

## Inside this issue

**THE MOST COMPLETE** collection of system software ever published by Apple is available on this month's Developer CD, along with a variety of other materials.

**HYPERCARD WILL** again become an Apple product.

**SEVERAL ADVANCED** troubleshooting tools, previously sold only to technicians, are now available to Apple developers.

**THE SOFTWARE** Publishers Association's recently completed 1993 Spring Symposium is summarized in this month's *Editor's Note*.

**THE MACINTOSH** PowerBook 165c offers users consistent, versatile, portable color. Read about the technology behind this new product.

**FOR NEW** Apple and Third-Party developer products, see *Now Available from APDA*.

***SPOTLIGHT ON...*** announces hot new tools for commercial developers sold through APDA.

***IT SHIPPED!*** lists third-party products that shipped in February 1993.

**APPLE'S** Developer Support Center will close April 16–19 while moving to its new location.

**PREFERENCE SETTINGS** are getting too complex, says human interface writer Pete Bickford.

## BUSINESS & MARKETING

**MARKETING** consultant Leigh Marriner offers tips for creating successful direct response ads in this month's *Marketing Feature*.

***DEVELOPER OUTLOOK*** takes a look at T/Maker's experiences bundling software with other companies' products.

## Inside the Macintosh Color Classic

To the average user, the Macintosh Color Classic® is easily summed up—it's a Macintosh Classic II computer with a color monitor.

Whether you're a developer or a user, there are plenty of details that you'd benefit from knowing.

Last month, in "Color That's Easy to Take" (*Apple Direct*, March 1993), we looked at the main features of the Macintosh Color Classic computer and why Apple added it to the Macintosh family of computers. In this article, we'll take a closer look at the technology inside the Macintosh Color Classic. Though software compatibility isn't a problem, knowing more about the Macintosh Color Classic may help you design and sell your products.

### LC IN A (COMPACT) BOX

Though the Macintosh Color Classic looks like a compact Macintosh, this computer is closest in its architecture to the Macintosh LC II. Here are some details on the most important Macintosh LC-like features in the Macintosh Color Classic:

- *68030 processor running at 16 MHz.* This is the same processor, running at the same speed as the Macintosh Classic II and Macintosh LC II.
- *Up to 10 MB of memory.* Both computers have two SIMM (single inline memory module) slots. By using two 4 MB 30-pin SIMMs, you can expand both computers to a maximum of 10 MB. (2 MB of memory goes unused because both computers have a 16 MB address space, and the computer itself needs 6 MB of the address space for things like I/O functions, video memory, and system software in ROM.)
- *16-bit-wide internal data bus.* Apple engineers stayed with the 16-bit data bus for reasons of design and cost.
- *Works in both 24-bit and 32-bit modes.* The Macintosh Color Classic's ROM is 32-bit clean (meaning that it assumes that all 32 bits of any memory address are always used).
- *Has an internal processor-direct slot (PDS) that works with most Macintosh LC PDS cards.* This is one of the most important features in the Macintosh Color Classic. Because it has a processor-direct slot, users have a way of expanding their Macintosh Color Classic computers. Because it can take Macintosh LC PDS cards, users can expand their computers *today*. Two popular PDS cards from

Apple are the Apple IIe Card, which lets users run Apple II software, and the Apple Ethernet LC Card.

If you make (or are thinking about making) Macintosh LC PDS cards, the Macintosh Color Classic will significantly enlarge the potential audience for your product. For a PDS card to be usable on both the Macintosh Color Classic and the Macintosh LC-line computers, it should not depend on a specific processor (the original Macintosh LC uses a 68020 processor) or clock speed (the Macintosh LC III runs at 25 MHz).

(To be completely accurate, I should add that the Macintosh Color Classic PDS slot is identical to the PDS in the Macintosh LC computers, except that the Macintosh Color Classic PDS does not have pin A 31 connected. The signal on pin A 31 is FAN, a signal that is not important on the Macintosh Color Classic.)

### **“SOFT” POWER CONTROL**

Based on test studies and user feedback, a group of Apple people were charged with making the process of turning the Macintosh computer on and off as simple and intuitive as possible. The result is a slightly different way of turning power on and off that will make perfect sense to new Macintosh users but that may need to be explained to current Macintosh users. You may want to alert your users about this new behavior in your products' documentation.

Here, in essence, is what new users had to say about the old way of turning the Macintosh on and off: “I hit the Power key on the keyboard, and the Macintosh turns on—fine. But you're telling me the only safe way to turn the power off is to switch to the Finder, then choose one particular menu command from one particular menu? That doesn't make sense.” When asked what the behavior should be, the users' answers boiled down to “If we're supposed to press the Power key to turn the computer on, we should be able to hit the same key again to turn it off.”

Given that feedback, Apple engineers and user-interface people changed the Macintosh Color Classic computer to behave as follows. The rocker switch on the rear face of the Macintosh Color Classic is no longer an on/off switch. Instead, it is the “main power switch”—when you move the Macintosh Color Classic to a new location, you plug it in, turn the main power switch to the “on” position—and leave it that way, all the time. Turning this switch off is equivalent to unplugging the computer—not something you want to do when you might have unsaved documents.

The Power key works as a press-to-toggle switch—you press it once to turn the Macintosh Color Classic on, press it again to turn the Macintosh off (more on this later). Current users need to have this model in their heads; otherwise, they may think the Macintosh Color Classic isn't working. ("I turned the power switch in the back on, but nothing happened.") The switch in back no longer turns the Macintosh on—it delivers power to the Macintosh itself. The Power key on the keyboard turns the Macintosh on and off.

"But," you add, "the Power key is on the main keyboard—the user might hit it anytime!" (Anybody remember the Reset key on the Apple II, right where the Backspace key should have been?) Not to worry—when the Macintosh Color Classic is already on and the user presses the Power key (intentionally or by accident), the user gets a dialog box that asks, "Are you sure you want to shut down your computer now?" (The button on the left says "Cancel." The default button, which is on the right, says "Shut Down.")

If the user clicks the Shut Down button or presses the Return key (to select the Shut Down button as the default), the Macintosh Color Classic begins the same shutdown procedure as it does when the user chooses the Shut Down command from the Special menu in the Finder. (Pressing the Esc key is the same as clicking the Cancel button. Of course, you can still shut the Macintosh Color Classic down using the Shut Down menu command.) The shutdown sequence causes each open program to exit, and each program should give the user a chance to save pending documents before it exits.

## **FRONT-PANEL BUTTONS**

Two of the most visible additions to the front panel of the Macintosh Color Classic computer are two pairs of push buttons just below the color monitor. One pair increases and decreases the sound interactively (yay!), beeping to indicate the new sound level; it also adjusts the sliding control in the Sound control panel accordingly.

The other pair of push buttons interactively control the screen's intensity; this is equivalent to the Screen Contrast sliding control in the Screen control panel. According to Apple engineers, the intensity control—better known as the contrast control in other video equipment—is the only one the user should be adjusting to improve the video image. The brightness control is more accurately characterized as a "global" control, meant to be changed only to correct the dimming of the color

monitor as it ages. These thoughts led to the design decision to put control of screen intensity, but not of screen brightness, on the front panel.

Your program does not have to do anything differently because of these two sets of push buttons. These buttons, which are interrupt driven, are serviced automatically by interrupt routines built into the ROM of the Macintosh Color Classic.

## **SCREEN POWER SAVER**

In response to an initiative by the United States Environmental Protection Agency (EPA), Apple added a screen power-saving feature to the Macintosh Color Classic computer. (The EPA is encouraging computer manufacturers to design computers that save power when they're not in use, thus saving energy and money and decreasing the pollution that is a byproduct of large-scale electricity generation.)

As you can see from the Screen control panel (shown below), the user can optionally set the Macintosh Color Classic to turn off power to the color monitor if the Macintosh has been inactive for a while (a user-selected period between 15 and 60 minutes). The rest of the Macintosh Color Classic stays on, so the user loses no work, but turning the monitor off saves about 50 percent of the power it would otherwise be consuming, depending on what other internal devices are present and consuming power.

When the user presses a key or moves the mouse, internal circuitry returns power to the color monitor. If the monitor has been off long enough to cool, it may take ten seconds or longer before the video image appears on the monitor. To keep users from being confused by this ("I hit a key, but the screen's still black"), the interior speaker beeps periodically to tell users that the computer is, in fact, on and in transition.

## **SONY TRINITRON COLOR MONITOR**

To me, the built-in 10-inch Sony Trinitron color monitor makes the Macintosh Color Classic computer the equal of any other color Macintosh available. This monitor is every bit as good as the 13-inch Trinitron color monitors I've been using for five years, both at home and at work. Sony Trinitron monitors have a reputation for their high quality, and the presence of one in the Macintosh Color

Classic is the most visible evidence possible that Apple did not compromise the quality of this computer to keep the price low.

The color display of the Macintosh Color Classic is 512 x 384 pixels—the same as one of the video modes on the Macintosh LC line. By itself, the Macintosh Color Classic provides 8-bit video; you can increase that to 16-bit video by adding 256 KB of video memory. The Trinitron monitor has a 0.26-strip pitch (Trinitrons have “strips” of color, not the dots of color on most color monitors), with a resolution of 76 dots per inch (dpi).

By the way, did you notice that I said “10-inch Sony Trinitron color monitor?” Is this a new size monitor for a Classic-line Macintosh? No, actually, the reason for the new description might be what is generally called “truth in advertising.” When the original Macintosh 128K came out, way back in 1984, Apple described its built-in monitor as a 9-inch monitor because that was the diagonal size of the monitor’s image. We did the same with our 13-inch monitors. Many other vendors, however, refer to their monitors by the diagonal size of the tube, which is always larger. (A

14-inch monitor must be some better than a 13-inch monitor, right?) To match the way the rest of the industry measures monitor size, we list the Macintosh Color Classic as having a 10-inch video display and the Apple Color Display as a 14-inch display. So now you know.

