Apple Macintosh Computers

The University of Minnesota has contracts with many computer hardware and software companies and through the U of M Bookstores provides discounted prices to departments and eligible faculty, staff and students.   Hardware products from Apple Computer, Hewlett-Packard, IBM, Zeos and many others are available and software products from Adobe, Aldus, Borland, Claris, Lotus, Microsoft, Symantec, WordPerfect and many others for Macintosh, DOS and Windows are available.

This handout covers microcomputer hardware that is part of the University of Minnesota's Microcomputer Discount Program.   We strongly suggest that you spend some time using the microcomputers you are considering to be sure they are useful for the tasks you want them to perform.   As part of this process, you should assure yourself that the software you plan to use will work with the microcomputer you plan to buy.

Currently, no University departments have plans for requiring or recommending use of any of these microcomputers in their programs and courses.

How Do I Order?   You place your order at the Computer Desk in the Minnesota Book Center in Williamson Hall.   The clerks at the Computer Desk are not prepared to answer technical questions, so if you are unsure about your purchase, please call or visit the Microcomputer HelpLine (see below).

Eligibility: University of Minnesota departments and eligible individuals may purchase through the Microcomputer Discount Program.   Eligible individuals are: any student enrolled at the University of Minnesota in a course of study leading to a degree (students with one or more hours are eligible), any faculty member and any permanent staff member.   To prove eligibility, students must show a current fee statement, faculty must show their faculty ID card or a letter from their department and staff members must show their ID card or a letter from their department.

Individuals (whether faculty, staff, or students) may purchase one computer, a desktop or portable system, per manufacturer, in a one-year period.   They may also purchase one printer per manufacturer in a one-year period.   There is no quantity restriction on departmental purchases.   Equipment purchased is for the individual's educational use and may not be resold for one year.   Violation of the agreement is grounds for disciplinary action by the University

Payment: Departments pay with   an Institutional Voucher (Form IV).   Please make sure that your IV has the proper Area and Org numbers, has the necessary signature and has ORTTA approval if necessary.   Faculty and staff can pay with a personal check, or charge to their VISA, Discover, or MasterCard account (the account must be in the name of the purchaser).   Students must pay with a cashier's check, bank check, money order, or cash, or charge to their VISA or MasterCard account (the account must be in the name of the purchaser).   Students can write checks up to $500 only.

Violations: Faculty and staff who misuse the discount program will be disciplined to the full extent of University rules and regulations and will be required to return the equipment to the bookstore.   The bookstore will refund the purchase price of the microcomputer equipment pro-rated by 10% (ten percent) for each month since the microcomputer equipment was purchased.   Faculty, staff, and students who violate the terms of the discount program will be prohibited from making any further microcomputer equipment purchases through the bookstore and will have their microcomputer lab access privileges suspended for one year.   Students who violate the Purchase Agreement will have a hold put on their records.   The hold can be removed only by returning the microcomputer equipment to the bookstore.

Changing or Canceling an Order: If you wish to change or cancel an order, send a note, signed by the person who placed the order, to: Computer Desk, c/o Minnesota Book Center, 160 Williamson Hall, 231 Pillsbury Dr. SE, Minneapolis, MN 55455.   The note should include your name, phone number, item in question, order number, and the date the equipment or software was ordered.   In addition, to speed up processing, send a copy of the order.

HelpLine: This write-up is published by Computer and Information Services (CIS).   If you have microcomputer questions or problems, you can call the CIS Microcomputer HelpLine at 626-4276 (dial MA-MICRO) between 9:00 and 4:00, Monday through Friday, or you can visit one of our HelpLine locations in person.   Locations and hours are: 152 Shepherd Labs (9-4, Monday through Friday); 99B Coffey Hall (9-12 Monday and Friday, 1-4, Wednesday); 93 Blegen Hall (1-4 Tuesday and Friday, 9-12 Thursday).

Free Training Available: The CIS Microcomputer HelpLine offers orientation sessions for all new computer owners.   These free sessions cover the basics of setting up and using your machine.   To register for a training session, call the Minnesota Book Center at 625-3854.

Memory and Memory Upgrades

Prices of memory chips can fluctuate rapidly. Prices and availability are subject to change without notice.

To purchase memory with a Mac order, go to the Book Center. To have memory installed after purchase, call Eng. Serv. (625-1595).

Macintosh Model	Mem on logic board	Max Mem

Sockets handled individually*

	Mem on logic board	Max Mem
LC III	4MB	(72 pin, 80 ns)
Centris 610	4MB	(72 pin, 80 ns)
Centris 650**	4MB	132MB (72 pin, 80 ns)
Quadra 800**	8MB	136 MB (72 pin, 60 ns)

	Mem on logic board	
		(30 pin, 100 ns)
Color Classic	4 MB	(30 pin, 100 ns)

* With 72-pin SIMMs you no longer have to add RAM in pairs or sets of four. You can also mix SIMMs, e.g. a 4MB and a 16MB.

** If you put SIMMs of the same capacity in neighboring slots, the Centris 650's and Quadra 800's memory circuitry interleaves the two SIMMs resulting in twice-normal access speeds.

Macintosh	Mem on logic board	Max Mem
LC	2 MB	(30 pin, 100 ns)
LC II	4MB	(30 pin, 100 ns)

Macintosh	Mem on logic board	Max Mem

Sockets handled in sets of 4

Macintosh	Mem on logic board	Max Mem
SE/30 II*,** IIx** IIcx	0 MB	8MB*** (30 pin, 120 ns)
IIsi	1 MB	65MB (30-pin, 120 ns)
IIci	0 MB	128MB (30-pin, 80 ns) (30 pin, 120 ns)

Macintosh	Mem on logic board	Max Mem
II**	4 MB	68MB (30-pin, 80) (30 pin, 80 ns)
IIfx	0 MB	128MB (64-pin, 80) (30 pin, 100 ns)
Quadra 700	4 MB	68MB (30-pin, 80)
Quadra 900	0 MB	256MB (30-pin, 80)
Quadra 950	0 MB	256MB (30-pin, 80)

* The II requires an FDHD upgrade kit to use 4MB SIMMs in bank A.

** The II and IIx require special 4 MB SIMMs.

*** 68MB (II) or 128MB (SE/30, IIx, IIcx) with MODE32 or Apple's 32-bit System Enabler: see page 6.

Macintosh	Mem on logic board	Max Mem

Sockets handled in pairs

Macintosh	Mem on logic board	Max Mem
Plus/SE	0 MB	(30 pin, 150 ns)
Classic (1MB)	1 MB	(30 pin, 120 ns)
Classic (2MB)	1 MB plus 1 MB on memory card	(30 pin, 120 ns)
Classic II	2 MB	

PowerBooks, Duos, and Portables

Macintosh	Mem on logic board	Max Mem
PowerBook 100	2 MB	6 MB (100 ns)
PowerBook 140	2 or 4 MB (2MB plus a 2MB replaceable expansion card)	8 MB (100 ns)
PowerBook 145, 170	2 MB plus a 2MB	8 MB (100 ns)

	replaceable expansion card	
PowerBook 145b	4 MB	8 MB (100 ns)
PowerBook 160, 165, 180	4 MB	14 MB (85 ns)
PowerBook 165c, 180c	4 MB	14 MB (85 ns)
Duo 210, 230	4	(70 ns)
Portable 5120	1 MB	(from Apple)
Portable 5126	1 MB	(from Apple)

*   Memory expansion kit from Marco. It comes with a lifetime guarantee.

**   Larger upgrades available from third parties.

***   While supplies last.

Memory prices fluctuate rapidly.

These prices were correct as of the date of publication.

Central Processing Unit

The CPU (Central Processing Unit) is the "brain" of the computer and is often called the microprocessor. It is the part that performs the actual computations and acts as controller of all the activities a computer does— such as pay attention to what you type on the keyboard, find files on your disk, display things on the monitor, and pull data out of memory to be acted on.

Physically, the CPU is a single large chip that is plugged into a circuit board inside the computer. If you take the cover off the computer, you can easily find it because it is usually the largest chip in there.

When considering the different CPU chips, look at several features and functions: internal and external bus, clock speed, memory addressing, cache, and math coprocessing capabilities.

Internal and External Bus

A bus transfers information between different components of the computer. The larger the bus, the more information it can transport. Buses can be of different widths, measured by the number of bits they can handle at one time. Typical buses are 16- or 32-bits wide. A 32-bit bus can handle twice the information that a 16-bit bus can handle in the same amount of time.

The internal bus connects different sections of the CPU chip itself. The external bus connects the CPU to memory (RAM/random access memory) and other devices. It is also called the I/O (Input/Output) bus or the data bus.

Clock Speed

The CPU uses an internal clock to time and coordinate the execution of instructions. Clock speed refers to the speed at which this clock ticks and is measured in units called megahertz (MHz), which is one million ticks per second. Ultimately, computation speed is determined by clock speed and CPU type. In general, a more powerful CPU running at a slower clock speed gives better performance than a less powerful CPU running at a faster clock speed.

Memory: RAM

When you use an application, the operating system copies the program and its data from your disk into RAM (Random Access Memory). RAM is actually a sequence of storage locations, each with its own address. You could think of RAM as a huge wall of post office boxes. Each box has its own number. The more digits you can use, the more boxes you can identify. (The only restriction is that, for our analogy, each box can hold only one piece of mail at a time.) Similarly, the more bits a computer can use to address memory, the more memory locations it can identify.

Cache Memory

Some CPUs have special memory called cache. Cache memory is much faster to access than regular memory; it's also much more expensive. Cache means "keep for later use." Most programs tend to need certain segments of memory over and over. Systems with cache load data into the cache from main memory and then feed it to the CPU as requested. Various algorithms try to keep information in the cache that the CPU is most likely to request. When the CPU requests information that hasn't been copied into cache, the processor must wait until the cache fetches the data it didn't have. The larger the cache, the more likely it will already contain what the CPU needs.

