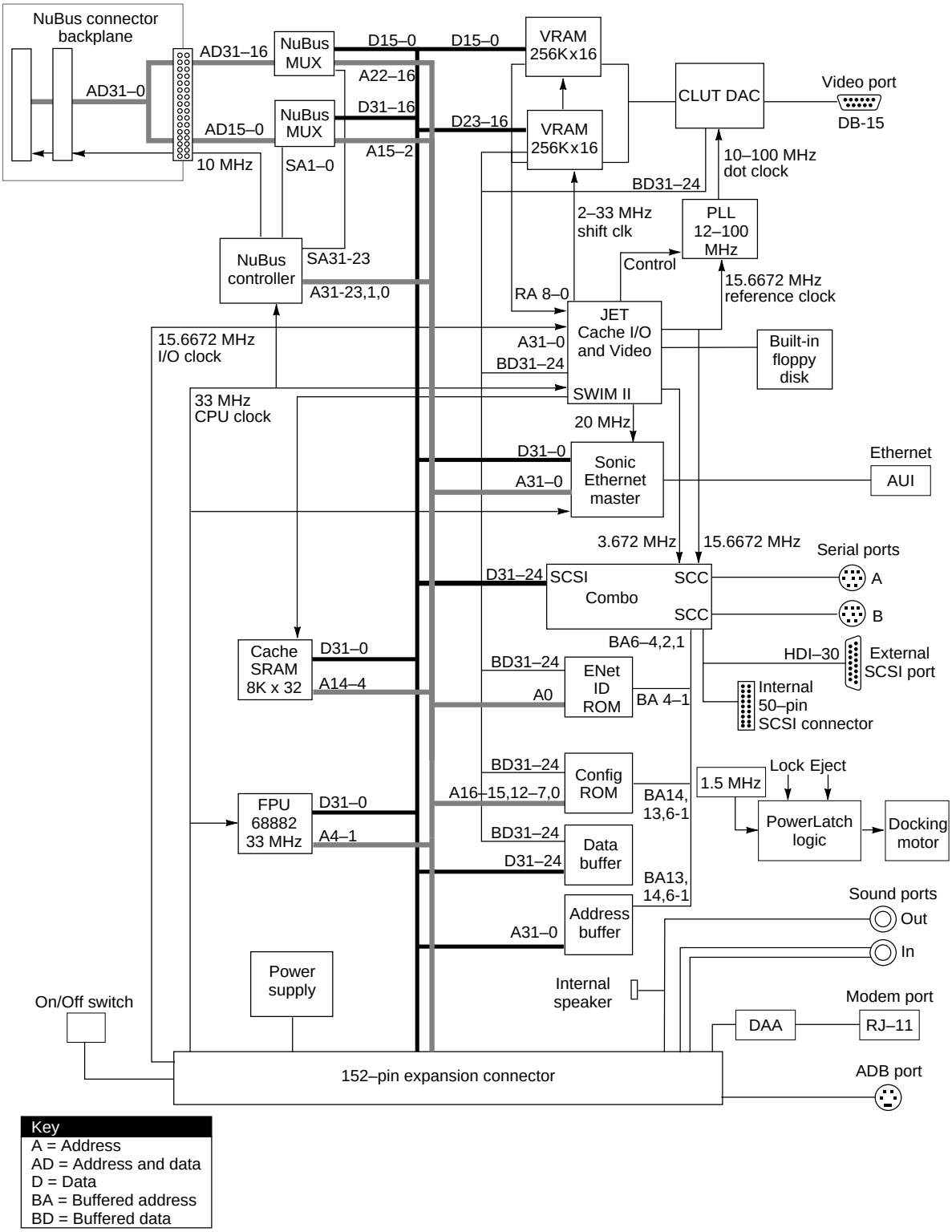
Figure 2-3 shows a block diagram of the main logic board functions.