## **MISCELLANY**

Here are a handful of facts about the Macintosh Color Classic computer that you may find of interest:

**The Spice Custom Chip.** This new custom chip controls timing and clock generation, memory mapping, video addressing and timing, sound control and timing, and the front-panel push buttons. It also includes circuitry equivalent to the VIA1 and VIA2 interface circuits and the SWIM2 floppy-disk interface.

**System 7.1 and System Enablers.** Like the other Macintosh computers introduced last February (the Macintosh Centris 610 and 650, Macintosh Quadra 800, and Macintosh LC III), the Macintosh Color Classic requires the new “world-ready” System 7.1 and a system enabler (supplied with the computer). A system enabler is a file that helps Apple implement its new strategy of “reference” system software. In this implementation, all Macintosh computers can run the same

“reference” version of system software (System 7.1 is the current reference version), requiring at most only a system enabler file to allow system software to run on a particular Macintosh model.

**Built-in Microphone.** The Macintosh Color Classic is the first desktop Macintosh computer that has a built-in microphone (it’s the black dot centered above the color monitor). Through the Options button of the Sound control panel, you can set the default sound input source to be either the built-in microphone or an external microphone connected to the sound-in jack on the rear panel.

**Monaural Sound.** Developer, beware! Like several previous Macintosh models, the Macintosh Color Classic has monaural sound that comes from the left channel. Any audio that a program directs to the right sound channel will be lost.

**Easy Servicing.** The Macintosh Color Classic is the first compact Macintosh computer that is easy to service—just pop the lower back panel off and slide the main logic board out! You can easily add main memory, video memory (VRAM), a Macintosh LC PDS board, or a 68882 FPU (floating-point unit). Then all you have to do is slide the main logic board back in, put the lower back panel in place, and turn the Macintosh Color Classic on. I wouldn’t be surprised if the Macintosh Color Classic sells more add-in products than other Classic models just because it makes adding extra hardware so much easier.

**The 68882 FPU.** You can add the Motorola 68882 FPU to a Macintosh Color Classic computer in two ways. First, there is a socket for this FPU on the Macintosh Color Classic main logic board. Second, you can add the FPU to a Macintosh Color Classic by installing a PDS board that includes the FPU. If you sell such a board, you need to make certain that no one installs it in a Macintosh Color Classic that already has the 68882 FPU on the main logic board. A Macintosh Color Classic with two FPUs installed may not work properly.

**No Upgrades.** Given the new features and different form factor of the Macintosh Color Classic computer, it should come as no surprise that there’s no way to upgrade a black-and-white compact Macintosh to a Macintosh Color Classic.



**More Technical Documentation.** For more technical documentation, you can order *Macintosh Developer Note #3: Macintosh Color Classic, Macintosh LC III, Macintosh PowerBook 165c, Macintosh Centris 610, Macintosh Centris 650, and Macintosh Quadra 800.* This technical document is available from APDA; its part number is R0461LL/A.◆

\*\*\*\*\*

## **Technical Summary: Macintosh Color Classic**

The Macintosh Color Classic computer is Apple's first all-in-one Macintosh that has a built-in Sony Trinitron color display. On the outside, the Macintosh Color Classic resembles other members of the Macintosh Classic product line, but on the inside, it resembles the popular Macintosh LC II. The Macintosh Color Classic should present no compatibility problems.

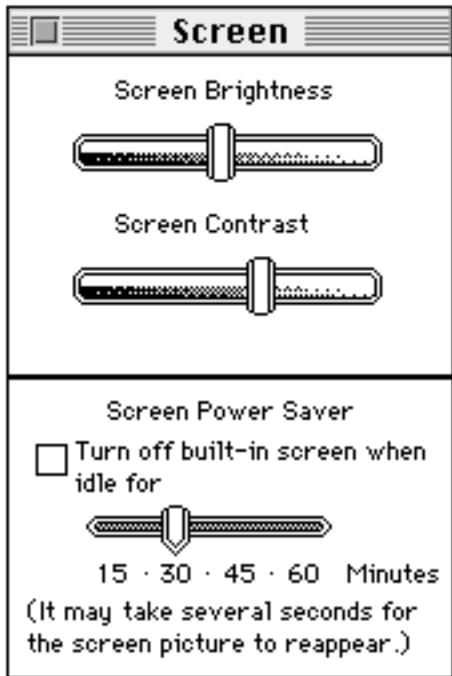
Features new to the Macintosh Color Classic include a slightly different way of turning the computer off, front-panel push-button controls for sound volume and screen intensity, and an energy-saving mode. Also, only audio sent to the left audio channel will play on the Macintosh Color Classic. ◆

\*\*\*\*\*

## **Macintosh Color Classic Suggested Retail Prices**

Since last issue, Apple has finalized the U.S. suggested retail price for the Macintosh Color Classic computer. Only one configuration is available in the United States. The Macintosh Color Classic comes with 4 MB of memory, built-in 8-bit video, an 80 MB internal hard disk, and a keyboard; this configuration sells for \$1,389.

\*\*\*\*\*



***The Screen Control Panel.*** Users can cut the energy consumption of the Macintosh Color Classic in half by using the Screen Power Saver feature.

## TECHNOLOGY

# Personal, Expandable LaserWriters

If you read last month's article on Apple's newest computers (see "A Macintosh for Every Pocketbook" in the March 1993 *Apple Direct*), you'll know that Apple's computer strategy is to offer one or more Macintosh computers in any given price range. So it is with printers: With the introduction of the StyleWriter II and the LaserWriter Pro 600 and 630 printers in January and the LaserWriter Select 300 and 310 printers last month, Apple is building a line of printers to fit any pocketbook.

The LaserWriter Select 300 and 310 are important because they are personal LaserWriter printers—they connect directly to one user's Macintosh, not to an AppleTalk network. The LaserWriter Select 310 is the lowest-cost PostScript™ printer that Apple has ever offered. The LaserWriter Select 300 is an affordable QuickDraw-based LaserWriter that is a good investment because it has built-in expansion to meet users' future needs.

There is very little you have to know about these two printers. The technology behind them is interesting, however, and knowing about them will help you understand the Macintosh market and its customers. (For product information on these printers, see "The LaserWriter Select 300 and 310," in the March 1993 *Apple Direct*.)

## COMMON FEATURES

The LaserWriter Select 300 and 310 printers come from the same design, so the two printers, though very different internally, look the same externally. In fact, it's important to note that these printers are based on a modular design that Apple plans to reuse in the future. This gives Apple the flexibility to bring new printers to market quickly and to keep existing ones competitive by folding enhancements into an existing design.

One important feature in both printers is their ability to handle more paper—up to 800 pages—from up to three sources. Both printers can add either a 250-sheet or 500-sheet bin in a very elegant, "zero-footprint" way—by setting the printer on top of the second paper source. And—wonder of wonders!—the drivers for both these printers give users the option of printing the first page of a job from one bin and the rest of the pages from a second bin.

## **THE LASER ENGINE**

There are two ways for technology to advance—either you do it, or the competition does. To make the LaserWriter Select 300 and 310 printers possible, Apple engineers knew they needed new laser-engine technology, so they found the most promising new laser engine and worked with the vendor to make the engine even better.

The result is a new 300 dots-per-inch (dpi) laser engine from Fuji Xerox. Because the engine is more accurate, it can print up to 91 shades of gray when driven by Apple's PhotoGrade technology (on the LaserWriter Select 300 only)—equivalent to a 1,000-dpi printer when printing a grayscale image. The engine can print up to five pages per minute.

Because the engine has fewer moving parts, it is more reliable. The engine has an expected lifetime of 150,000 pages, which translates to 50 pages per day, 5 days a week, 50 weeks per year, for 12 years. Not bad!

Apple also worked with Fuji Xerox to make their laser engine deliver higher quality output than any competing engine in the same price range. Part of the solution was the development of a new, finer toner. (FYI, the toner cartridge is incompatible with the ones used in previous LaserWriter printers.) This toner contributes to the overall print quality of the Fuji Xerox engine; it also results in higher-quality printed transparencies.

One subtle but important feature of the Fuji Xerox engine is that the path the paper takes is more gently curving than in previous designs. This decreases the chance of a paper jam and makes transparencies easier to print. Also, because the paper tray fits fully into the body of both the LaserWriter Select 300 and 310, there are no paper trays hanging off the side of these printers—which means that they take up much less space than previous models. Both the LaserWriter Select 300 and 310 have dimensions of 15 x 18.3 x 8 inches (38 x 45 x 25.3 cm).

## **LASERWRITER SELECT 300**

Now that we've looked at these printers' common features, it's time to look at what makes them different—and they are *very* different printers. The largest difference between them is the different imaging models they use for printing—one is based on QuickDraw and depends on the Macintosh computer to which

it's connected to drive the printing; the other is based on PostScript and depends on a processor inside the printer to drive the printing.

The LaserWriter Select 300 printer uses QuickDraw (the graphics system built into every Macintosh) for printing graphics and Apple's TrueType font technology for printing text. Because the LaserWriter Select 300 is a QuickDraw printer, the Macintosh it's connected to must provide the computing power to create the rasterized image that the LaserWriter Select 300 then prints.

In theory, a QuickDraw printer needs at least 1 MB of memory to hold the image of an entire page. The LaserWriter Select 300 comes with only 0.5 MB (512 KB) of memory. It can still print an entire page because its printer driver compresses the data before sending it across the serial interface to the printer itself; the printer controller—a proprietary custom chip—then decompresses the image in real time as the page is printed.