Math Coprocessing

Math coprocessing is a special set of functions that are optimized to perform very high-speed floating-point arithmetic. These functions can be built into the CPU itself, or they can come on their own chip.

Not all software will take advantage of the presence of math coprocessing capabilities. Programs that tend to use math coprocessors are spreadsheets, CAD applications (Computer Aided Design), statistical packages, and font-scaling utilities (especially if they use PostScript).

Motorola CPUs

All Macintoshes come with CPUs manufactured by Motorola. The first Motorola processor was the 68000, followed by the 68020, the 68030, and the 68040. Each of these chips can be manufactured to operate at different clock speeds. (Unlike the Intel chips, which incorporate the clock speed into the CPU

designation, such as the 386-16 or the 386-20, the names of Motorola chips give no hint of their clock speed.) The following table shows Motorola CPUs, their speeds, and the Macintoshes that use them. (The table does not include those Macs that are no longer sold as part of the Microcomputer Discount Program.)

Motorola CPU	Clock Speed in MHz	Macintosh
68030	16	Classic II
	16	Color Classic
	25	LC III
	25	Duo 210
	25	PowerBook 145
	25	PowerBook 145b
	25	PowerBook 165
	33	Duo 230
	33	PowerBook 165
	33	PowerBook 165c
	33	PowerBook 180
	33	PowerBook 180c
68LC040	20	Centris 610
68040	25	Centris 650
	25	Centris 660AV
	33	Quadra 800
	33	Quadra 950
	40	Quadra 840AV

68000

From the beginning, all Motorola processors had full 32-bit address registers. However, the 68000 uses only 24 of those bits to address 16 megabytes of address space. Of that 16 MB of address space, half is directly available as RAM (Random Access Memory), the system memory used by software programs. The other 8MB are allocated for ROM (Read Only Memory) and I/O (Input/Output).

Although the 68000 uses 32-bit data registers to perform computations, it uses a 16-bit data bus to retrieve data from memory. Thus it requires two fetches from memory to fill a register.

68020

The original Macintosh II and the original Mac LC were the only Macintoshes to use the 68020 chip.

The 68020 is a full 32-bit processor (32-bit registers and 32-bit data path) that can utilize a companion chip, the 68851, to handle memory management.

68030

The 68030 merges the 68020 processor and the 68851 memory management unit (MMU). It uses full 32-bit addresses, allowing direct access to 4 gigabytes (4 billion bytes) of addressable space. The 68030 also uses a 32-bit data bus, allowing it to fill one 32-bit register with just one fetch from memory.

The 68030 also has two 256-byte caches, a RAM cache, and an instruction caches. These caches speed up processing because they eliminate the wait that occurs in the execution of instructions in the 68020. (More detailed information about memory will be available in an upcoming article in our Computer Basics series.)

MMU: Memory Management Unit

The MMU supports A/UX (Apple's implementation of the UNIX operating system).

The MMU also supports virtual memory if you are running System 7.0. Virtual memory allows you to run more applications simultaneously than your RAM would otherwise allow by treating part of your hard disk as additional RAM. (System 7 users turn virtual memory on or off by using the *Memory* option in the Control Panel's folder.)

68040 and 68LC040

In the 68040, the RAM and instruction caches are expanded to 4K each. Speed is further enhanced by reducing the average number of clock cycles per instruction.

The 68040 chip also incorporates the functions of a math (floating-point) coprocessor. In prior Motorola CPUs,

math coprocessing capability could be obtained by using a separate coprocessor chip.) The math coprocessor on the 68LC040 chip is disabled.

680XX Comparisons

Each Motorola processor provides enhanced performance over its predecessor.

o The 68000 has 32-bit registers with a 16-bit data bus.

o The 68020 is a full 32-bit processor, i.e. both registers and bus are 32-bit.

o The 68030 merges memory management functions into the CPU itself and adds data and instruction caches.

o The 68040 incorporates a floating-point coprocessor and has larger caches.

o On the 68LC040 the floating-point coprocessor is disabled.

Clock speed provides another point of comparison. A 68030 running at 25MHz will execute instructions 25% faster than one running at 20MHz.

The 68000 is the only Motorola processor with a 16-bit data bus. All the others have a 32-bit data bus, enabling them to retrieve data from memory twice as fast as the 68000. Thus a 68030 running at 20MHz will process data around five times faster than a 68000 running at 8MHz. (You get a fivefold speed increase because of improvements to the clock speed and the data bus. The 68030 is two and a half times as fast because of the clock speed, then twice as fast as that because of the data bus).

Motorola Summary

CPUs offer different features. Some features affect the speed of processing, such as clock speed, caches, and data bus size. Other features, such as integrated coprocessing, affect the functionality of the chip.

Which CPU you select depends on what you plan to do with the software you will be using. Simple word processing does not require a very fast CPU. However, if you are designing and reformatting

elaborate desktop publishing documents, you will probably want all the speed you can get.   Simple line art can be drawn with any CPU; complex graphics or spreadsheet software can benefit from, and may even require, a floating-point coprocessor.

Finally, you must decide what you want to do with the computer, find software that will enable you to do it, then select the computer that will run that software. Don't buy anything less than what the software requires, but also don't spend a lot of money for speed that you will never need or functionality that you will never use.

modem cards, accelerator cards, network cards, and so on.   Macintoshes differ in how many slots (if any) they have, and of what sort.   Please note that there are currently five different kinds of expansion boards: 020 Direct Slot, 030 Direct Slot, Processor Direct Slot, IIfx Direct Slot, and NuBus.   The Centris 610 uses only 7" NuBus cards.   Not every board will work in every computer. Make sure you choose the appropriate type of board!

32-Bit Clean ROMs and MODE32 or 32-bit System Enabler

If you are running System 7 and your machine has 32-bit clean ROMS (i.e., the LC, IIsi, IIci, IIfx, or later), you will be able to use more than 8 megabytes of RAM only if you turn on 32-bit addressing.   You turn this on by selecting the *Memory* icon in the *Control Panel* folder and then clicking the ON button.

The Mac SE/30, II, IIcx, and IIx do not have 32-bit clean ROMs.   This means that, even though you can physically put up to 68 (II) or 128 (SE/30, IIx, IIcx) megabytes in these computers, the system can access only 8 megabytes of memory. The Microcomputer HelpLine has two memory management utilities which will enable these Macs to access all the memory that will fit. MODE32 or Apple's 32-bit System Enabler (for System 7.1) can be copied from the *System Software* folder on the Mac Information Server which is accessible through the campus internet, the Microcomputer HelpLines, and many of the Public Computer Facilities.

Expansion Slots

Expansion slots can be used for internal

Floppy Disk Drives

All Macintoshes available under the discount program (except the Duo 210 and 230) come with the FDHD (Floppy Disk High-Density) drive.   This floppy disk drive allows you to format, read, and write 400K, 800K, and 1.4 megabyte Macintosh disks.   In addition, using the Apple File Exchange Utility you can read, write, and format 720K and 1.4 megabyte IBM PS/2 disks (both DOS and OS/2 Standard Edition), and 800K Apple II ProDOS disks.

Hard Disk Drives

Most of the Macintosh configurations available under the discount program come with an internal hard disk drive. Some configurations do not, allowing you to choose any size hard drive you want.   In addition, all Macintoshes listed in this handout have a SCSI (Small Computer System Interface) or HDI-30 SCSI (PowerBook 160 and 180, Duo Dock) connector and can thus be connected to an external SCSI hard disk drive.

CD-ROM Drives

Some configurations of the Macintosh IIvx, Centris 610 and 650, and the Quadra 800 are available with an optional internal Apple 300i CD-ROM drive in a 5.25" expansion bay.   If a particular configuration does not come with a drive, you may add one, or a backup tape drive or optical drive to the 5.25" bay.

Interfaces

All Macintoshes listed in this brochure, except where noted, have the following interfaces:

• two RS-232/RS-422 serial ports for modems and printers.

• an AAUI-15 Ethernet connector is an option on the Centris 610 and 650, or standard on the Quadra 800 and 950.

• one (Classic II and LC III) or two Apple Desktop Bus Connectors for connecting the mouse and the keyboard.

• an external drive interface for connecting an external floppy disk drive(Classic II only).

• an audio port. All current Macintoshes have a sound-out port and a sound-in port.

• a SCSI or HDI-30 SCSI (Small Computer System Interface) port for connecting SCSI devices such as a hard disk, scanner, and the LaserWriter IISC.

In addition to the above interfaces, the LC III, the IIvx, the Centris 610 and 650, the Quadras, the PowerBooks 160/160c and 180/180c, and the Duo Dock have a video port.

Other Hardware

Macintosh IIci Cache Card: The Cache Card features 32K of 25-nanosecond SRAM (static RAM) to speed performance.   This card can be used on the older IIci only.   All new IIci configurations came with the cache card already installed.

Macintosh Centris 610 NuBus Adapter: The Centris 610 has a single expansion slot that accepts an adapter for either a NuBus or processor-direct slot card.   To install any 7" NuBus card, you need the Macintosh Centris 610 NuBus Adapter.

Macintosh PowerBook 2400 Data/9600 Fax Modem: This low-power modem fits inside the PowerBook 100, 140, 145, 160, 170, and 180, and operates at 2400, 1200, or 300 baud.   It can also send faxes at 9600 baud.

Macintosh PowerBook Express Modem: This low-power modem comes in two models, one fits inside the PowerBook 160 and 180, and the other in the Duo 210 and 230, and operates up to 14,400 bps. It can also send or receive faxes at 9600 baud.