Figure 2-2 Outline of the PowerBook Duo Dock II main logic board



Drawing not to scale

Figure 2-3 Block diagram of PowerBook Duo Dock II functions



Memory Mapping

Memory mapping for the PowerBook Duo Dock II has been modified to accommodate additional features, such as Ethernet support. Addresses for the pseudo-NuBus expansion space (see Figure 2-4) have not changed. They are assigned as follows:

- Addresses $FEE0 0000 through $FEF0 0000 are assigned to I/O space accessible in 32-bit mode (see Figure 2-5).
- Addresses $FE00 0000 though $FE10 0000 are assigned to I/O space accessible in 24-bit mode (see Figure 2-6).

Figure 2-4 Pseudo-NuBus expansion slot memory map

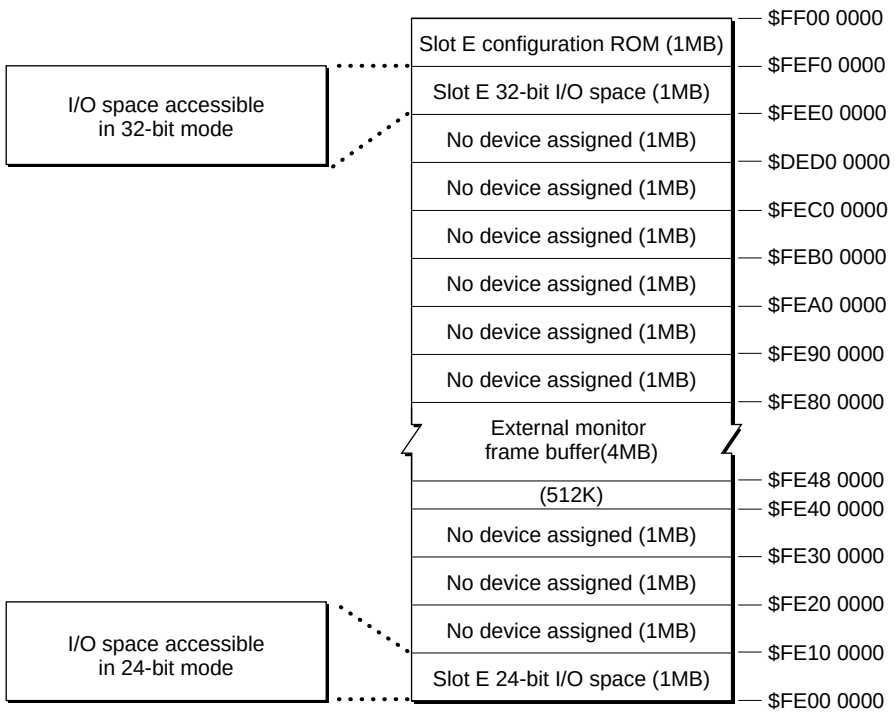


Figure 2-5 shows the addresses assigned to I/O space accessible in 32-bit mode.