The Fuji Xerox is capable of printing up to five pages per minute, but that is a maximum figure. Because the Macintosh drives the printing process, a faster Macintosh will print faster. An engineer told me that, as a very rough rule of thumb, a Macintosh LC II will print twice as fast as a Macintosh Classic, and a Macintosh IIfx will print twice as fast as a Macintosh LC II.

**LaserWriter Select 300 Enhancements.** This printer contains three very important enhancements that are not available on third-party printers. The first is GrayShare, which does two important things—it gives this QuickDraw printer the ability to print grayscale images (up to 28 shades of gray), and it allows the printer's owner to allow other users on the same AppleTalk network to print to the LaserWriter Select 300 printer. (For more information, see "GrayShare: A New Printer Technology," in the February 1993 *Apple Direct*.)

The second enhancement is FinePrint, which was first available on the LaserWriter IIf and IIfg. FinePrint improves the smoothness of text by shifting printed dots horizontally to minimize the stairstep effect of rasterized text.

The third enhancement, PhotoGrade, is built into the LaserWriter Select 300 but becomes active only when you add 4 MB of memory to the printer. It dramatically increases the quality of a grayscale image being printed—up to 91 shades of gray. It does so by changing the width and placement of printed dots to create more shades of gray than would otherwise be possible. (As mentioned in the beginning of this article, it would take a 1,000-dpi printer to create a

grayscale image of the same quality as a PhotoGrade image printed on a LaserWriter Select 300.)

**Upgrades.** One of the features that makes the LaserWriter Select 300 printer a good buy is its expandability. You can add either 1 MB or 4 MB of memory to it. Users may want to add an extra 1 MB of memory for the rare case when a complicated page image doesn't compress into the standard 512 KB of memory in the LaserWriter Select 300. Users must add 4 MB of memory to enable PhotoGrade and its ability to print grayscale images. (Unlike PostScript printers, adding more memory to this printer does not improve its printing speed.) You can also upgrade the LaserWriter Select 300 by adding one extra bin that holds either 250 or 500 additional pages of paper.

For those who decide they need a PostScript printer, Apple is offering the Apple LaserWriter Select 300 PostScript Option, which makes the printer equivalent to a LaserWriter Select 310. (Essentially, the LaserWriter Select 300 logic board is replaced.) This feature helps sell the LaserWriter Select 300 to users who think they may someday want a faster, PostScript printer. However, note that a LaserWriter Select 300 that is converted to being a PostScript printer loses access to the LaserWriter Select 300's FinePrint, GrayShare, and PhotoGrade features.

## **LASERWRITER SELECT 310**

The LaserWriter Select 310 printer differs from the LaserWriter Select 300 in two very important ways. First, the LaserWriter Select 310 uses Adobe PostScript (not QuickDraw) to draw its pages. Second, the LaserWriter Select 310 has its own processor that drives the printing process (the LaserWriter Select 300 depends on the Macintosh computer it's connected to). Here are some notes about the LaserWriter Select 310:

- The LaserWriter Select 300 uses an AMD 29205 processor, which is a 16-bit RISC (reduced instruction set computer) chip.
- Apple expects that many of the people who will be buying the LaserWriter Select 300 and 310 will be relatively new users with modest printing needs (who will usually prepare simple text documents with some graphics in them). To meet these customers' wishes for a PostScript printer, Apple designed Adobe PostScript into the LaserWriter Select 310. Because of their simple printing

needs, however, Apple chose to include PostScript Level 1 in the LaserWriter Select 310. The reason? These customers will have little or no use for PostScript Level 2, and including it would have made the LaserWriter Select 310 considerably more expensive and therefore less attractive to these customers.

- The amount of memory in the LaserWriter Select 310, 1.5 MB, is adequate for most users' printing needs. However, if their needs grow, users may want to add more memory so they can print legal-size or very complicated pages. Without extra memory, Apple recommends that, when printing on a LaserWriter Select 310 printers without extra memory, users print documents with any number of built-in PostScript Type 1 fonts but no more than three downloadable fonts (which decreases the amount of memory left for drawing the page).

- The LaserWriter Select 310 has both serial and parallel input ports. The parallel port makes the LaserWriter Select 300 a good single-user PostScript printer for PC-compatible computers that run Microsoft Windows 3.x. (It can also be used with DOS programs that can drive PostScript printers.) Apple even includes a DOS/Windows printer driver disk with every LaserWriter Select 310 printer.

Users can connect a Macintosh computer to its serial port, or they can connect a DOS/Windows computer through either port—but the LaserWriter Select 310 was designed to connect to only one computer at a time. This is consistent with the expected audience for the LaserWriter Select 310. If users want a LaserWriter that can print from both Macintosh and DOS/Windows computers, they should buy a LaserWriter Pro 600 or 630 or a Personal LaserWriter NTR.

- The connection between a LaserWriter Select 310 and its Macintosh computer is a serial link running at 57.6 kilobits per second, with a handshaking line to ensure that no data gets lost. To guarantee that the LaserWriter Select 300 works with any computer from a Macintosh Plus to a Macintosh Quadra 950, the printer driver sends data to the LaserWriter Select 310 in 3-byte packets. ◆

\*\*\*\*\*

## **Technical Summary: LaserWriter Select 300 and 310**

A new laser engine from Fuji Xerox is at the heart of the LaserWriter Select 300 and 310. Both printers are “personal” LaserWriter printers in that both are meant to connect directly to one Macintosh computer. (You can also connect

the LaserWriter Select 310 to a PC running Windows or some DOS programs.) The LaserWriter Select 300 uses QuickDraw and the Macintosh computer to which it's connected to draw and print a page. Because of this, a faster Macintosh will print a document faster on the LaserWriter Select 300. The LaserWriter Select 310 has its own processor, which draws and prints pages using Adobe™ PostScript. In most cases, its printing speed is not affected by the Macintosh that uses it. You can upgrade a LaserWriter Select 300 to be essentially the same as a LaserWriter Select 310, but by doing so, you lose the LaserWriter Select 300's FinePrint, GrayShare, and PhotoGrade features and gain the LaserWriter Select 310's PostScript features. ◆

\*\*\*\*\*

## **LaserWriter Select 300 and 310 Suggested Retail Prices**

Since last issue, Apple has finalized the U.S. suggested retail prices for the LaserWriter Select 300 and 310 printers and their accessories:

LaserWriter Select 300	\$819
LaserWriter Select 310	\$1,079
LaserWriter Select 300 PhotoGrade Upgrade	\$269
LaserWriter Select 300 PostScript Option	\$349

(available April '93)



TECHNOLOGY

## Inside Apple's New 68040 Computers

### Technical Details on the Macintosh Centris 610 and 650 and Macintosh Quadra 800

*By Gregg Williams*

Apple Direct *Staff*The Macintosh Centris 610, Macintosh Centris 650, and Macintosh Quadra 800 computers, introduced on February 10th, bring the Motorola 68040 processor to the mainstream of Macintosh computing. They do this by offering a variety of models and configurations that span the price range between \$2,000 and \$7,000.

Last month's *Apple Direct* (March 1993) gave an overview of these three computers and explained Apple's strategy in creating them. This article describes much of the technology inside these computers, including some technical points that you may need to know—like problems due to a hardware artifact called “byte smearing” and information on designing expansion cards that work in a range of Macintosh models. (See “Technical Summary” below for an overview.) The most important points are described in the first half of this article.

Most of you won't have to worry about possible hardware incompatibilities, but a few items may affect some of you. Here are the items you may need to know about.

**Video Driver Problems.** Directly manipulating the hardware is a no-no (see “If I've Told You Once...” below), but in some cases it's unavoidable. For example, if you design video interface cards, changes in the hardware of the Macintosh Centris 610 and 650 and Macintosh Quadra 800 may force you to rewrite the video drivers that you supply.

Many video cards and their drivers will continue to work as they are. Among those video drivers that may need to be changed are drivers that change video configuration parameters “on the fly” (as multisync monitors do). The new MEMC chip, which controls access to video memory, works the same as the video circuitry of earlier Macintosh models when programmed through Toolbox routines. But the on-chip registers are different on the MEMC chip, and if your video driver changes these registers directly, you will have to modify it to work with the MEMC chip.

**Byte Smearing.** An artifact can be described as a feature known to be present but not “officially” part of the object that contains it. Byte smearing is a well-known artifact of the Motorola 68020 and 68030 processor family, but it is not present on the 68040 chip (which the Macintosh Centris 610 and 650 computers and all the Macintosh Quadra computers use).

The definition of, say, the MOVE.B instruction in the 68020 and 68030 processor is that the (8-bit) byte of data being moved is available in one byte of the longword result that MOVE.B returns—and that the data in the rest of the longword is undefined. On the 68020 and 68030, byte smearing results in the desired byte of data being duplicated in the other three bytes of the longword result. (Byte smearing works similarly for 16-bit move operations.)

Byte smearing becomes a problem when the programmer uses the value in one of the undefined bytes or words as the result of the move operation. (A developer might do this to keep from having to shift the desired value to the correct “byte lane.”) Since the 68040 processor does not do byte smearing, code that depends on byte smearing will read some random value. At best, the operation doesn’t work; but it may destroy some data, cause your program to crash, or worse.

So who would be lazy enough to do byte smearing? Well... Apple Computer, for one. The video-driver software for three early Apple video cards, the Macintosh II Video Card, Macintosh Portrait Video Card, and Macintosh Two-Page Video Card, rely on byte smearing.