Monitors

Monitor Resolution dpi Part number Price	12" Mono 640x480 76 dpi M0298LL/A $ 195	15" Portrait 640x870 80 dpi M0404 $ 645	14" Basic Color (VGA) 640x480 67 dpi M1595LL/A $ 250	14" Color Trinitron 640x480 69 dpi M1198LL/A $ 445	14" Audio Vision 640x480 70 dpi M5814LL/A $ 595	16" Color 832x624 70 dpi M1044LL/A $ 1120	21" Color 1152x870 79 dpi M5812LL/A $ 2675
LC III[1] w/512K VRAM w/768K VRAM	256 grays 256 grays	16 grays 256 grays	256 colors 32,768 colors	256 colors 32,768 colors	256 colors 32,768 colors	256 colors 256 colors	N/A N/A
Centris 610 & Centris 650[2] w/512K VRAM w/1MB VRAM	256 grays 256 grays	16 grays 256 grays	256 colors 32,768 colors	256 colors 32,768 colors	256 colors 32,768 colors	256 colors 32,768 colors	16 colors 256 colors
Centris 660AV w/1MB VRAM	256 grays	256 grays	32,768 colors	32,768 colors	32,768 colors	32,768 colors	256 colors
Quadra 800[2] w/512K VRAM w/1MB VRAM w/ 1.5 MB VRAM	256 grays 256 grays 256 grays	16 grays 256 grays 256 grays	256 colors 16.7 million 16.7 million	256 colors 256 colors 16.7 million	256 colors 256 colors 16.7 million	256 colors 256 colors 16.7 million	16 colors 256 colors 256 colors
Quadra 840AV w/1MB VRAM w/2MB VRAM	256 grays 256 grays	256 grays 256 grays	32,768 colors 16.7 million	32,768 colors 16.7 million	32,768 colors 16.7 million	32,768 colors 16.7 million	256 colors 32,768 colors
Quadra 950 w/1MB VRAM w/2MB VRAM	256 grays 256 grays	256 grays 256 grays	32,768 colors 16.7 million	32,768 colors 16.7 million	32,768 colors 16.7 million	32,768 colors 16.7 million	256 colors 32,768 colors

Workgroup Server 95 w/1MB VRAM w/2MB VRAM	256 grays 256 grays	256 grays 256 grays	32,768 colors 16.7 million	32,768 colors 16.7 million	32,768 colors 16.7 million	32,768 colors 16.7 million	256 colors 32,768 colors
PowerBook[4] **165,165c** **180, 180c** On-board video	256 grays	16 grays	256 colors	256 colors	256 colors	256 colors	N/A
Duo 210/230 w/Dock/MiniDock w/Dock/1MB VRAM	256 grays 256 grays	16 grays 256 grays	256 colors 32,768 colors	256 colors 32,768 colors	256 colors 32,768 colors	256 colors 32,768 colors	N/A N/A

[1]   The LC III also supports third-party and VGA monitors.

[2]   The Centris 610 and 650, the Quadra 800, and the Workgroup Server 95 also support a wide range of third-party displays, including some 19-inch, VGA, SVGA, NTSC, and PAL monitors. You will need an appropriate adapter cable.

[3]   The 21" Color Display requires a third-party video NuBus card to display 16.7 million colors.

[4]   The PowerBooks 165, 165c, 180, and 180c also support some VGA and SVGA displays.

Warranty and Repair Service

Warranty Service

Engineering Services is an "authorized" warranty service center for most microcomputer products manufactured by Apple, IBM, NeXT and Zenith; for Rodime hard disks; and for most printers manufactured by Hewlett-Packard.   Engineering Services works as a team with the Microcomputer Center and the Book Center to provide service beginning the day your equipment is picked up.   If items are missing from your shipment, contact the Electronics Desk at the Book Center.   If you have trouble with the equipment but are not sure if it is a hardware, software, or setup problem, your first call or visit should be to the Microcomputer HelpLine/lab **626-4276** at 152 Shepherd Labs.   If a hardware problem is suspected, call the Engineering Services service line, **625-1595**.   Engineering Services will provide free carry-in hardware warranty service.   They need a copy of your warranty papers showing what you bought, by model and serial number, and when it was picked up.   For Apple products purchased at the Book Center, the paper you need is the copy of the Book Center Order Form you receive when you pick up your computer.   **Be sure you know when your warranty ends and where your warranty papers are kept!**   These papers can be worth hundreds of dollars!

Engineering Services also offers departments the convenience of on-site warranty service (within a 5 mile radius) at a cost of $25 to cover travel expenses not authorized under manufacturer's warranties.   On-site warranty is provided at no charge   to departments with on-site contracts on their micros.

Post Warranty Maintenance Service Options

Engineering Services offers three levels of post warranty contract service as well as non-contract Time and Materials service.   The choice between contract service and T & M service involves many factors such as cost, risk, response, and convenience.   Over the life of microcomputer products, maintenance costs will typically range from about 20% to more than 50% of the purchase price of the product depending on many factors.   A service contract is an insurance policy and covers almost any problem with your Macintosh except accident or abuse.   You receive priority service at a guaranteed annual price with a single payment.

Under Time and Materials service, you are charged for parts and labor.

The most popular and cheapest contract service is Carry-In.   Equipment delivered to the shop one day is usually ready for pickup the next day.   Some departments use Campus Courier service for pickup and delivery of their equipment.

Two levels of on-site service are available (within a five mile radius).   Under both levels, response is an average of four working hours.   With Level I service, Engineering Services provides loaner equipment if your unit cannot be repaired within a reasonable period.

If you choose to extend your protection through a service contract, you can avoid both a gap in coverage and an inspection of your equipment by contacting Engineering Services before your warranty expires.

Annual Service Contract Price List

COMPUTERS	LEVEL I	LEVEL II	CARRY-IN
	On-Site Loaner	On-site No loaner	
Mac 512/Mac 512E	$118	$102	$ 61
Mac Plus	$128	$110	$ 66
Mac Classic, FDHD, no HD	$ 89	$ 76	$ 59
Mac Classic, HD40	$108	$ 94	$ 77
Mac Classic II, HD40	$113	$ 99	$ 82
Mac Classic II, HD80	$144	$121	$ 95
Mac LC, no HD	$113	$ 99	$ 81
Mac LC, HD40	$167	$149	$108
Mac LC, HD80	$176	$158	$117
Mac LC II, HD40	$157	$139	$102
Mac LC II, HD80	$166	$149	$111
Mac SE dual floppy, no HD	$128	$110	$ 66
Mac SE HD20	$216	$162	$117
Mac SE HD40	$234	$180	$135
Mac SE/30, no HD	$212	$176	$149
Mac SE/30 HD40	$261	$225	$180
Mac SE/30 HD80	$297	$252	$216
Mac II, no HD	$203	$171	$140
Mac II, HD40	$257	$221	$185
Mac IIx, no HD	$234	$194	$162
Mac IIx, HD 40	$274	$229	$193
Mac IIx, HD80	$293	$248	$207
Mac IIx, HD160	$333	$288	$243
Mac IIcx, no HD	$234	$194	$162
Mac IIcx, HD 40	$270	$230	$185
Mac IIcx, HD 80	$306	$266	$230
Mac IIci, no HD	$288	$243	$202
Mac IIci HD40	$338	$293	$243
Mac IIci HD80	$356	$311	$261
Mac IIsi, HD40	$198	$171	$144
Mac IIsi, HD80	$225	$203	$180
Mac Portable, no HD	$275	$230	$194
Mac Portable 40 HD	$306	$257	$221
Mac IIfx, no HD	$374	$329	$288
Mac IIfx HD 80	$428	$392	$351
Mac IIfx HD 160	$446	$423	$383
PowerBook 100, HD20		$190	$150
PowerBook 100, HD40		$210	$170
PowerBook 140, HD20		$190	$150
PowerBook 140, HD40		$240	$200

PowerBook 140, HD80		$255	$215
PowerBook 170, HD40		$250	$220
PowerBook 170, HD80		$265	$235
COMPUTERS	LEVEL I	LEVEL II	CARRY-IN
Quadra 700, no HD	$304	$269	$228
Quadra 700, HD80	$334	$295	$250
Quadra 700, HD160	$363	$320	$273
Quadra 700, HD400	$389	$340	$290
Quadra 900, no HD	$419	$366	$312
Quadra 900, HD160	$479	$421	$360
Quadra 900, HD400	$497	$429	$372

MONITORS	LEVEL I	LEVEL II	CARRY-IN
High-Res Monochrome	$ 19	$ 16	$ 10
Macintosh 12-inch Monochrome	$ 19	$ 16	$ 10
High-Res RGB Color	$ 48	$ 41	$ 25
12" RGB Color	$ 38	$ 32	$ 22
Portrait Display	$ 63	$ 54	$ 36
16" Color Display	$ 74	$ 65	$ 55
Two Page Monochrome		$112	$ 71

APPLE DISK DRIVES	LEVEL I	LEVEL II	CARRY-IN
External PC 5.25" Floppy	$ 38	$ 32	$ 20
External 400K/800K Floppy	$ 38	$ 32	$ 20
External Hard Disk 20 SC	$ 59	$ 50	$ 41
External Hard Disk 40 SC	$ 77	$ 68	$ 59
External Hard Disk 80 SC	$104	$ 90	$ 77
External Hard Disk 160 SC	$117	$103	$ 94

RODIME DISK DRIVES*	LEVEL I	LEVEL II	CARRY-IN
20MB, 45MB, 60MB external	$ 86	$ 80	$ 67
70MB Cobra external	$ 86	$ 80	$ 67
100MB, 140MB external	$105	$ 95	$ 86
210MB Cobra external	$190	$162	$ 133

QUANTUM DISK DRIVES*	LEVEL I	LEVEL II	CARRY-IN
40/52/80MB external	$ 90	$ 81	$ 72
105/120MB external	$108	$ 99	$ 90
170MB external	$117	$108	$ 99
210MB external	$134	$120	$110
240MB external	$160	$140	$130

*   Internal hard disks are priced with the Macintosh when included in the product description, e.g., Mac IIcx-Quantum 52. Combination prices are not listed here due to the large number of combinations. Call for quotes for your internal hard disks.