Figure 2-5 Memory map of I/O space accessible in 32-bit mode

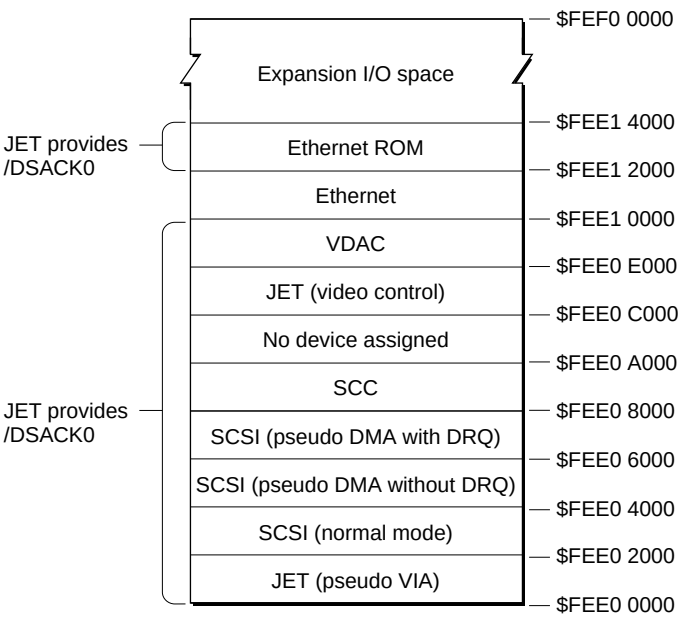
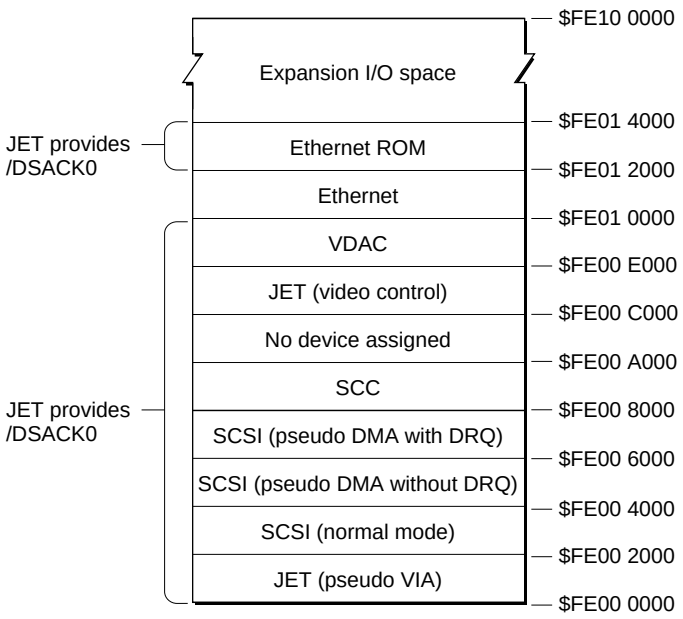


Figure 2-6 shows the addresses assigned to I/O space accessible in 24-bit mode.

Figure 2-6 Memory map of I/O space accessible in 24-bit mode



Hard Disk Drive

The PowerBook Duo Dock II includes physical space to accommodate a 1/3 high (1 inch) hard disk drive, with a 50-pin SCSI interface and a 4-pin power connector. If a third party is installing a hard disk drive in the PowerBook Duo Dock II, it is also up to the third party to provide the appropriate SCSI cable to connect the drive to the SCSI internal connector shown in Figure 2-2. The cable is a 50-wire ribbon cable, with a 50-pin connector at each end. Figure 2-7 shows the cable with the relative position of pin 1. The pin assignments and signal descriptions for the connector are provided in the next section of this chapter.