This presents a problem, and here’s the solution Apple came up with: If any of the above Apple cards are present, system software for the Macintosh Centris 610 and 650 and Macintosh Quadra 800 (and the other Macintosh Quadra computers) patches the video drivers so they work correctly. If you supply a video card or some other card (such as an accelerator card) that patches a video card’s driver, you may need to modify your product to work correctly on these 68040 computers. (Of course, if your product already works on a Macintosh Quadra 700, 900, or 950, it should also work correctly on the Macintosh Centris 610 and 650 and Macintosh Quadra 800.)

**Power Budgets.** If you’re designing PDS (processor direct slot) or NuBus™ cards (or have already done so), you need to know how much power is allotted to each card. The Macintosh Centris 610 computer has an 86-watt (W) power

supply. It can hold one expansion card, either a 68040 processor-direct slot (PDS) card or (with an adapter) a NuBus card; this card's power budget is 10 W. The total power available to internal devices is up to 1.5 amperes (A) at 5 volts (V) and up to 1.5 A at 12 V.

The Macintosh Centris 650 has a 112 W power supply. It can hold up to three expansion cards, of which one can be a 68040 PDS card and the rest NuBus cards. Each such card has a power budget of 15 W. The total power available to internal devices is up to 1.5 A at 5 V and up to 2.0 A at 12 V.

The Macintosh Quadra 800 has a whopping 200 W power supply. The number, type, and power budgets of its three internal slots are the same as for the Macintosh Centris 650. The total power available to internal devices is up to 16.0 A at 5 V and up to 4.3 A at 12 V.

**Carriers and Bezels.** Peripherals that mount internally in the Macintosh Centris 610 and 650 and Macintosh Quadra 800 need new carriers (mounting hardware), bezels, and bezel shields (the last two of which are needed only by devices that use removable media). For design guides of these parts and further details, see the document *Macintosh Developer Note #3: Macintosh Color Classic, Macintosh LC III, Macintosh PowerBook 165c, Macintosh Centris 610, Macintosh Centris 650, and Macintosh Quadra 800* (part number R0461LL/A, available from APDA—see page 11 for ordering information).

## EXPANSION CARDS

You're probably interested in the material that follows if you have built or plan to build either a NuBus or a PDS card. In certain situations, you can build a card that can be used in more than one Macintosh model.

### **Macintosh Centris 650 and Macintosh Quadra 800 Expansion Cards.**

Both of these have three standard NuBus slots, one of which must be empty if the user installs a PDS card. The NuBus slots hold standard-size NuBus cards, as defined in *Designing Cards and Drivers for the Macintosh Family*, third edition. As discussed later, certain NuBus cards will also fit the Macintosh Centris 610 computer.

The Macintosh Centris 650 and the Macintosh Quadra 800 contain the same PDS connectors as those in the Macintosh Quadra 700, 900, and 950. So the Macintosh Centris 650 and the Macintosh Quadra 800 will work with many of the

68040 PDS cards available today. (Many PDS cards are dependent on the processor speed of the computer and may not work on computers running at a different speed. You can design many PDS cards—for example, video cards, SCSI accelerators, and network cards—to be processor-speed independent. That often takes more effort, but it results in a PDS card with a bigger market.)

On all three computers, the PDS card maps into the addresses of NuBus slot \$E and must contain the appropriate NuBus declaration ROM. In addition, the card must tell the NuBus controller that it is occupying the NuBus slot by pulling the /PDS.SLOT.E.EN line low.

**Macintosh Centris 610 PDS Cards.** The Macintosh Centris 610 computer has power and space for one internal expansion card. As described below, it can be adapted to hold either a 68040 PDS card or a NuBus card.

Because of the size and power constraints of the Macintosh Centris 610, PDS cards meant to be used with it must be no longer than 7.0 inches (177.8 mm) long and must consume a maximum of 10 W of power. (PDS and NuBus cards for the Macintosh Centris 650 and Macintosh Quadra 800 can be longer—usually 11.68 inches or 296.75 mm—and use up to 15 W.)

The Macintosh Centris 610 uses a PDS connector that is different from the PDS connectors in the Macintosh Centris 650, and the Macintosh Quadra computers (though the signals on both connectors are the same). If an existing 68040 PDS card meets the size and power restrictions mentioned earlier, such a 68040 PDS card will probably work in a Macintosh Centris 610 computer—but only if somebody manufactures an adapter card that converts the Macintosh Centris 610 PDS connector into the PDS connector used by the Macintosh Centris 650 and the Macintosh Quadra computers.

(If you want to create a PDS card for the Macintosh Centris 610 only, you can do so by meeting the card size and power requirements and plugging the card directly into the Macintosh Centris 610 PDS connector. A card created this way will be significantly less expensive than the way mentioned above—this design leaves out the adapter card and a bracket needed to support the PDS card connected to it.)

It's possible to create a 68040 PDS card for the Macintosh Centris 610 that will also work on the Macintosh Centris 650 and the Macintosh Quadra computers. The only restriction is that the PDS card must not need to interact with the outside world through a back-panel connector. The reason for this restriction is simple:

the 7-inch PDS card, by design, reaches to the back panel of the Macintosh Centris 610—but a 7-inch PDS card does not reach the back panel of the Macintosh Centris 650 or any of the Macintosh Quadra computers.

**Macintosh Centris 610 NuBus Cards.** If you got through the explanations so far, the rest is simple: To use a NuBus card in a Macintosh Centris 610, it must be at most 7 inches long and must use less than 10 W of power. Because of the connectors used, the customer must have a NuBus adapter board (which Apple is selling as a product).

Because of the placement of the NuBus connectors on a NuBus card, a 7-inch NuBus card that needs to connect to the computer's back panel does so on both the Macintosh Centris 610 and 650 and the Macintosh Quadra computers. This opens many more 7-inch NuBus cards to the possibility of working on both the Macintosh Centris 610 and any other Macintosh computer that has a NuBus slot.

**NuBus Cards and NuBus '90.** NuBus is an industry-standard expansion bus that Apple has used since the Macintosh II computer. Since then, the industry has proposed a new standard, NuBus '90, that includes numerous improvements, including a clock signal at 20 MHz, twice the 10 MHz speed of the original NuBus. The remarks that follow pertain to the implementations of NuBus that are in the Macintosh Centris 650 and Macintosh Quadra 800. Though most of the same signals are present on the NuBus adapter inside the Macintosh Centris 610, they have no meaning because that computer can only hold one NuBus card.

The NuBus slots in the Macintosh Centris 650 and Macintosh Quadra 800 are “NuBus '90-friendly”—that is, the traces for these lines exist on the backplane that connects all the NuBus connectors so that two or more cards can use NuBus '90 features, but the Macintosh Centris 650 and the Macintosh Quadra 800 make no use of them. (This is true for all the previous Macintosh Quadra computers as well.) Here are the main features supported on these computers:

- *Double-rate block transfers.* Using the /TM2, /CLK2X, and /CLK2XEN signals, two NuBus '90 cards can do double-rate block transfers with each other (but not to or from the computer's main logic board).
- *High-speed serial bus.* Two new signals, SB0 and SB1, occupy formerly reserved pins A2 and C2 on the NuBus connector. These two lines implement an IEEE P1394 high-speed serial bus.

- *Cache-coherency protocol.* Signals /CM0, /CM1, /CM2, and /CBUSY support a cache-coherency protocol. These signals have pins on the NuBus connector assigned to them, but the computers listed above do not support them.

In addition, the computers listed above do not supply power to the STBYPWR pin (which is itself an optional signal within the NuBus '90 specification).

**A Possible NuBus Incompatibility.** Only a very few of the earliest-designed NuBus cards have this problem, but I mention it in the interest of completeness. Eight pins in the original NuBus specification, pins B8–B11 and B24–B27, were defined as pins for –5.2-V power. Some early NuBus cards tied those eight pins together. Now those same pins are being used to implement NuBus '90 features.

If any NuBus card in a Macintosh Centris 650 or Macintosh Quadra computer ties these eight pins together, all the NuBus cards will work overall, but the NuBus '90 features that use these lines will not work. Apple engineers say that this problem occurs in a very few NuBus cards.

## SYSTEM ARCHITECTURE

“The Macintosh Centris 610 and 650 and Macintosh Quadra 800 Architecture” (on page 7) shows the overall architecture of these three computers. Here are some notes on various subsystems.

***Custom Chips.*** Apple engineers designed three custom chips to provide numerous functions while minimizing both cost and power. These three chips are the MEMC, the IOSB, and the KIWI.

The MEMC provides control and timing signals for ROM, memory, and video memory. It also controls system bus arbitrations and the frame buffer controller.

The IOSB custom chip consolidates various I/O circuits into one chip, including the SWIM II floppy-disk controller, VIA1 and VIA2 (which handle various control and interface functions), sound circuitry, and I/O data bus buffers and address decoders.

The KIWI custom chip serves as interface between the 68040 processor and the NuBus bus. It contains the same functions as the YANCC NuBus chip used in the Macintosh Quadra 700 and 950 computers, but it is accessed differently. Most developers will not be affected by this.

**I/O Bus.** The system bus, which contains the computer's address and data lines, is connected directly to the 68040 processor and runs at the same clock rate. The I/O bus, which connects the 68040 processor to all external peripherals and systems (such as SCSI hard disks and Apple Desktop Bus devices), is partially buffered from the 68040 processor and is synchronous with the system bus.

The IOSB custom chip serves as a buffer between the 68040 processor and I/O devices. One of its functions is to hide differences between the 68040 and previous processors so that existing software continues to work.

The IOSB chip does byte steering, described later, and something else called *dynamic bus sizing*. In the 68030 processor, instructions that write 32-bit data to a peripheral with a 16-bit interface first write the top 16 bits, wait for the I/O device to accept the data, then write the bottom 16 bits. The 68040 processor isn't so considerate; it throws all 32 bits out simultaneously and goes on with its work.