NOTES:

1)   All Macintosh computer contracts include keyboard, mouse, memory (including Apple memory upgrades), internal Apple hard disks as noted, internal floppy drives, and built-in monitors in Mac 128, 512, 512E, Plus, SE, Classic, Classic II and SE/30.

2)   Mac computer contracts DO NOT INCLUDE internal hard disks unless specifically noted by the product's model/description, external Apple monitors and hard disks, network boards, or other non-Apple products unless specifically noted on the contract.

University Discount Price List

For prices of computers,
see the tables at the end of this handout.

Monitors and video parts

Monochrome Monitors

M0298LL/A	Macintosh 12" Monochrome	$195
M0404	Apple 15" portrait monochrome	$645

Color Monitors

M1595LL/A   14" Basic Color Monitor (VGA)
with tilt/swivel base........................$250

M1198LL/A   14" Color Monitor (Trinitron) with
tilt/swivel base...............................$445

M5814LL/A   Apple AudioVision 14" display.....$595
*High-quality stereo speakers,
microphone, high-contrast color
display, 640x480, 70 dpi.*

B1247LL/A   Apple AudioVision 14" display
with adapter kit..............................$630

M1044LL/A   16" Color Monitor with tilt/swivel
base (IIfx and IIsi require a video
card and possibly adapter card, IIci
and IIvx require 8•24 display card,
Quadras use built-in support)........$1120

M5812LL/A   Macintosh 21" Color Display with
tilt/swivel base (IIfx and IIsi
require a NuBus adapter card, the
IIci and IIvx require 8•24 display
card, Quadras use built-in support)$

M0403   Apple Universal Monitor stand.....$70

M0507PA/A   8•24 video card
(requires System 6.0.5 or later).....$482

M0505LL/A   DRAM expansion kit for 8•24 GC
card (M0122)................................$340

M0213   Macintosh II video RAM
expansion kit (for old display cards
only—NOT the boards listed
above)...$90
While supplies last!

512KVRAMLC   512K VRAM (1 SIMM)
expansion kit for LC, LC II, and
IIvx*..$55

256KVRLCIII   256K VRAM (1 SIMM)
expansion kit for LC III and Color
Classic*..$43

QuadraVRAM 512K (2-256K SIMMs) VRAM
expansion kit for all Quadras and
Centris 610 and 650*.....................$86

M1311LL/A   Duo Dock 512K VRAM expansion
kit (32,000 colors)........................$84

*   Lifetime warranty

Keyboards and Mice

M0487LL/AS	Apple Keyboard II (standard)	$90
M0312S	Apple Extended Keyboard II	$155
M1242LL/AA	Apple Adjustable Keyboard (purchased with CPU)	$65
M1242LL/A	Apple Adjustable Keyboard (purchased separately)	$155
M2706LL/A	Apple Desktop Bus Mouse II	$75
M1481LL/A	Apple Omni-Directional Microphone	$17

Memory Upgrades

Prices of memory include installation.

See pages 2-4 of this handout.

Note: Prices of memory chips can fluctuate rapidly, and
the bookstore cannot stock infinite supplies of memory.
Supplies are limited and prices are subject to change without
notice.

Hard Disk Drives

Macintosh Drives		Internal	External	MB
Quantum	ELS 85	$ 249	$ 279	81
Quantum	ELS 127	$ 307	$ 337	122
Quantum	LP 240s	$ 429	$ 470	234
Quantum	LPS 525	$ 865	$ 895	501
Quantum	Q 1225	$ 1395	$1435	1169
PowerBook Drives				
Quantum	80GRS*	$ 295	$ 395	80
Quantum	Go•120*	$ 395	$ 495	120
Quantum	160GRS*	$ 495	$ 595	160

Toshiba   213mb $ 675 $ 213
*   Price of internal drives includes in-shop installation.
Hard disks for Quadras are available up to 2.5 gigabytes.

*Models and prices change frequently. Call Engineering
Services, 625-1595, for the latest information.*

AppleCD 300i Internal Drives

B1328LL/A   AppleCD 300i for Quadra 900/950$
B1329LL/A   AppleCD 300i for Centris 650......$270
B1330LL/A   AppleCD 300i for Quadra
              800/840AV...................................$270
B1332LL/A   AppleCD 300i for Centris
              610/660AV...................................$270

Miscellaneous Macintosh parts

M4475LL/A   AppleDesign Powered Speakers....$137
M4040LL/A   Apple Font Pack with 43 TrueType
              fonts..$75

Macintosh Color Classic parts

Third Party   Color Classic math coprocessor....$102
              Price includes installation.

Macintosh LC, LC II, LC III parts

M0444LL/C   Apple IIe Card (includes built-in
              connection for 5.25-inch drive; user
              installable) $135
A9M0107   Apple 5.25-inch drive (requires
              M0444)..$260
Third Party   Mac LC II math coprocessor.........$65
              Price includes installation.
Third Party   Mac LC III math coprocessor........$102
              Price includes installation.

Macintosh IIsi parts

M0481LL/A   Macintosh IIsi NuBus Adapter with
              co-processor (user installable).......$185
M0480LL/A   Macintosh IIsi 030 Direct Slot
              Adapter Card with co-processor
              (user installable)...........................$185

Macintosh IIci parts

M0326LL/A   Mac IIci cache card.......................$280
              (For older Mac II ci's.)

Macintosh Centris 610/660AV parts

M1402LL/A   Macintosh Centris 610 NuBus
              Adapter Card.................................$79
M9049LL/A   Macintosh Centris 660AV NuBus
              Adapter Card................................$108

Macintosh Quadra 840AV parts

M1694LL/A   Apple GeoPort Telecom Adapter...$108

Workgroup Server 95 parts

M6940Z/A   Apple Workgroup Server 95 PDS
              Card Upgrade Kit..........................$1871
M6810Z/A   Apple Workgroup Server 95
              128K/Tag Second-level Memory
              Cache Upgrade Kit........................$320
M6815Z/A   Apple Workgroup Server 95 256K
              Second-level Memory Cache
              Upgrade Kit..................................$245
M6820Z/A   Apple Workgroup Server 95 16MB
              Parity Memory Expansion Kit.......$617
M2092Z/A   Blank DDS Tape 5 Pack (box)......$85

Macintosh Portable parts

M0239   Numeric keypad module*.............$49
M0250   Data modem 2400 (internal 2400
              bps modem)*...............................$320
M0275   Battery recharger..........................$95
M0277   Rechargeable battery.....................$40
              (while supplies last)

*   Requires installation by level I service
     technician.   Call Engineering Services (625-
     1595) for installation costs.
**   Requires installation by level I service
     technician. Price includes installation.

Individual purchasers must pay 7% sales tax.

PowerBook parts

Batteries/Rechargers/Adapters
M1183LL/A   Macintosh PowerBook 100 Rechargeable Battery $ 69
M5545LL/A   Macintosh PowerBook 140/145/145b/160/165c/170/180/180c Rechargeable Battery $ 63
M5130LL/A   Macintosh PowerBook 100 Battery Recharger. *Requires AC Adapter.* $ 69
M1027LL/A   Macintosh PowerBook 140/145/145b/160/165c/170/180/180c Battery Recharger.
                      Requires AC Adapter...........................$ 78
M4662LL/A   Macintosh PowerBook AC Adapter....$ 54

Disk Drives/Adapters/Cables
M8061LL/A   Macintosh HDI-20 External 1.4MB floppy disk drive for PowerBook 100 $ 117
M2539LL/A   Apple HDI-30 SCSI Disk Adapter......$ 35
                      Enables use of the 100, 160, 165c, 180, 180c as an external SCSI hard disk with another Macintosh system.
                      (You will also need an HDI-30 SCSI system cable, and possibly a SCSI cable terminator. Check your
                      manual.)
M2538LL/A   Apple HDI-30 SCSI System Cable *Connects any SCSI   peripheral device to a PowerBook.* $ 35

Modems
M0970LL/A   Macintosh PowerBook 2400 Data/9600 Send Fax Modem (all PowerBooks).** $ 195
M1366LL/A   PowerBook Express Modem for 145b/160/165c/180/180c 14.4-Data/9600 S/R FAX** $ 283

PowerBook Duo/Duo Dock parts

M6775LL/A   Duo Dock Math Coprocessor..............$ 83
                      (For Duo Dock)

Batteries/Rechargers/Adapters
M4176LL/A   PowerBook Duo Rechargeable Battery $ 60
M4178LL/A   Duo Battery Recharger *Requires AC adapter.* $ 100
M4174LL/A   PowerBook Duo AC Adapter..............$ 56

Disk Drives/Adapters/Cables
M8061LL/A   Macintosh HDI-20 External 1.4MB floppy disk drive $ 117
                      Requires Floppy Adapter or MiniDock.
M4180LL/A   PowerBook Duo Floppy Adapter........$ 92
                      Connects a Duo 210 or 230   to a HDI-20 External 1.4MB floppy disk drive.
M2538LL/A   Apple HDI-30 SCSI System Cable.....$ 35
                      Connects a Duo Dock or MiniDock to any SCSI   peripheral device.
M2539LL/A   Apple HDI-30 SCSI Disk Adapter......$ 35
                      *Enables use of the Duo 210 or 230 as an external SCSI hard disk with another Macintosh system. Requires a
                      MiniDock.*

Modems
M4186LL/A   PowerBook Express Modem for Duo 210/230 14.4-Data/9600 S/R FAX $ 273

  *   Requires installation by level I service technician.   Call Engineering Services (625-1595) for installation costs.
  **   Requires installation by level I service technician. Price includes installation.