Figure 2-7 Hard disk drive cabling

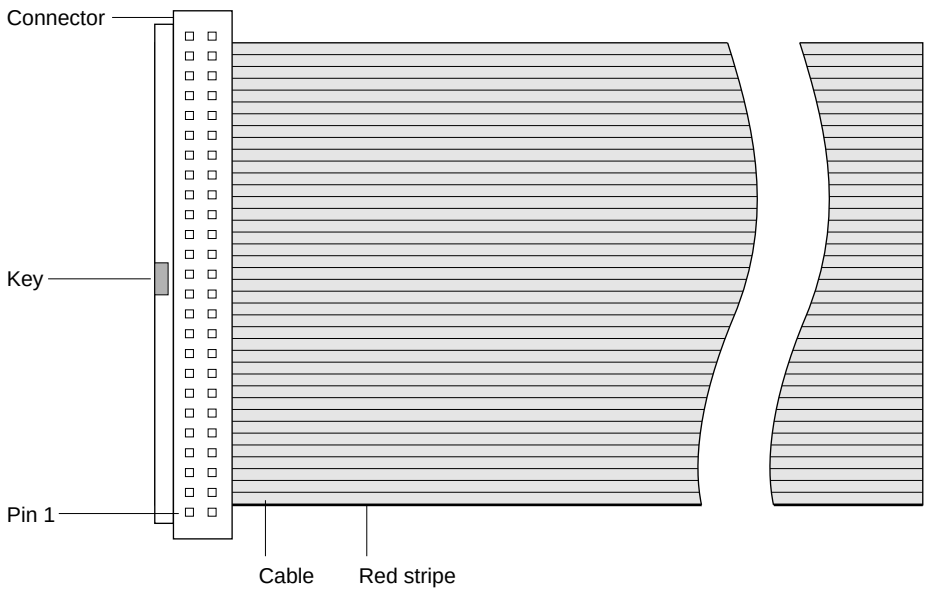


Table 2-2 lists the power available for the hard disk drive upgrade

Table 2-2 Hard disk drive power specifications

Current	Voltage
700 mA	+5 V no surge
300 mA	+12 V steady state

NOTE 1.0 A additional on +12 V for a surge duration of 8 seconds

Internal SCSI Connector

The PowerBook Duo Dock II provides an internal SCSI connector for a third-party hard disk drive. The 50-pin SCSI connector is mounted on the main logic board and connects to the internal hard disk by means of the custom cable described in the previous section. If an internal hard disk drive is not installed, an active terminator plug is inserted in the SCSI connector to provide termination for the Duo Dock II side of the SCSI bus. Table 2-3 shows the pin assignments and signal descriptions for the internal connector.

Note

Inputs (I) and outputs (O) are referenced to the PowerBook Duo computer. For example, /SEL is output by the computer to the hard disk drive. When the computer drives /SEL low, it selects the related hard disk (or other SCSI device). ◆

Table 2-3 Internal SCSI connector signal assignments

Pin number	Signal name	I/O	Description
1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 33, 34, 35, 37, 39, 41, 43, 45, 47, 49	GND		Ground
2	DB0	I/O	SCSI data bit 0
4	DB1	I/O	SCSI data bit 1
6	DB2	I/O	SCSI data bit 2
8	DB3	I/O	SCSI data bit 3
10	DB4	I/O	SCSI data bit 4
12	DB5	I/O	SCSI data bit 5
14	DB6	I/O	SCSI data bit 6
16	DB7	I/O	SCSI data bit 7
18	DBP	I/O	SCSI data parity bit
26	TERM PWR		+5 V power for the terminating resistors
32	/ATN	I	When active (low), indicates a SCSI attention condition
36	/BSY	I	When active (low), indicates the SCSI data bus is busy

continued

Table 2-3 Internal SCSI connector signal assignments (continued)

Pin number	Signal name	I/O	Description
38	/ACKS	I	Handshake signal; when low, acknowledges a request for data transfer
40	/RST	O	SCSI bus reset
42	/MSG	I	Indicates the SCSI message phase
44	/SEL	O	Driven low to select a SCSI device (hard disk)
46	/C/D	O	When low, indicates that data is on the SCSI bus; when high, indicates that control signals are on the bus
48	/REQ	O	Request for a data transfer
50	/I/O	O	Controls the direction of data flow; when low, data is output from the computer to the disk drive; when high, data is input to the computer from the disk drive

Note

The HDI-30-pin connector located on the edge of the main logic board is the external SCSI port for the PowerBook Duo Dock II (see Figure 2-2). It is described in Chapter 14, "Macintosh Duo Dock Hardware," of *Macintosh Developer Notes, Number 2.* ◆

Video Support

Unlike the original Macintosh Duo Dock, the PowerBook Duo Dock II has 1 MB of VRAM built into the main logic board. The VRAM consists of four 256K x 8-bit VRAM devices, with an access speed of 80 ns or less. The position of the VRAM on the board is shown in Figure 2-2, earlier in this section.

Since the video hardware can support dot clocks of up to 100 MHz, the PowerBook Duo Dock II can support new 19- and 21-inch displays that cannot be supported by the original Macintosh Duo Dock. In general, the PowerBook Duo Dock II provides the same level of display support as is provided by the Macintosh Quadra 950, Macintosh Centris 610 and 650, and the Macintosh Quadra 800. Table 2-4 lists all the displays supported by the PowerBook Duo Dock II. The additional displays are shown in boldface.

An added feature of The PowerBook Duo Dock II video system is programmable sync-on-green. If the unit senses that a VGA or super VGA monitor is connected, the sync-on-green signal is disabled (default condition) so that the green channel will not include video sync information. This prevents the "green tint" that can occur on VGA and super VGA monitors. The sync-on-green signal is automatically enabled when a non-VGA monitor is connected.