To keep developers (and Apple) from having to rewrite a lot of low-level I/O code, Apple engineers designed the IOSB chip to store all 32 bits of the data being given, let the 68040 continue, then "feed" the data to the I/O device 16 bits at a time. A similar thing happens for data coming from the peripheral, through the IOSB, and into the 68040.

**SIMMs and Memory Interleaving.** Both the Macintosh Centris 610 and 650 and Macintosh Quadra 800 use essentially the same SIMM (Single Inline Memory Module) strips as some IBM PC-compatible computers. (Apple adds certain manufacturing requirements that, strictly speaking, rule out certain 4 MB and higher PC SIMMs. Also, Apple SIMMs do not use the parity bit that is supplied on some PC SIMMs.)

These SIMMs have 72 pins, as opposed to the 30-pin SIMMs that Macintosh computers have used to date. These extra pins make it possible to access 32 bits of data at one time; they also make it possible to create double-sided SIMMs that look to the computer like two separate SIMM banks. The Macintosh Centris 610 and 650 computers use 80-nanosecond (ns) memory, while the Macintosh Quadra 800 computer uses 60-ns memory.

With this new design, you no longer have to install SIMMs in sets of four, nor do you have to worry which SIMM should go where. At startup time, ROM boot code automatically determines the size of each bank of memory and configures the MEMC chip to map all the memory into one contiguous block. This design

requires you to use 4 or 16 MB SIMMs; you can't use the 30-pin, 1 MB SIMMs that populate most Macintosh computers today.

Since the SIMM slots in the Macintosh Centris 610 and 650 and Macintosh Quadra 800 are designed to take double-sided SIMMs, the densest SIMMs that these computers can use is a 32 MB SIMM—that is, a double-sided SIMM that contains 16 MB of memory on each side.

Though it's true that you can be more casual in installing SIMMs, you can increase memory performance by installing two SIMMs of the same size in the right SIMM banks. The Macintosh Centris 650 and Macintosh Quadra 800 (but not the Macintosh Centris 610) can do something called *interleaving*. If two SIMM slots in a pair (slots 1 and 2 or slots 3 and 4) contain the same density SIMMs, the system hardware reads adjacent memory locations, one from each SIMM, at a considerably faster rate than the hardware otherwise could—theoretically up to 30 percent faster during burst accesses. This increases the computer's overall performance. The Macintosh Quadra 800 comes with two 4 MB banks of memory on the main system board; these banks always interleave their memory accesses.

**Single SCSI Bus.** The Macintosh Centris 610 and 650 and Macintosh Quadra 800 computers all have one SCSI (Small Computer System Interface) bus that begins with the internal SCSI cable, goes through the bus traces on the internal logic board, and (optionally) continues through a chain of external SCSI devices. This contrasts with the Macintosh Quadra 900 and 950, which have separate internal and external SCSI buses. (The separate buses make the computers faster, but they also add to their cost.)

Because of the length of the SCSI bus, both ends must be terminated. (This must be done to minimize noise across the bus.) Apple supplies the internal SCSI hard disk on the end with a terminator. If you add external SCSI peripherals, the one on the end should be terminated—standard practice for SCSI devices.

However, the second end of the SCSI bus must be terminated, even if no external SCSI peripherals are connected to the computer itself. To solve this problem in as elegant and automatic a way as possible, Apple has devised and patented auto-termination circuitry, which detects the status of the rear-panel SCSI connector and provides the proper termination if it senses no external SCSI devices connected.



**68040 Processor.** The bottom line here is that the Motorola 68040 processors in the Macintosh Centris 610 and 650 and the Macintosh Quadra 800 computers won't cause you any problems. The reason for this is that Apple first used the 68040 in the Macintosh Quadra 700 and 900, which were introduced almost a year and a half ago, and you would have found almost all of the potential problems while ensuring your products' compatibility with the Macintosh Quadra 700, 900, and 950. (For more details on the Macintosh Quadra 700 and 900, see pages 6 and 7 of "The October Revolution" in the October 1991 issue of *Apple Direct*. If you don't have a paper copy, you can find the article on AppleLink—pathname Developer Support:Developer Services:Periodicals:Apple Direct:Apple Direct October 1991:New Product Intros.sit. You can also find it on a recent Developer CD. On the March 1993 Developer CD, titled *Other's Peoples Memory*, the pathname is Dev.CD Mar 93:Periodicals: Apple Direct: Apple Direct 1991:1. Apple Direct Oct '91:New Product Intros:Notebooks, 040s, etc..)

Actually, some computers (the Macintosh Centris 610 and some configurations of the Macintosh Centris 650) don't use a 68040 processor; they use a 68LC040 processor, which is identical to the 68040, except that the 68LC040 doesn't contain the floating-point unit (or FPU—also called a math coprocessor) that is present in the 68040 chip. This is another example of Apple targeting different audiences and removing certain features to offer Apple products at the lowest possible prices. In this case, Apple removed the FPU because it felt that the expected purchasers of the Macintosh Centris 610 and the entry-level Macintosh Centris 650 configurations don't need an FPU. (On both the Macintosh Centris 610 and 650, you can add an FPU—though not inexpensively—by replacing the 68LC040 chip with a 68040.)

You might want to keep some key features of the 68040 in mind:

- built-in memory-management units (MMUs), one for instructions and one for data
- a built-in FPU (absent on the 68LC040 chip)
- separate 4-kilobyte (KB) instruction and data caches
- support for *copyback caching*, a method of caching that causes some pre-68040 code to crash

For more information on these and other 68040 operation and compatibility issues, see the October 1991 *Apple Direct* article mentioned earlier.

## **OTHER FEATURES**

Here are a few other features of the Macintosh Centris 610 and 650 and Macintosh Quadra 800 that bear mentioning:

- *Ω SANE*. The Standard Apple Numerics Environment is a package of standardized numerical routines that any Macintosh program can call on. Ω SANE is an enhancement that is present in the Macintosh Centris 610 and 650, as well as all the Macintosh Quadra computers and all the PowerBook computers except the PowerBook 100. Ω SANE watches for the first execution of a SANE instruction. If Ω SANE finds that the calling code is in memory, it replaces the SANE instruction and the “glue” code around it with a direct call to the routine that implements that SANE instruction; subsequent executions of the same code execute faster. Overall, Ω SANE can execute SANE instructions up to 2.5 times faster than normal.

- *The 68040 FPU*. The FPU built into the Motorola 68040 processor is designed to run the most-often executed floating-point instructions more quickly than in previous implementations. However, the 68040 FPU does not execute all the instructions that the 68881 and 68882 (FPU chips used by the 68020 and 68030 processors) do. Code supplied by Motorola emulates the missing instructions to maintain backward compatibility with existing code. However, if you’re really into optimization, you can increase your code’s speed by using the floating-point operations built into the 68040 hardware as much as possible.

- *Faster video*. As with previous designs, the Macintosh Centris 610 and 650 and Macintosh Quadra 800 have video memory separate from main memory. These computers run faster than previous models, where periodic access to the part of main memory used for video slowed the access to all the rest of the memory in the same bank.

These three computers use a redesigned video controller chip that provides faster video access than before. The Macintosh Centris 650 and the Macintosh Quadra 800 use 80-ns video memory (the Macintosh Centris 610 uses 100-ns memory). Because of the new video controller, the video performance of the Macintosh Centris 610 and 650 and the Macintosh Quadra 800 can be up to 20 percent faster than that of the Macintosh Quadra 700.

- *Byte steering*. A subject related to byte smearing is *byte steering*. Previous Macintosh models have used I/O hardware that expected to “see” a byte or word of data in one of the four byte lanes of the 32-bit data bus. One of the functions of the IOSB custom chip inside the Macintosh Centris 610 and 650 and Macintosh Quadra 800 is, when necessary, to shift data to the same byte lanes that 68030-

based Macintosh computers use. In this way, today's software works on all Macintosh computers, even though the 68040 processor does not deliver data in the same way that the 68030 does.

- *Sound and the CD-ROM.* On the Macintosh Centris 610 and 650 and Macintosh Quadra 800 (as on the Macintosh Quadra 900 and 950), the stereo audio output of the CD-ROM drive, when present, is mixed with the computer's stereo audio and the monophonic input from the sound-input port; the resulting signal is delivered to the computer's internal speaker and its stereo sound-output port. This means that you can hear audio from both the computer and the CD-ROM at the same time. Similarly, the CD-ROM's stereo audio output is mixed to monophonic and routed to the computer's sound-input hardware, making it easy for you to digitize audio coming from the CD-ROM.

- *SCSI IDs for 5.25-inch removable-media drives.* When Apple configures a Macintosh Centris 610 and 650 or Macintosh Quadra 800 with an internal CD-ROM drive (the AppleCD 300i drive), it is set with a SCSI ID of 3. For this reason, if your product is an internally mounted 5.25-inch removable-media drive, you should also set its SCSI ID to 3.

- *Software support for new features.* The ROM in the Macintosh Centris 610 and 650 and the Macintosh Quadra 800 is similar to the ROM software in the Macintosh Quadra 700, 900, and 950 in that it is based on the Macintosh IIci ROM and preserves as much of the original ROM image as possible. ROM changes include support for the 68040 FPU and MMU, video hardware, memory mapping, virtual memory, exception handlers, and RAM disk. In most cases, the software and hardware of these computers work together to mimic the behavior of 68030-based Macintosh models. By doing so, they execute existing code that would otherwise crash when confronted with the architectural differences between these three new Macintosh models and previous models. ◆

\*\*\*\*\*

## **Technical Summary: Macintosh Centris 610 and 650 and Macintosh Quadra 800**

The Macintosh Centris 610, Macintosh Centris 650, and Macintosh Quadra 800 computers have been designed to maximize compatibility with existing pre-68040 hardware and software, while still exploiting the Motorola 68040 processor and the new features in these computers' hardware.