Software

M1269LL/A   QuickTime Starter Kit.........................$ 125
M1252LL/A   Macintosh PC Exchange....................$ 60
M0033LL/A   AppleTalk Remote Access.................$ 145

M6825Z/A   AppleShare Pro v1.0..........................$ 1450

Special Orders
The Minnesota Book Center Computer Desk (625-3854)
may be able to special order items not on this price list.

Purchasing Department
University Departments can send a Requisition to the   Purchasing Department to order computer related   equipment. If you have never ordered anything from the   Purchasing Department before, the *How to Purchase Equipment and Supplies from Non-University Vendors*   section of *The Paper Cycle* may help you.

Other Discounts
ComputerLand offers a 25-31% discount from the list   prices for University staff and students. Call Stuart Lipsky   at 612/550-3235.   The Micro HelpLine has   ComputerLand's price list.

Whenever you contact a vendor, mention your University   of Minnesota affiliation and ask if they offer discounts.

Networks

Apple LocalTalk Network: The Apple LocalTalk Local Area Network (LAN) is used to share resources among several Macs that are located reasonably close together. You can connect up to 32 devices on one AppleTalk network. The maximum total length of the network is 300 meters. The most common use of the AppleTalk LAN is to share a resource such as a LaserWriter. To connect a device to the network you need an Apple LocalTalk (or Farallon PhoneNET) connector. An Apple LocalTalk connector kit consists of a LocalTalk connector, a two-meter length of cable, and a cable extender. One end of the Apple LocalTalk connector plugs into the device (on the Mac it plugs into one of the serial connectors). The other end of the connector has two sockets into which you plug the Apple LocalTalk cable. If you want a long run of network cable, use an Apple LocalTalk cable extender to connect two shorter runs of cable together. The Apple LocalTalk Cable Kit consists of a ten-meter length of cable and an Apple LocalTalk cable extender.

PhoneNET: An alternative to Apple LocalTalk connectors is Farallon's PhoneNET connectors. PhoneNET is functionally equivalent to LocalTalk network hardware but is somewhat less expensive. Rather than using Apple LocalTalk cable, PhoneNET connectors use inexpensive telephone wire.

Apple EtherTalk: The EtherTalk card is an Apple Macintosh II hardware product; the EtherTalk card is an Ethernet interface you use to connect the Mac II, IIx, IIsi, IIcx, IIci, IIvx, or IIfx directly to an Ethernet local area network.   The EtherTalk card comes with software to use an Ethernet network as a high speed AppleTalk network.   This product is Apple's answer to the complaint that there should be a faster AppleTalk network. (Ethernet runs at 10 MBits/second; the classic Apple Local-Talk network runs at 230 KBits/second.)   To use an EtherTalk network, you connect the cables and then use the Networks option in the ▫ menu's Control Panel to select between EtherTalk and AppleTalk. After it's all set up, using EtherTalk is completely transparent; that is, existing software should work without modification.

When you use an EtherTalk card to communicate over an Ethernet network, the messages (datagrams) sent over the network are structured to conform to the AppleTalk protocol. Sending AppleTalk datagrams works well for departmental networks, but the campus-wide Ethernet network is designed to handle TCP/IP-protocol datagrams. This means that EtherTalk may not work across parts of the campus-wide network because some parts of the network may not expect to handle AppleTalk datagrams. A/UX (UNIX),

which runs on the Mac II, does support the TCP/IP protocols with the EtherTalk card. To support the TCP/IP protocols in addition to AppleTalk, you can pick up a copy of the MacTCP network drivers from the Computer and Information Services HelpLine.

Apple LocalTalk network hardware

M2068	DIN-8 LocalTalk connector kit for Macintosh Plus, SE, Classics, SE/30, Mac II family, Centrises, Quadras, PowerBooks, ImageWriter II/LQ, Personal LaserWriter NTR, LaserWriter IIf/IIg, Pro 600/630, HP DeskWriter, DeskWriter C, or DeskWriter 550C, HP PaintJet XL300, HP LaserJet IIIP, 4M, 4Si MX. (kit includes connector box, two meters of cable, and extender)	$ 35
AT-1L	DIN-8 LocalTalk connector kit for Macintosh Plus, SE, Classics, SE/30, Mac II family, Centrises, Quadras, PowerBooks, ImageWriter II/LQ, Personal LaserWriter NTR, LaserWriter IIf/IIg, Pro 600/630, HP DeskWriter, DeskWriter C, or DeskWriter 550C, HP PaintJet XL300, HP LaserJet IIIP, 4M, 4Si MX. (Same as M2068, kit includes connector box, two meters of cable, and extender)	$ 35
M2065	DB-9 LocalTalk locking connector kit for Macintosh 128K, 512K, 512K E, LaserWriter, LaserWriter Plus, and Apple LocalTalk PC Card (kit includes connector box, two meters of cable, and extender)	$ 35
M2066	10-meter cable kit (10 meters of Apple LocalTalk cable and cable extender)	$ 56
ATV-33L	LocalTalk cable 33 feet and cable extender (same as M2066)	$ 35
M2069	25-meter cable kit (25 meters of Apple LocalTalk cable and cable extender)	$ 80
M1657Z/A	LocalTalk RJ11/DIN-8	$ 35
LP-1LS	LocalTalk RJ11/DIN-8 (Same as M1657Z/A)	$ 35
M1661Z/A	LocalTalk RJ11/DB-9	$ 35

PhoneNET

PN308	PhoneNET Connector (with DIN-8 connector and 7 feet of telephone wire)	$ 38
PN209	PhoneNET Connector (with DB-9 connector and 7 feet of telephone wire)	$ 38
PN120	PhoneNET to Apple LocalTalk Cable and Cable Extender	$ 6

Apple/Asanté EtherTalk network hardware

M0417LL/A	Apple Ethernet NuBus Card for Mac II family, Duo Dock (transceiver or AUI adapter required)	$ 305
M0443LL/A	Apple Ethernet LC Card (transceiver or AUI adapter required); does not work with LC II	$ 145
M0329LL/A	Apple Ethernet Thin Coax (10 Base2) Transceiver for use with M0417/M0433, all Ethernet equipped Macs, LaserWriter IIG. 2-meter self-terminating coax cable included.	$ 75
FNTNA	Thin FriendlyNet Transceiver for Quadra/Centris computers (same as M0329)	$ 65
M0437LL/A	Apple Ethernet Twisted Pair (10 BaseT) Transceiver for use with M0417/M0433, all Ethernet equipped Macs, LaserWriter IIG. 3-meter RJ-45 patch cable included.	$ 75
FN10TA	10 BaseT FriendlyNet Transceiver for Quadra/Centris computers (same as M0437)	$ 65
M0432LL/A	Apple Ethernet AUI Adapter *(special order only)*	$ 75
FNTKA	Thick FriendlyNet Transceiver for Quadra/Centris computers (same as M0432)	$ 65
M0833LL/A	Apple Ethernet 5-meter Thin Coax Cable	$ 40
M0436LL/A	Apple Ethernet 13-meter Plenum Cable	$ 69

Asanté Ethernet cards*

<u>For LC, LC II</u>
MCLCTNMCII   Thin Ethernet, comes with math coprocessor...$ 220
MCLC10TII   10BaseT**...$ 140
MCLC10TMCII   10BaseT**, comes with math coprocessor..$ 220

<u>For Mac Color Classic, LC II, LC III</u>
MC+LCIII   Thin, 10BaseT**, with FPU socket, 32-bit...$ 165
MCLCTNIII   Thin Ethernet, with FPU socket, 32-bit..$ 140
MCLC10TIII   10BaseT**, with FPU socket, 32-bit..$ 140

<u>For PowerBooks</u>
EN/SC10TPB   10BaseT** SCSI Ethernet Adapter with SCSI cable...$ 248
EN/SCPB (#11253)   Thick/Thin 10BaseT with SCSI cable...$ 345

<u>E Series, Thick and Thin Ethernet</u>
MC+SEE   For Mac SE...$ 140
MC+30IE 64   For Mac SE/30 and Mac IIsi..$ 140
MC+30IEMC 64   For Mac IIsi, comes with math coprocessor..$ 220
MC+IIE 64   For NuBus (Mac II family)..$ 140

<u>ET Series, Thick and 10BaseT**</u>
MC+SEET   For Mac SE...$ 140
MC+30IET64   For Mac SE/30 and Mac IIsi..$ 140
MC+30IETMC64   For Mac IIsi, comes with math coprocessor..$ 220
MC+IIET64   For NuBus (Mac II family)..$ 140

EN/SC10T   SCSI Ethernet, 10BaseT with SCSI cable...$ 220

*   Prices do not include installation. Asanté ethernet cards include a 10 foot RJ-45 cable.
**   10BaseT interfaces let you use unshielded twisted-pair (UTP) telephone wire.   Maximum cable length on UTP cable is
     about 90 meters.

Network Software

M0559   AppleShare User's Guide (manual)...$ 14

Note: Departments may obtain AppleShare Fileserver software through a site license administered by Computer and Information Services in room 190 Shepherd Labs.   The first year license fee is $75.00 with $50 annual renewals. Call 625-1300 for more information.

Upgrades available directly from Engineering Services
625-1595

How to purchase an upgrade: The upgrades listed on this page should be ordered by contacting Engineering Services directly (625-1595). When purchasing an upgrade from Engineering Services, departments must pay by Expense Transfer (Form IV); faculty   and staff can pay with a personal check; students can pay amounts up to $500 with a personal check, amounts over $500 with a cashier's check or money order.

Call Engineering Services for full specifications.