Table 2-4 Displays supported by the PowerBook Duo Dock II

Display	Resolution (horizontal x vertical)	Bits per pixel (bpp)
12″ RGB	512 x 384	1–16 bpp
12″ monochrome	640 x 480	1–16 bpp*
13″ and 14″ RGB	640 x 480	1–16 bpp
VGA	640 x 480	1–16 bpp
Super VGA (56 Hz)	800 x 600	1–16 bpp†
Portrait	640 x 870	1–8 bpp
15″ RGB	640 x 870	1–8 bpp
16″ RGB	832 x 624	1–16 bpp
19″ RGB	**1024 x 768**	**1–8 bpp**
Two-page	**1152 x 870**	**1–8 bpp**
21″ RGB	**1152 x 870**	**1–8 bpp**

* The Apple 12″ High-Resolution Monochrome Display shares the sense code ($06) with the 13″ and 14″ Color Displays. Therefore, the Monitor control panel allows you to select up to “Thousands” of colors. However, if you put the monochrome display into the 16 bpp mode required to select those colors, you will only have 32 available shades of gray. If you are using a monochrome display, you are advised not to select 16 bpp mode, although it is available.

† Super VGA is accessed as a family mode option of VGA, and you must be connected to a display capable of supporting both VGA and Super VGA timing.You select Super VGA through the Monitors control panel Options button. Once you have selected Super VGA, the Super VGA timing is used each time the system is booted.

Power Supply

The PowerBook Duo Dock II power supply was designed specifically for this docking station. It provides the same DC voltages as the power supply used in the original PowerBook Duo and described in Chapter 14, "Macintosh Duo Dock Hardware," of *Macintosh Developer Notes, Number 2*. However, some of the electrical specifications are slightly different, and they are defined in this section. Table 2-5 summarizes DC output currents and power requirements.

Table 2-5 DC output currents and power

Load condition	+5 V	+12 V	–12 V	+19 V	Total power
Minimum load	0.5 A	0.00 A	0 mA	0.00 A	2.50 W
Maximum load	8.36 A	1.24 A	0.30 A	1.00 A	79.28 W
Peak load	8.36 A	2.24 A*	0.30 A	1.00 A	87.68 W
Peak load	0.00 A	0.00 A	0.00 A	1.40 A†	26.60 W

* The peak load can be applied for a period of 15 seconds, maximum; duty cycle to be 10%. The +12V supply may drop to 11.0 V during the peak load.

† The peak load for +19V has a constant-power, negative-resistance characteristic, and a 50 µs surge of 1.4 A during the time the motor is initially powered up.

Table 2-6 lists DC voltage cross-regulation limits.

Table 2-6 DC output voltage cross-regulation limits

Condition	+5 V	+12 V	–12 V	+19 V	Unit
Minimum	+4.85	+11.40	–10.80	+18.00	VDC
Maximum	≤+5.25	≤+12.8	≤–13.20	≤21.00	VDC

Network Support

The PowerBook Duo Dock II has built-in support for the Ethernet high-speed, local area network system, in the form of a built-in EtherTalk port. The Ethernet connector is an Apple AUI connector. It accepts Apple Ethernet adapters, which provide transceivers for thick net, thin net, and 10BaseT cables. Figure 2-8 shows the rear panel of the PowerBook Duo Dock II, with the Ethernet connector.