Opportunities exist to create NuBus and 68040 PDS (processor-direct slot) expansion cards that will work in all three computers. In addition, properly designed NuBus boards can also work in other Macintosh models that have NuBus slots. Several restrictions apply (such as the 10 W power budget and 7-inch length of expansion cards for the Macintosh Centris 610), and this article tells you about them.

If you have created low-level code (usually for things like video and accelerator cards) that depends upon the pre-68040 artifact called *byte smearing*, you may need to rewrite that code.

Also, if you sell internal SCSI peripherals, be aware that the Macintosh Centris 610 and 650 and Macintosh Quadra 800 computers use different carriers and bezels from those used by other Macintosh models.

For more details, see this article, as well as the article on the Macintosh Quadra 700 and 900 computers in the October 1991 issue of *Apple Direct*. ◆

\*\*\*\*\*

## Suggested Retail Prices

Since the last issue, Apple has finalized the U.S. suggested retail prices for these computers. The following configurations are available:

Macintosh Centris 610 68LC040, 4 MB/80 HD	\$1,859
Macintosh Centris 610 68LC040, 4 MB/80 HD, Ethernet	\$1,969
Macintosh Centris 610 68LC040, 8 MB/230 HD, Ethernet	\$2,519
Macintosh Centris 610 68LC040, 8 MB/230 HD, CD, Ethernet, 1 MB VRAM	\$2,899
Macintosh Centris 650 68LC040, 4 MB/80 HD	\$2,699
Macintosh Centris 650 8 MB/80 HD, Ethernet	\$3,189
Macintosh Centris 650 8 MB/230 HD, Ethernet	\$3,559
Macintosh Centris 650 8 MB/230 HD, CD, Ethernet, 1 MB VRAM	\$3,939
Macintosh Centris 650 8 MB/500 HD, Ethernet, 1 MB VRAM	\$4,379
Macintosh Quadra 800, 8 MB/230 HD, Ethernet	\$4,679

Macintosh Quadra 800, 8 MB/500 HD, Ethernet	\$5,429
Macintosh Quadra 800, 8 MB/500 HD, CD, Ethernet, 1 MB VRAM	\$5,829
Macintosh Quadra 800, 8 MB/1000 HD, Ethernet, 1 MB VRAM	\$6,399

(all prices in U.S. dollars)

\*\*\*\*\*

## If I've Told You Once...

Some advice is timeless, as is—unfortunately—the giving of it. This is certainly the case with Macintosh compatibility rules; here are several that need repeating. Some of them are general, others are tied to specific conditions—all of them are important:

- *Don't manipulate the hardware directly.* Instead, use the Macintosh Toolbox routines that accomplish the task you want to get done. Sometimes, to make a better Macintosh, Apple changes the hardware but leaves the relevant Toolbox programming interface the same. (We do this a lot with custom I/O chips.) Not messing with the hardware greatly increases the probability that your program will work on new Macintosh models.

- *"Don't assume..."* In particular, don't assume that a given feature—an internal floating-point unit (FPU) coprocessor, for example—is tied to a given product line or processor. Apple is and will be offering key features in various combinations, and it's your program's responsibility to check for a feature before you use it. In most cases, you can use the Gestalt Manager routines to make such a check.

In the case of the new Macintosh Centris 610 and 650 and Macintosh Quadra 800, don't assume that you have an internal FPU or Ethernet. Use the Gestalt routine to check.

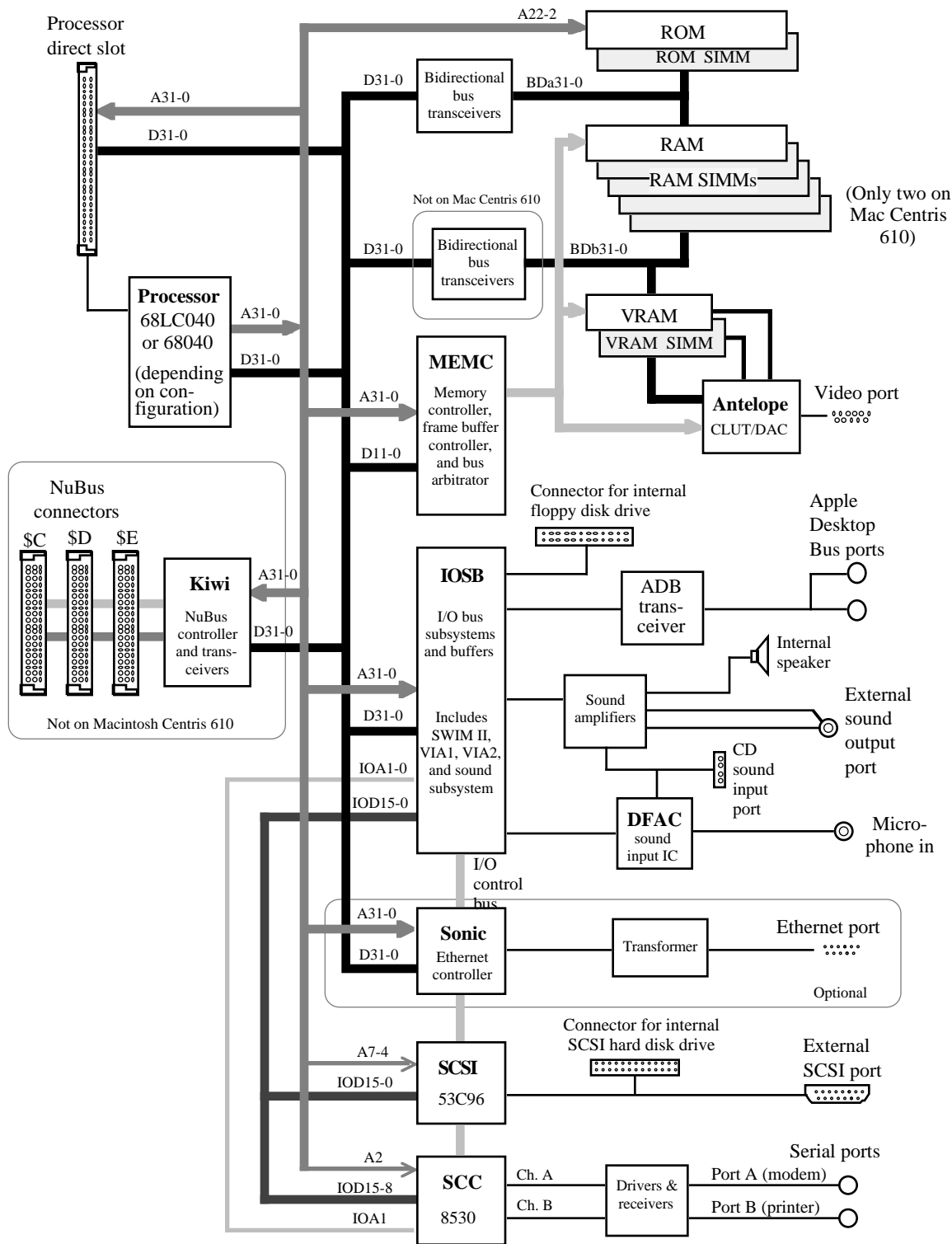
- *Don't use timing loops.* Don't assume that a certain piece of code will always take a certain amount of time. You can be sure that the code will run on a variety of Macintosh models, each with its own processor (from the Motorola 68000 to the 68040) and its own processor speed (from 8 MHz to 40 MHz). Instead, use the Toolbox routines provided by the Time Manager.

- *16-bit video.* The Macintosh Centris 610 and 650 and Macintosh Quadra 800 are the first 68040-based Macintosh models to have 16-bit color but not 24-bit color. (The Macintosh Quadra 700, 900, and 950 have both 16-bit and 24-bit color.) Some existing programs assume—wrongly—that if better than 8-bit color is available, it must be 24-bit color. If your program doesn't check for and handle 16-bit color, it is going to be in trouble.

- *SWIM-chip copy protection.* In general, you should not use copy protection—which I define loosely as the attempt to prevent software theft by checking for some nonstandard disk characteristic that is difficult to reproduce using normal disk-copying operations. Apple reserves the right to change its hardware, and new hardware may not behave exactly as your copy-protection routine expects.

In particular, some developers have used copy-protection routines that depend on the presence of the SWIM chip (which controls floppy disk drives). In the Macintosh Centris 610 and 650 and Macintosh Quadra 800, the IOSB custom chip implements the functions of a SWIM II chip—a later floppy-controller design. SWIM-chip copy-protection routines may not work with the IOSB chip. ◆

\*\*\*\*\*



**Macintosh Centris 610 and 650 and Macintosh Quadra 800 Architecture.** The processor used depends upon the computer model and configuration. The Macintosh Centris 610 and entry-level versions of the

*Macintosh Centris 650 computers use the 68LC040 processor. All other Macintosh Centris 650 computers and Macintosh Quadra 800 computers use the 68040 processor.*



## Compatibility + Options = Macintosh LC III

### Apple Improves Its Most Popular Macintosh

The Macintosh LC and LC II have been the most popular desktop models in the history of the Macintosh. Now Apple is adding a new model, the Macintosh LC III, to the Macintosh LC line. Last month (in the March 1993 *Apple Direct*), we looked at the features of the Macintosh LC III and why Apple introduced it. In this article, we'll look at the technology of the Macintosh LC III.