M0487LL/AS   Apple Keyboard II (standard)........$90

M0312S   Apple Extended Keyboard II.........$155
(with function keys) (purchased
separately)

M1242LL/A   Apple Adjustable Keyboard..........$155
(purchased separately)

M0142   Apple Desktop Bus Mouse............$75

M2706LL/A   Apple Desktop Bus Mouse II........$75

M1481LL/A   Apple Omni-Directional
Microphone...................................$17

M0970LL/A   PowerBook Data/FAX Modem.....$195

M1545LL/A   Mac Classic to Mac Classic II
upgrade...$560
*Includes 2MB RAM, software,
microphone, and case.*

M1386LL/A   Mac LC or LC II to Mac LC III
upgrade...$540

M1330LL/A   Macintosh IIvx to Macintosh
Centris 650 upgrade. *Includes 8MB
DRAM, 512K VRAM*..............$1020

M1421LL/A   Mac Quadra 900 to Quadra 950
Logic Board Upgrade............$1600

M6052/B   Macintosh SE FDHD upgrade $370

M0247   Macintosh II/SE FDHD
Second drive only...........................$280

M6051/C   Macintosh II FDHD
Drive upgrade...............................$370

M5950LL/A   Mac IIcx or IIci to Quadra 700
Upgrade $1670
*Includes 4MB DRAM, system
software, microphone, and case.*

M0375LL/B   Mac II to IIfx upgrade (Logic board
only, you must also add 4MB
DRAM).................................$1510

M6945Z/A   Apple Workgroup Server 95 PDS
Card/DDS-DC Drive Upgrade Kit $3300

Classic, Color Classic, LC III

The **Classic II** comes with the standard keyboard, mouse, and microphone. The **Color Classic** comes with the standard keyboard and mouse. The microphone is built-in. The **LC III** comes with the standard keyboard and mouse. You can purchase the extended keyboard or the adjustable keyboard (for $155) separately.

	Classic II	Color Classic	LC III	
Part number	M1542 LL/A	M1602 LL/A	M1312 LL/A	M1313 LL/A
CPU	68030 16 MHz 16-bit	68030 16 MHz 16-bit	68030 25 MHz 32-bit	68030 25 MHz 32-bit
Coprocessor	none	not currently available	optional	optional
RAM (max)	4 MB (10)	4 MB (10)	4MB (36MB) (72 pin)	4MB (36MB) (72 pin)
Hard disk	80	80	80	160
Display	9" b/w 512x342	10" Trinitron 512x384 low-emission	not included	not included
Video RAM	none	256K* (1 slot)	512K** (1 slot)	512K** (1 slot)
Floppy disk drive	FDHD	FDHD	FDHD	FDHD
Expansion slots	none	1 LC PD***	1 LC PDS***	1 LC PDS***
Networking	AppleTalk	AppleTalk	AppleTalk	AppleTalk
SCSI support	standard	standard	standard	standard
Power	47-63 Hz 120V	47-63 Hz 90-240 V	47-63 Hz 100-240 V	47-63 Hz 100-240 V
Price	**$ 840**	**$ 1040**	**$ 1100**	**$ 1225**

*   Expandable to 512K with 256K upgrade.
**   Expandable to 768K. 512K VRAM is soldered on the logic board, and there is one slot available for an additional 256K.
*** For Apple IIe card, Apple Ethernet LC networking card, NTSC video-out card, a monitor card for larger external displays, or a graphics card for 24-bit color.

Centris 610

The **Centris 610** comes with a standard keyboard and mouse. You can substitute the extended or adjustable keyboard for the standard keyboard by adding $65.

	Centris 610			
Part number	M1345 LL/A	M1392 LL/A	M1397 LL/A	M1398 LL/A
CPU	68LC040 20 MHz 32-bit 8K-cache	68LC040 20 MHz 32-bit 8K-cache	68LC040 20 MHz 32-bit 8K-cache	68LC040 20 MHz 32-bit 8K-cache
Coprocessor	none	none	none	none
Memory (max)	4 MB (68) (72 pin)	4 MB (68) (72 pin)	8 MB (68) (72 pin)	8 MB (68) (72 pin)
Hard disk	80	80	230	230
Display	not included	not included	not included	not included
Video RAM	512K* (2 slots)	512K* (2 slots)	512K* (2 slots)	1MB (2 slots)
Floppy disk drive	FDHD	FDHD	FDHD	FDHD
Expansion bay	5.25-inch bay	5.25-inch bay	5.25-inch bay	5.25-inch bay w/AppleCD 300i
Expansion slots	1 for 7-inch NuBus** or PDS	1 for 7-inch NuBus** or PDS	1 for 7-inch NuBus** or PDS	1 for 7-inch NuBus** or PDS
Networking	AppleTalk, optional Ethernet	AppleTalk, Ethernet***	AppleTalk, Ethernet***	AppleTalk, Ethernet***
SCSI support	high performance	high performance	high performance	high performance
A/UX available	yes	yes	yes	yes
Power	47-63 Hz 100-240 V	47-63 Hz 100-240 V	47-63 Hz 100-240 V	47-63 Hz 100-240 V
Price	**$ 1250**	**$ 1335**	**$ 1765**	**$ 1925**

*   Expandable to 1MB. There are two slots available for two additional 256K VRAM SIMMs.
**   Requires the Mac Centris 610 NuBus adapter (M1402LL/A).
***   AAUI-15 Ethernet connector requires the Apple Ethernet Thin Coax Transceiver (M0329LL/A), or the Apple Ethernet Twisted Pair Transceiver (M0437LL/A), or the Apple Ethernet AUI Adapter (M0432LL/A).

Centris 650

The **Centris 650** comes with a standard keyboard and a mouse. You can substitute the extended
or adjustable keyboard for the standard keyboard by adding $65.

	Centris 650			
Part number	M1613 LL/A	M1337 LL/A	M1279 LL/A	M1209 LL/A
CPU	68040 25 MHz 32-bit 8K-cache	68040 25 MHz 32-bit 8K-cache	68040 25 MHz 32-bit 8K-cache	68040 25 MHz 32-bit 8K-cache
Coprocessor	integral FPU	integral FPU	integral FPU	integral FPU
Memory (max)	8 MB (136) (72 pin)	8 MB (136) (72 pin)	8 MB (136) (72 pin)	8 MB (136) (72 pin)
Hard disk	80	230	230	500
Display	not included	not included	not included	not included
Video RAM	512K* (2 slots)	512K* (2 slots)	1MB (2 slots)	512K* (2 slots)
Floppy disk drive	FDHD	FDHD	FDHD	FDHD
Expansion bay	5.25-inch bay	5.25-inch bay	5.25-inch bay w/AppleCD 300i	5.25-inch bay
Expansion slots	3 NuBus 1 in-line 040 PDS	3 NuBus 1 in-line 040 PDS	3 NuBus 1 in-line 040 PDS	3 NuBus 1 in-line 040 PDS
Networking	AppleTalk, Ethernet**	AppleTalk, Ethernet**	AppleTalk, Ethernet**	AppleTalk, Ethernet**
SCSI support	high performance	high performance	high performance	high performance
A/UX available	yes	yes	yes	yes
Power	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V
Price	**$ 1770**	**$ 2045**	**$ 2345**	**$ 2560**

*   Expandable to 1MB. There are two slots available for two additional 256K VRAM SIMMs.
  **   AAUI-15 Ethernet connector requires the Apple Ethernet Thin Coax Transceiver (M0329LL/A), or the Apple Ethernet Twisted Pair
            Transceiver (M0437LL/A), or the Apple Ethernet AUI Adapter (M0432LL/A).

Centris 660AV

The **Centris 660AV** comes with a standard keyboard, mouse, and microphone. You can substitute the extended or adjustable keyboard for the standard keyboard by adding $65.

	Centris 660AV				
Part number	M9045 LL/A	M1839 LL/A	M9043 LL/A	M9044 LL/A	M1840 LL/A
CPU	68040 25 MHz 32-bit 8K-cache	68040 25 MHz 32-bit 8K-cache	68040 25 MHz 32-bit 8K-cache	68040 25 MHz 32-bit 8K-cache	68040 25 MHz 32-bit 8K-cache
Digital Signal Processor	AT&T 3210 55 MHz	AT&T 3210 55 MHz	AT&T 3210 55 MHz	AT&T 3210 55 MHz	AT&T 3210 55 MHz
Coprocessor	integral FPU	integral FPU	integral FPU	integral FPU	integral FPU
Memory (max)	8 MB (68) (72 pin)	8 MB (68) (72 pin)	8 MB (68) (72 pin)	8 MB (68) (72 pin)	8 MB (68) (72 pin)
Hard disk	80	230	230	500	500
Display	not included	not included	not included	not included	not included
Video RAM	1MB	1MB	1MB	1MB	1MB
Floppy disk drive	FDHD	FDHD	FDHD	FDHD	FDHD
Expansion bay	5.25-inch bay	5.25-inch bay	5.25-inch bay w/AppleCD 300i	5.25-inch bay	5.25-inch bay w/AppleCD 300i
Expansion slots	1 NuBus/DAV 2 serial 2 S-video 2 composite video	1 NuBus/DAV 2 serial 2 S-video 2 composite video	1 NuBus/DAV 2 serial 2 S-video 2 composite video	1 NuBus/DAV 2 serial 2 S-video 2 composite video	1 NuBus/DAV 2 serial 2 S-video 2 composite video
Networking	AppleTalk, Ethernet* GeoPort	AppleTalk, Ethernet* GeoPort	AppleTalk, Ethernet* GeoPort	AppleTalk, Ethernet* GeoPort	AppleTalk, Ethernet* GeoPort
SCSI support	high performance	high performance	high performance	high performance	high performance
Power	47-63 Hz 100-240 V	47-63 Hz 100-240 V	47-63 Hz 100-240 V	47-63 Hz 100-240 V	47-63 Hz 100-240 V
Price	**$ 1770**	**$ 1965**	**$ 2290**	**$ 2560**	**$ 2800**

*   AAUI-15 Ethernet connector requires the Apple Ethernet Thin Coax Transceiver (M0329LL/A), or the Apple Ethernet Twisted Pair Transceiver (M0437LL/A), or the Apple Ethernet AUI Adapter (M0432LL/A).