Figure 2-8 Rear view of PowerBook Duo Dock II

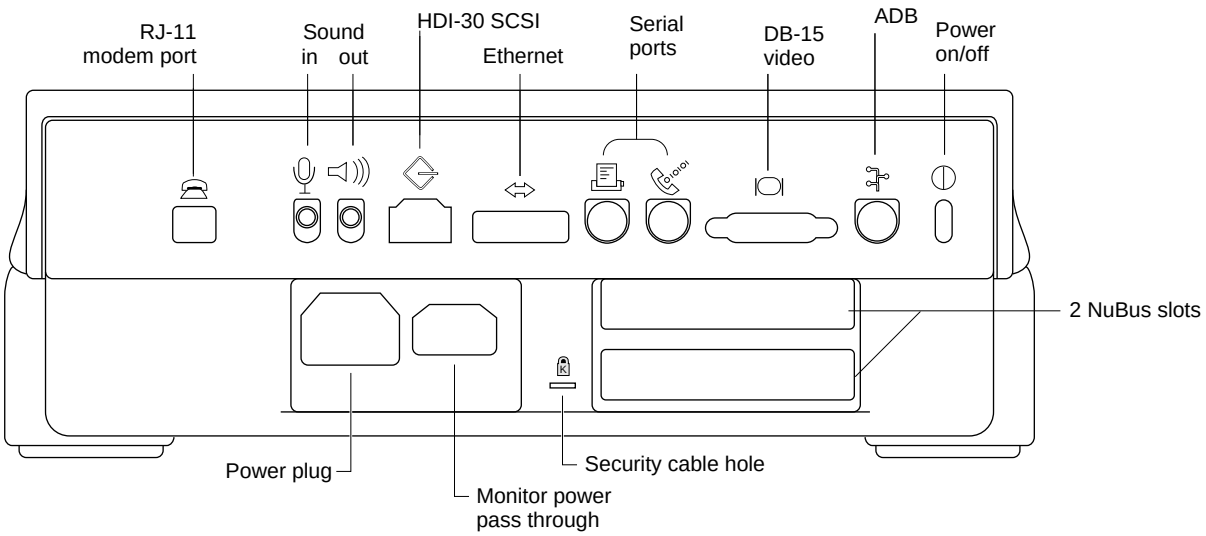
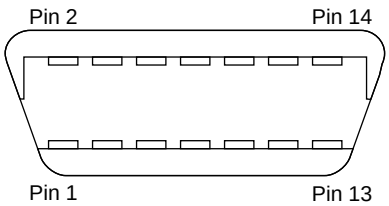


Figure 2-9 shows details of the Ethernet connector.

Figure 2-9 The 14-pin Ethernet connector



Connector viewed from side of printer

Odd pins in one row
even pins in other row

Table 2-7 lists the pin assignments for the Ethernet connector and provides signal descriptions.

Table 2-7 Ethernet connector signal assignments

Pin number	Signal name	I/O	Description
1, 7, 8, 14	AUI+5V	I	+% V power
2	RX+EXT	I	Receive data positive
3	RX EXT	I	Receive data negative
4, 11	GND	—	Ground
5	CD+EXT	O	Carrier detect positive
6	CD EXT	O	Carrier detect negative
9	TX+EXT	O	Transmit data positive
10	TX EXT	O	Transmit data negative
12, 13	No connection	—	Open line

NOTE In Table 2-7, *I* indicates an incoming signal (to the Duo Dock II) and *O* indicates an outgoing signal (from the Duo Dock II).

CHAPTER 3

PowerBook Duo Dock II Software

The PowerBook Duo Dock II software has been upgraded to support a variety of additional features that were not supported by the original Macintosh Duo Dock software. The built-in video software now supports extended video capabilities. The video features supported are described in Chapter 2 of this note, under “Video Support.” The software also supports the built-in Ethernet capability, with the Apple AUI , as well as providing unified processor cache support.

Declaration ROM

The declaration ROM used in the original Macintosh Duo Dock has been extensively modified to support the enhanced video capabilities of the PowerBook Duo Dock II.

- Support was added support to remove the `'scrn'` resource for family-mode switches. This fixes the problem in which switching from VGA to SVGA causes the screen to go back to 1 bpp the next time the system is booted.
- The `'scrn'` resource is now updated to reflect the current state of Slot parameter RAM instead of deleting it.
- Code has been added to the PowerBook Duo Dock II video driver that installs a Time Manager task during dimming. This allows the screen to be activated again merely by moving the mouse.
- New CLUT DAC and associated circuit that enables the sync-on-green signal. The PowerBook Duo Dock II also supports toggling for the sync-on-green signal.

Sleep State

Currently, the system software does not allow a docked PowerBook Duo computer to go to sleep. However, the PowerBook Duo Dock II hardware is set up to accept a sleep state should any future PowerBook Duo computers support sleep docking.

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WRITER
Joyce D. Mann, Rolly Reed

EDITOR
Jeanne Woodward

ILLUSTRATOR
Deborah Dennis

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