In the United States, a Macintosh LC III costs between \$160 and \$180 more than a comparable Macintosh LC II. What do you get for that money? A lot. You get a Macintosh that's almost twice as fast. Two factors contribute significantly to the increase in speed: the processor speed (25 MHz on the Macintosh LC III, as opposed to 16 MHz on the Macintosh LC II) and the internal data bus width (32 bits wide, as opposed to 16 on the Macintosh LC II).

The Macintosh LC III is a lot more expandable than its predecessor—you can expand it to 36 MB, as opposed to 10 MB on the Macintosh LC II; you can also add a Motorola 68882 FPU (floating-point unit). The Macintosh LC III can handle larger monitors, at deeper pixel depths, than the Macintosh LC II—see the next section and last month's article for details.

#### COMPATIBILITY IS HIGH

The good news (and there's no bad news, really) is the Macintosh LC III retains compatibility with previous models, while providing new features. Here are some of the items that are both compatible and improved.

**Video.** The Macintosh LC III supports larger monitors and deeper pixel depths than the Macintosh LC II. The reason for this is that the Macintosh LC III comes with more video memory than the Macintosh LC II—512 KB on the Macintosh LC III, compared with 256 KB on the Macintosh LC II—and you can expand both by an additional 256 KB of video memory. So, for example, the built-in video interface of the Macintosh LC III can drive the Apple 16-inch Color Display (832 x 624 pixels) at up to 8-bit color, while the largest monitor the Macintosh LC II can handle without adding an internal video card is the 14-inch Macintosh Color Display (640 x 480 pixels).

One delightful addition to the Macintosh LC III's video is a new video mode, 640 x 400 (not 480) pixels of 16-bit color on an *unenanced* Macintosh LC III. If you can afford to lose the 80 bottom lines of a normal 640 x 480-pixel display, you can get 16-bit color from a Macintosh LC III out of the box. (You can get 16-bit color at 640 x 480 pixels if you add the extra 256 KB of video memory.) Congratulations to whoever thought this up—it costs Apple nothing, and it's a feature many users will enjoy having.

**Other I/O.** More good news: The two serial ports, the SCSI port, the floppy-disk interface, and the Apple Desktop Bus microcontroller chip are essentially the same as they are on the Macintosh LC II. The SWIM II floppy-interface circuitry is now part of a new custom chip called Sonora (more on it later)—but any copy-protection software that depends on the older SWIM chip will probably not work.

The sound circuitry on the Macintosh LC III is essentially the same as on a Macintosh LC II. One interesting note: The memory for the sound input and output buffers (1 KB each) is tucked away in video memory. Of course, you will have no problems if you've played by the rules. As the developer note for the Macintosh LC III summarizes it, "The change is transparent to application software that uses the Sound Manager." (The full title of the document is *Macintosh Developer Note #3: Macintosh Color Classic, Macintosh LC III, Macintosh PowerBook 165c, Macintosh Centris 610, Macintosh Centris 650, and Macintosh Quadra 800*; its part number is R0461LL/A, and it's available from APDA.)

The Apple Desktop Bus (ADB) keyboard on the Macintosh LC III works the same as on the Macintosh LC and LC II. No Macintosh LC model has actual interrupt or reset buttons. On the Macintosh LC III, as on previous Macintosh LC models, you can generate an interrupt by pressing the Command and Power keys simultaneously, and you can generate a reset by pressing the Command, Control, and Power keys.

**New Memory SIMMs.** One thing that's *not* compatible with previous Macintosh computers is the memory. Until now, most Macintosh computers used a 30-pin SIMM (Single Inline Memory Module). The Macintosh LC III, along with the Macintosh Centris 610 and 650 and the Macintosh Quadra 800, uses a new 72-pin SIMM; this is the same design that is used in the IBM-compatible world. All these Macintosh computers must use 4 MB and larger SIMMs.

Why the extra pins? With them, a single SIMM can be double-sided, with each side being a memory bank that's independent of the other. The Macintosh LC III has only one SIMM slot, but the hardware sees *two* banks of memory. This one SIMM can hold either one or two 1 MB, 4 MB, or 16 MB banks of memory. Since 4 MB of memory is soldered on the main logic board, this gives the Macintosh LC III possible configurations of 4, 5, 6, 8, 12, 20, and 36 MB. (At the moment, a 32 MB SIMM costs about as much as the computer itself, but SIMM prices always go down eventually.)

**Adapting NuBus Cards.** If you sell NuBus cards, it may be profitable to take your NuBus card design and adapt it to be a Macintosh LC III PDS (processor direct slot) card. If you do so, there is one architectural difference you should be aware of. NuBus cards assume a 32-bit path to video memory, but the Macintosh LC III has a 16-bit path to its video memory. If your NuBus card works with the Macintosh LC III video memory directly, it must do so in either 8-bit or 16-bit transfers.

## THE MACINTOSH LC III PROCESSOR-DIRECT SLOT

One of the biggest pieces of Macintosh LC III-related news for hardware vendors is its 68030 PDS. This PDS design gives both developers and users the best of two worlds. The connector is in two pieces: One piece is compatible with existing 68030 PDS cards, while the other piece supplies 18 new signals that make this connector a true processor-direct slot. (The Macintosh LC and LC II PDS connectors lack certain useful signals that come from the 68030 processor—for example, three address lines—A28, A29, and A30—and the cache burst request and acknowledge lines—/CBREQ and /CBACK.)

As with previous models of the Macintosh LC computer, a Macintosh LC III PDS card can be a bus master. (A bus master card has its own processor and takes control away from the processor that normally runs the computer.) Because the Macintosh LC III has a full PDS, its PDS cards can be 16-bit or 32-bit bus masters. One new PDS pin, 16MASTER, tells the Macintosh LC III hardware whether the PDS card installed uses either 16 or all 32 of the 68030's 32 data lines.

Another useful signal new to the Macintosh LC III PDS is /CPU.DISABLE. This pin disables the 68030 processor and (if present) the 68882 FPU on the

Macintosh LC III main logic board. /CPU.DISABLE is primarily used to implement hardware accelerator cards.

Software should address a Macintosh LC III PDS card as if it were a NuBus card in logical slot \$E. (The design philosophy behind this requirement is called *pseudoslot design*. If the PDS card is based on a previously designed NuBus card, pseudoslot design allows you to reuse the NuBus slot driver with the PDS card.) Software must address this card as if its addresses were either in the 16 MB standard slot \$E slot space (addresses \$FE00 0000 through \$FEFF FFFF) or slot \$E's 256 MB super-slot space (addresses \$E000 0000 through \$EFFF FFFF) Also, the PDS card should decode all of its address lines, and it must have a declaration ROM located at the upper address limit of its 16 MB address space.

One final requirement: A Macintosh LC III PDS card, like Macintosh LC and LC II PDS cards, must use no more than 4 watts of power.

## **OTHER ITEMS**

**Sonora.** A new custom chip, Sonora, consolidates the functions in previous Macintosh LC custom chips—the SWIM (floppy-disk controller) and V8 chips. Sonora provides two clock signals to the Macintosh LC III and handles the audio, video, floppy disk, PDS slot compatibility logic, and miscellaneous control signals. It has a memory controller that works with the MMU (memory-management unit) of the 68030 to map the hardware into either a 24-bit or 32-bit address space. Its floppy-disk control circuitry implements the SWIM2 chip, which is a later chip design than the SWIM chip found in earlier Macintosh LC models.

**Existing Ethernet PDS Designs.** Because the Macintosh LC III is a different machine, it needs different driver software for any Ethernet PDS card that might be installed. However, if an Ethernet card “plays by the rules,” Macintosh system software knows how to patch the driver so that it works on the Macintosh LC III. If you sell an Ethernet card, you should make sure that it works correctly on a Macintosh LC III.

**PDS Accessing Memory.** To get higher performance, the Sonora chip accesses memory in a slightly different way from the V8 chip (on the Macintosh LC and LC II). This difference might affect existing PDS cards, but, according to *Developer Notes: Macintosh LC III*, “This change should not affect existing PDS

cards unless designers have taken specific steps to work around the timing delays of the V8 chip.” ◆

\*\*\*\*\*

## **Technical Summary: Macintosh LC III**

The Macintosh LC III improves the Macintosh LC II in several ways. It's almost twice as fast as its predecessor (which is still available, at a lower price) and can use more memory and connect to more video monitors. It does this with no serious compatibility problems.

One of the most significant improvements in the Macintosh LC III is its processor direct slot (PDS). The Macintosh LC III PDS is backward compatible with existing Macintosh LC and LC II PDS cards, but the Macintosh LC III PDS connector includes 18 more signals that make new, more powerful PDS card designs possible. ◆

\*\*\*\*\*

## **Macintosh LC III Suggested Retail Prices**

Since last issue, Apple has finalized the U.S. suggested retail prices for the Macintosh LC III. The following configurations are available:

Macintosh LC III, 4 MB/80 MB HD, Keyboard	\$1,349
Macintosh LC III, 4 MB/160 MB HD, Keyboard	\$1,499

## CD Highlights

Welcome to the April issue of the Developer CD Series, the first System Software edition. (Fear not! the amusing movie titles will be back next month.) As promised, this disc contains the most complete collection of system software ever published by Apple Computer. Our intent in designing this disc is to provide our developers with every possible resource for integrating new system software technologies into their products.

A special thank you goes to the folks in Central Software Support and International Software Support for their tireless efforts in making this disc possible. The real superhero, who assisted us in the design, testing, and content development of this disc, was Chris Hansten. Thank you, Chris!

### SYSTEM SOFTWARE

In the System Software folder at the top level of your CD you will find three folders: Worldwide System Software, System Enablers, and System Extensions. Here's what to look for in each of these folders.