Quadra 800

The **Quadra 800** comes with a standard keyboard and a mouse. You can substitute the extended or adjustable keyboard for the standard keyboard by adding $65.

	Quadra 800			
Part number	M1287 LL/A	M1288 LL/A	M1329 LL/A	M1291 LL/A
CPU	68040 33 MHz 32-bit 8K cache	68040 33 MHz 32-bit 8K cache	68040 33 MHz 32-bit 8K cache	68040 33 MHz 32-bit 8K cache
Coprocessor	integral FPU	integral FPU	integral FPU	integral FPU
Memory (max)	8 MB (136) 72 pin	8 MB (136) 72 pin	8 MB (136) 72 pin	8 MB (136) 72 pin
Hard disk	230	500	500	1000
Display	not included	not included	not included	not included
Video RAM	512K* (2 slots)	1MB (2 slots)	1MB (2 slots)	1MB (2 slots)
Floppy disk drive	FDHD	FDHD	FDHD	FDHD
Expansion bay	one 5.25-inch two 3.5-inch	one 5.25-inch two 3.5-inch	one 5.25-inch w/AppleCD 300i two 3.5-inch	one 5.25-inch two 3.5-inch
Expansion slots	3 NuBus 1 in-line 040 PDS	3 NuBus 1 in-line 040 PDS	3 NuBus 1 in-line 040 PDS	3 NuBus 1 in-line 040 PDS
Networking	AppleTalk Ethernet**	AppleTalk Ethernet**	AppleTalk Ethernet**	AppleTalk Ethernet**
SCSI support	high performance	high performance	high performance	high performance
A/UX available	yes	yes	yes	yes
Power	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V
Price	**$ 2895**	**$ 3435**	**$ 3665**	**$ 4030**

*   Expandable to 1MB. There are two slots available for two additional 256K VRAM SIMMs.
**   AAUI-15 Ethernet connector requires the Apple Ethernet Thin Coax Transceiver (M0329LL/A), or the Apple Ethernet Twisted Pair Transceiver (M0437LL/A), or the Apple Ethernet AUI Adapter (M0432LL/A).

Quadra 840AV

The **Quadra 840AV** comes with a standard keyboard, mouse, and microphone. You can substitute the extended or adjustable keyboard for the standard keyboard by adding $65.

	Quadra 840AV				
Part number	M9025 LL/A	M9028 LL/A	M1836 LL/A	M1837 LL/A	M1838 LL/A***
CPU	68040 40 MHz 8K cache	68040 40 MHz 8K cache	68040 40 MHz 8K cache	68040 40 MHz 8K cache	68040 40 MHz 8K cache
Digital Signal Processor	AT&T 3210 66 MHz	AT&T 3210 66 MHz	AT&T 3210 66 MHz	AT&T 3210 66 MHz	AT&T 3210 66 MHz
Coprocessor	integral FPU	integral FPU	integral FPU	integral FPU	integral FPU
Memory (max)	8 MB (128) 72 pin	8 MB (128) 72 pin	16 MB (128) 72 pin	16 MB (128) 72 pin	16 MB (128) 72 pin
Hard disk	230	230	500	500	1000
Display	not included	not included	not included	not included	not included
Video RAM	1MB* (2 slots)	1MB* (2 slots)	1MB* (2 slots)	1MB* (2 slots)	1MB* (2 slots)
Floppy disk drive	FDHD	FDHD	FDHD	FDHD	FDHD
Expansion bay	one 5.25-inch two 3.5-inch	one 5.25-inch w/AppleCD 300i two 3.5-inch	one 5.25-inch two 3.5-inch	one 5.25-inch w/AppleCD 300i two 3.5-inch	one 5.25-inch w/AppleCD 300i two 3.5-inch
Expansion slots	3 NuBus/1 DAV 2 serial 2 S-video 2 composite video	3 NuBus 2 serial 2 S-video 2 composite video	3 NuBus 2 serial 2 S-video 2 composite video	3 NuBus 2 serial 2 S-video 2 composite video	3 NuBus 2 serial 2 S-video 2 composite video
Networking	AppleTalk Ethernet** GeoPort	AppleTalk Ethernet** GeoPort	AppleTalk Ethernet** GeoPort	AppleTalk Ethernet** GeoPort	AppleTalk Ethernet** GeoPort
Power	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V
Price	**$ 3115**	**$ 3280**	**$ 3815**	**$ 4145**	**$ 4745**

*　　Expandable to 2MB. One slot with 1 MB VRAM, one slot available.
**　　AAUI-15 Ethernet connector requires the Apple Ethernet Thin Coax Transceiver (M0329LL/A), or the Apple Ethernet Twisted Pair Transceiver (M0437LL/A), or the Apple Ethernet AUI Adapter (M0432LL/A).

***   Available October, 1993.

Quadra 950

The **Quadra 950** comes with the standard keyboard, a mouse, and a microphone. You can substitute the extended or adjustable keyboard for the standard keyboard by adding $65

	Quadra 950			
Part number	M6710 LL/A	M6720 LL/A	M6735 LL/A	M6780 LL/A
CPU	68040 33 MHz 32-bit 8K cache	68040 33 MHz 32-bit 8K cache	68040 33 MHz 32-bit 8K cache	68040 33 MHz 32-bit 8K cache
Coprocessor	integral FPU	integral FPU	integral FPU	integral FPU
Memory (max)	8 MB (256) 30 pin	8 MB (256) 30 pin	8 MB (256) 30 pin	16 MB (256) 30 pin
Hard disk	none	230	500	1000
Display	not included	not included	not included	not included
Video RAM	1 MB* (2 slots)	1 MB* (2 slots)	1 MB* (2 slots)	1 MB* (2 slots)
Floppy disk drive	FDHD	FDHD	FDHD	FDHD
Expansion bays	three 5.25-inch	three 5.25-inch	three 5.25-inch	three 5.25-inch
Expansion slots	5 NuBus 1 in-line 040 PDS	5 NuBus 1 in-line 040 PDS	5 NuBus 1 in-line 040 PDS	5 NuBus 1 in-line 040 PDS
Networking	AppleTalk Ethernet**	AppleTalk Ethernet**	AppleTalk Ethernet**	AppleTalk Ethernet**
SCSI support	dual high performance	dual high performance	dual high performance	dual high performance
A/UX available	yes	yes	yes	yes
Power	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V
Price	**$3065**	**$ 3515**	**$ 3990**	**$ 4885**

*   Expandable to 2MB. There are two slots available for two additional 512K VRAM SIMMs.
**   AAUI-15 Ethernet connector requires the Apple Ethernet Thin Coax Transceiver (M0329LL/A), or the Apple Ethernet Twisted Pair Transceiver (M0437LL/A), or the Apple Ethernet AUI Adapter (M0432LL/A).

Workgroup Server 95

	Workgroup Server 95				
Part number	M6855 LL/A	M6865 LL/A	M6875 LL/A	M6885 LL/A	M6895 LL/A
CPU	68040 33 MHz	68040 33 MHz	68040 33 MHz	68040 33 MHz	68040 33 MHz
Coprocessor	integral FPU	integral FPU	integral FPU	integral FPU	integral FPU
Memory (max)	16 MB (256)	16 MB (256)	32 MB (256)	32 MB (256)	48 MB (256)
Hard disk(s)	230	500	1000	230 & 500	230 & 1000
Display	not included	not included	not included	not included	not included
Video RAM	1 MB upgradable to 2	1 MB upgradable to 2	1 MB upgradable to 2	1 MB upgradable to 2	1 MB upgradable to 2
Floppy disk drive	FDHD	FDHD	FDHD	FDHD	FDHD
Expansion slots	5 NuBus, 1 in-line PDS PDS card w/512K SRAM cache	5 NuBus, 1 in-line PDS PDS card w/512K SRAM cache	5 NuBus, 1 in-line PDS PDS card w/512K SRAM cache	5 NuBus, 1 in-line PDS PDS card w/512K SRAM cache	5 NuBus, 1 in-line PDS PDS card w/512K SRAM cache
Expansion bays	three 5.25-inch	three 5.25-inch DDS-DC backup drive	three 5.25-inch DDS-DC backup drive w/AS Pro preinstalled	three 5.25-inch DDS-DC backup drive	three 5.25-inch DDS-DC backup drive
Networking	LocalTalk Ethernet (AppleTalk & TCP/IP)	LocalTalk Ethernet (AppleTalk & TCP/IP)	LocalTalk Ethernet (AppleTalk & TCP/IP)	LocalTalk Ethernet (AppleTalk & TCP/IP)	LocalTalk Ethernet (AppleTalk & TCP/IP)
# of concurrently active users	up to 50	up to 50	up to 50	up to 50	up to 50
SCSI channels 20 devices max	4 high-performance (2 are SCSI DMA)	4 high-performance (2 are SCSI DMA)	4 high-performance (2 are SCSI DMA)	4 high-performance (2 are SCSI DMA)	4 high-performance (2 are SCSI DMA)
Operating System	A/UX 3.0.1 w/System 7 interface	A/UX 3.0.1 w/System 7 interface	A/UX 3.0.1 w/System 7 interface	A/UX 3.0.1 w/System 7 interface	A/UX 3.0.1 w/System 7 interface
Power	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V

Price	$ 4625	$ 6370	$ 8725	$ 7405	$ 8605

PowerBook 145 and 145b

The **PowerBooks 145 and 145b** come with a battery and AC adapter. The **PowerBook 145** also comes with an external microphone, the 145b an internal one.

	PowerBook 145		PowerBook 145b	
Part number	M4630 LL/A	M4650 LL/A	M1592 LL/A	M4855 LL/A
CPU	68030 25 MHz	68030 25 MHz	68030 25 MHz	68030 25 MHz
Coprocessor	none	none	none	none
Memory (max)	4MB (8)	4 MB (8)	4 MB (8)	4 MB (8)
Hard disk	40	80	40	80
Display	10" backlit passive-matrix 640 x 400	10" backlit passive-matrix 640 x 400	10" backlit passive-matrix 640 x 400	10" backlit passive-matrix 640 x 400
Floppy disk drive	FDHD	FDHD	FDHD	FDHD
Expansion slots	slot for modem	slot for modem	slot for modem	slot for modem
Modem	optional	optional	optional	optional
Networking	AppleTalk	AppleTalk	AppleTalk	AppleTalk
Battery	NiCad 2-3 hours	NiCad 2-3 hours	NiCad 2-3 hours	NiCad 2-3 hours
Size Weight	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 6.8 lb.
Power	50-60 Hz 100-220 V	50-60 Hz 100-220 V	50-60 Hz 100-240 V	50-60 Hz 100-240 V
Price	**$1435**	**$1640**	**$1175**	**$1375**

The PowerBook 145 has 2MB of RAM soldered onto the logic board and a 2MB card in the expansion slot. The 145b has 4 MB of RAM soldered onto the logic board. The 145b does not have a PMMU chip nor does it come with system disks.

PowerBook 165 and 180

The **PowerBooks 165 and 180** come with a battery, AC adapter, and built-in microphone.

	PowerBook 165			PowerBook 180		
Part number	M1641 LL/A	M2192 LL/A	M2193 LL/A	M4400 LL/A	M4410 LL/A	M4540 LL/A
CPU	68030 33 MHz	68030 33 MHz	68030 33 MHz	68030 33 MHz	68030 33 MHz	68030 33 MHz
Coprocessor	none	none	none	68882	68882	68882
Memory (max)	4 MB (14)	4 MB (14)	4 MB (14)	4 MB (14)	4 MB (14)	4 MB (14)
Hard disk	80	160	160	80	120	120
Display	10" backlit passive matrix 640 x 400 16 levels/gray	10" backlit passive matrix 640 x 400 16 levels/gray	10" backlit passive matrix 640 x 400 16 levels/gray	10" backlit active matrix 640 x 400 16 grays	10" backlit active matrix 640 x 400 16 grays	10" backlit active matrix 640 x 400 16 grays
Floppy disk drive	FDHD	FDHD	FDHD	FDHD	FDHD	FDHD
Expansion slots	video-out* (8 bit/256 colors) modem slot	video-out* (8 bit/256 colors) slot for modem	video-out* (8 bit/256 colors) slot for modem	video-out* (8 bit/256 colors) slot for modem	video-out* (8 bit/256 colors) slot for modem	video-out* (8 bit/256 colors) slot for modem
Modem	optional	optional	Express Modem	optional	optional	Express Modem
Networking	AppleTalk	AppleTalk	AppleTalk	AppleTalk	AppleTalk	AppleTalk
Battery	NiCad 2-3 hours 3-hr recharge	NiCad 2-3 hours 3-hr recharge	NiCad 2-3 hours 3-hr recharge	NiCad 2-3 hours 3-hr recharge	NiCad 2-3 hours 3-hr recharge	NiCad 2-3 hours 3-hr recharge
Size **Weight**	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25x9.3 6.8 lb.
Power	50-60 Hz 110-220 V	50-60 Hz 110-220 V	50-60 Hz 110-220 V	50-60 Hz 110-220 V	50-60 Hz 110-220 V	50-60 Hz 110-220 V
Price	**$ 1615**	**$ 1910**	**$ 2100**	**$ 2680**	**$ 2975**	**$ 3180**

* Includes a video-out cable for connecting to an external monitor. Two video-out modes: video mirroring and dual display.

Color PowerBook 165c and 180c

The **PowerBooks 165c and 180c** come with a battery, AC adapter, and built-in microphone.

	PowerBook 165c			PowerBook 180c		
Part number	M4900 LL/A	M4920 LL/A	M4930 LL/A	M7950 LL/A	M7960 LL/A	M7970 LL/A
CPU	68030 33 MHz	68030 33 MHz	68030 33 MHz	68030 33 MHz	68030 33 MHz	68030 33 MHz
Coprocessor	68882	68882	68882	68882	68882	68882
Memory (max)	4 MB (14)	4 MB (14)	4 MB (14)	4 MB (14)	4 MB (14)	4 MB (14)
Hard disk	80	120	120	80	160	160
Display	9" backlit passive-matrix 640 x 400 256 colors	9" backlit passive-matrix 640 x 400 256 colors	9" backlit passive-matrix 640 x 400 256 colors	8.4" backlit active matrix 640 x 480 256 colors	8.4" backlit active matrix 640 x 480 256 colors	8.4" backlit active matrix 640 x 480 256 colors
Floppy disk drive	FDHD	FDHD	FDHD	FDHD	FDHD	FDHD
Expansion slots	video-out* (8-bit/256 colors) modem slot	video-out* (8-bit/256 colors) modem slot	video-out* (8-bit/256 colors) modem slot	vvideo-out* (8 bit/256 colors) modem slot	video-out* (8 bit/256 colors) modem slot	video-out* (8 bit/256 colors) modem slot
Modem	optional	optional	Express Modem	optional	optional	Express Modem
Networking	AppleTalk	AppleTalk	AppleTalk	AppleTalk	AppleTalk	AppleTalk
Battery	NiCad 1-2 hours	NiCad 1-2 hours	NiCad 1-2 hours	NiCad 1-2 hours	NiCad 1-2 hours	NiCad 1-2 hours
Size **Weight**	2.29 x 11.25 x 9.3 7 lb.	2.29 x 11.25 x 9.3 7 lb.	2.29 x 11.25 x 9.3 7 lb.	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 6.8 lb.	2.25 x 11.25 x 9.3 7.1 lb.
Power	50-60 Hz 110-120 V	50-60 Hz 110-120 V	50-60 Hz 110-120 V	50-60 Hz 110-220 V	50-60 Hz 110-220 V	50-60 Hz 110-220 V
Price	**$ 1860**	**$ 2165**	**$ 2370**	**$ 3040**	**$ 3340**	**$ 3545**

* Includes a video-out cable for connecting to an external monitor. Two video-out modes: video mirroring and dual display.

PowerBook Duo 210 and 230

The **PowerBook Duos 210 and 230** come with a battery, AC adapter, and built-in microphone.

	PowerBook Duo 210		PowerBook Duo 230	
Part number	M4161 LL/A	M4195 LL/A	M4194 LL/A	M4196 LL/A
CPU	68030 25 MHz	68030 33 MHz	68030 33 MHz	68030 33 MHz
Memory (max)	4 MB DRAM (24)	4 MB DRAM (24)	4 MB DRAM (24)	4 MB DRAM (24)
Coprocessor	none	none	none	none
Hard disk	80	80	120	120
Display	9" Bright backlit Supertwist LCD 640 x 400 16 gray-scale	9" Bright backlit Supertwist LCD 640 x 400 16 gray-scale	9" Bright backlit Supertwist LCD 640 x 400 16 gray-scale	9" Bright backlit Supertwist LCD 640 x 400 16 gray-scale
Floppy Disk Drive	none	none	none	none
Expansion slots	1 152-pin PDS 1 modem port	1 152-pin PDS 1 modem port	1 152-pin PDS 1 modem port	1 152-pin PDS 1 modem port
Modem	optional	optional	Express Modem	optional
Size	1.4 x 10.9 x 8.5	1.4 x 10.9 x 8.5	1.4 x 10.9 x 8.5	1.4 x 10.9 x 8.5
Weight	4.2 lb.	4.2 lb.	4.2 lb.	4.2 lb.
Battery	Nickel hydride 2-4.5 hours	Nickel hydride 2-4.5 hours	Nickel hydride 2-4.5 hours	Nickel hydride 2-4.5 hours
Power	47-63 Hz 85-270 V	47-63 Hz 85-270 V	47-63 Hz 85-270 V	47-63 Hz 85-270 V
Price	**$ 1140**	**$ 1410**	**$ 1900**	**$ 1705**

Duo Dock, Duo MiniDock, Duo 210 Bundle

	Duo Dock*		Duo MiniDock*	Duo 210 Bundle**
Part number	M4179 LL/A	M5249 LL/A	M4181 LL/A	B1304 LL/A**
CPU				68030 25 MHz
Memory (max)				4 MB DRAM (24)
Coprocessor	optional	FPU	none	none
Hard disk	bay for optional 3.5" SCSI hard drive	230 MB	none	80
Display	built-in support for most Apple displays up to and including 16" color	built-in support for most Apple displays up to and including 16" color	built-in support for most Apple displays up to and including 16" color	9" Bright backlit Supertwist LCD 640 x 400 16 gray-scale
Video RAM	512K, expandable to 1MB	512K, expandable to 1MB	512K	
Floppy Disk Drive	FDHD	FDHD	none	HDI-20 1.4MB external Duo floppy adapter
Battery				Nickel hydride 2-4.5 hours
Power	47-63 Hz 85-270 V	47-63 Hz 85-270 V	47-63 Hz 85-270 V	47-63 Hz 85-270 V
Size and weight	16.25 x 12.25 x 4.75 13.1 lb.	16.25 x 12.25 x 4.75 13.1 lb.	2.1 x 10.6 x 3.2 1.24 lb.	1.4 x 10.9 x 8.5 4.2 lb.
Expansion slots	2 NuBus slots 1 modem port	2 NuBus slots 1 modem port	1 modem port 1 HDI-30 SCSI 1 HDI-20 (for floppy drive)	1 152-pin PDS 1 modem port
Modem	**none**	**none**	**none**	optional
Price	**$ 750**	**$ 1295**	**$ 490**	**$ 1599**

* The PowerBook Duo Dock and MiniDock do not come with a keyboard.
** Includes: M4161LL/A PowerBook Duo 210, M4180LL/A PowerBook Floppy Adapter, and M8061LL/A PowerBook Duo HDI-20 1.4 MB external floppy drive.