**Worldwide System Software:** Here you will find localized system software for 32 countries. For your convenience, system software has been included in two formats: net installs and disc images. The disc images are compressed self-extracting archives. The net installs, however, should let you install any country's software directly from your CD.

The Worldwide System Software folder is set up alphabetically by country. In each country's folder you will find not only the appropriate System 7.1 disc images and net install, but also aliases to system enablers and QuickTime versions that have been localized for that country as well. This allows you to search for all the software localized for a given country from this one folder.

Look for the following systems on this CD: Arabic 7.1, British 7.1, Catalan 7.1., Croatia 7.1, Czech 7.1, Danish 7.1, Dutch 7.1, Finnish 7.1, French 7.1, French Canadian 7.1, Chinese Simplified 7.1, German 7.1, Greek 7.1, Hebrew 7.0.1, Hungarian 7.0.1, Icelandic 7.0.1, International 7.1, Italian 7.1, Korean (Hangul) 7.12f, Norwegian 7.1, Persian 7.1, Polish 7.1, Portuguese 7.1, Romanian 7.1, Russian 7.1, Spanish 7.1, Swedish 7.1, Swiss French 7.1, Swiss German 7.1, Thai 7.1, Turkish 7.1, U.S. 6.0.5 – 7.1.

One noticeable omission from this list is KanjiTalk. This software has not yet been released to us. We are currently trying to negotiate for a special developer version designed for testing. No promises!—but we know this is important and we are trying. Watch the next two CDs for updates. Also, the Chinese Traditional system was not released to us since it is still in development. Again, see upcoming CDs for updates.

## **SYSTEM ENABLERS**

System enablers are system software components that update System 7.1 to add functionality for new CPUs. They make it easy to customize system software for new CPUs without creating new versions of system software. This is a significant advantage that aids the rapid development of new CPUs. Navigating the world of system enablers, however, can be quite a complex project! Believe me—we know from experience.

This disc contains more than 150 system enablers, the most complete collection available. No effort has been spared to get you the very latest updates as of this publication. Our hope is to eliminate the headaches associated with these system software components and provide you with a single, simple-to-use source of system enablers for testing and development.

This disc includes system enablers for the following new CPUs: Macintosh Ilvx, Ilvi (001); Macintosh Duo System (201); Macintosh PowerBook160/180 (111); Macintosh Centris/ Quadra (040), Macintosh Color Classic (401), Macintosh LC III (003), Macintosh PowerBook 165c (121).

Localized enablers are available for the following languages: Arabic, British, Croation, Czech, Danish, Dutch, Finnish, French, French Canadian, German, Greek, Hebrew, International, Italian, Norwegian, Polish, Portuguese, Russian, Spanish, Swedish, Swiss French, Swiss German, Turkish, and U.S.

Please read the ReadMe file at the top level of the System Enablers folder before attempting to install this software.

## **SYSTEM EXTENSIONS**

The System Extensions folder includes QuickTime 1.5 and the beta version of Apple's new AppleScript technology. Here are the details.

**QuickTime 1.5:** The QuickTime system extension adds capabilities that let your application programs integrate graphics, sound, video, and animation into documents. By providing a standard way for all Macintosh programs to control these multimedia elements, QuickTime makes them easier to use.

QuickTime 1.5 includes extensions and programming interfaces, CD-ROM Set-Up 4.0 for Photo CD support, MovieShop b24, MoviePlayer, and the QuickTime scrapbook. Featured in this version are a new video compressor, Compact Video for larger software-only video, support for hardware compression boards, alternate track support, and network tuning.

This disc includes the following localized versions of QuickTime: British 1.5, Czech 1.5, Danish 1.5, Dutch 1.5, Finnish 1.0, French 1.5, French Canadian 1.5, German 1.5, International 1.5, Italian 1.5, Norwegian 1.5, Polish 1.5, Spanish 1.5, Swedish 1.5, Swiss 1.5, Swiss German 1.5, Turkish 1.5, U.S. 1.5.

**AppleScript Beta:** The System Extensions folder also contains the beta version of AppleScript technology. AppleScript will be the first truly integrated scripting system for personal computers. With AppleScript, users will be able to leverage off-the-shelf applications to create powerful custom solutions and to automate routine tasks. AppleScript components include a revised Apple Event Manager that supports recording AppleScript scripts, the AppleScript extension, and Toy Surprise, a simple script editor. To get started with AppleScript, install AppleScript on your system and launch the editor. Practice writing scripts that manipulate Quill, the sample scriptable and recordable text processor.

Included in this folder are AppleScript Interactive Datasheet, Installing AppleScript, developer scripts, development tools, documentation, and example scripts.

## **NEW NON-SYSTEM SOFTWARE MATERIALS**

As promised, we are also including the latest non-system software materials that have been submitted to us in the last four weeks. Remember, you never have to wait more than four weeks for new materials. Look in the “What’s new on this CD?” folder to find the following new and updated materials.

**Apple Bug Reporter 1.0b8:** Use this updated version of the Apple Bug Reporter to report any bugs you discover in Apple hardware and software.



**Developer University Course Info:** Developer University offers a broad range of Macintosh programming courses and materials that meet professional developers' needs for understanding the latest technical directions from Apple. This course information is for January–June 1993.

**AE Registry Database Suite:** This is a programmer reference designed to provide technical specifications for the events and objects defined in this standard suite. This is an addition to the Apple Event Registry: Standard Suites.

**Express Modem Developer Guide:** This guide provides information necessary for developing modem and fax applications. It includes both data and fax command sets.

**Mac Tech Note Updates:** This folder contains new and updated notes for the April Developer CD. (Please refer to the Mar '93 Developer CD, *Other People's Memory*, for the full Technical Note library.) New tech notes include *Loading Components Bug*, *Dependent Files*, *+5 Volt Trickle*, *Sense Lines*, *Serial I/O*, and *Port Q&A*. Revised notes include *AppleTalk: The Rest of the Story*, and *Fond of FONDS*.

**ColorSync 1.0.2:** ColorSync provides an open framework in which color management systems can operate within. Release 1.0.2 is an incremental release for bug fixes only.

**Installer 3.4:** This update of the Installer 3.4 features revised documentation. Look for appendixes describing common questions and answers, common error and alert descriptions, plus new Font Family Atom resource examples.

**Maximizing Quadra Floating Point:** This code sample improves the float-to-int conversion speed of the Quadra by over an order of magnitude.

**NAVIGATING THE SYSTEM SOFTWARE EDITION**

Several tools are included to make finding what you need as easy as possible. Look in the “What’s on this disc?” folder for the following tools.

**Guide to the System Software Edition:** This guide provides you with a pictorial overview of your new CD. We recommend that you print it out and keep the hard copy beside you as you tour your disc for the first time.

**What’s New on This CD?:** As in the past, this folder includes references to new and updated materials on this month’s disc. For system software–related materials, you will find aliases to software included elsewhere on this disc. For non-system software materials, you will find the actual packages listed under their appropriate subject headings.

**Dev.CD Contents Catalog:** This is your familiar Contents Catalog with a new twist: The catalog now contains cumulative listings for all three editions of the Developer CD. This allows you to search for materials in all content areas from this one stack and gives you the pathname to the most recent version of a given package.

Once you’ve had an opportunity to try out the various new features of this disc, please take a few minutes to fill out the CD survey, pathname Dev.CD Apr 93: What’s on this disc?:Survey—please respond!. This is our first System Software edition, so we are very interested in hearing your feedback! We have worked hard to make this disc a developer’s dream come true. You can bet that as soon as the CD hits developer mailboxes, we will be waiting on the edge of our chairs for your surveys and suggestions. Please let us know how we did and how we can better meet your development needs! We may not be able to respond directly to each of your comments, but you can be sure they will be carefully read and considered in light of our future product plans.

And yes, stay tuned next month for an outstanding new Tools & Apps edition, literally packed with the very latest information on Apple’s new technologies. It’s definitely one disc you won’t want to miss!

*Sharon Flowers*

*Developer CD Project Manager*

## HyperCard Moves to Apple Developer Group

Product development of future versions of HyperCard® will be done within the Apple Developer Group (ADG) as the result of a recently announced agreement between Apple Computer and Claris®.

Details of what future versions of HyperCard might look like and how they will be made available have yet to be released, but it's clear that Apple will continue to look at HyperCard primarily as a tool for developers. Future HyperCard development will take place in ADG's Developer Tools group under the same management currently spearheading the AppleScript and Bedrock (that is, Apple's and Symantec's cross-platform application development framework) projects.

HyperCard development efforts will be coordinated with AppleScript to give Apple, in the words of Apple President and CFO Michael Spindler, "a unified approach to, and a competitive advantage in, the emerging area of next-generation software-developer tools."

In announcing the move, Spindler added: "With HyperCard as a strategic cornerstone of Apple's development tools strategy, developers and users can look forward to significant investments in future tools for the HyperCard development community. Apple is well equipped worldwide to support development tools, developers, and authors, which makes this an important step forward for HyperCard."

Claris will continue to ship the current version of HyperCard until Apple releases its new version, after which Apple will take over full responsibility for product shipment and support. ◆

## Advanced Troubleshooting Tools Now Available

Developers can now obtain three powerful troubleshooting tools developed by Apple's Service Tools and Training group that were previously available only to professional technicians. Apple TechStep, MacTest Pro, and the Apple Service Guides will allow you to troubleshoot Macintosh computers and peripherals more completely and accurately than ever before, enabling you to reduce system downtime and save time and money spent on phone support.

The tools are currently available only in the United States but will soon be made available to developers worldwide.

Apple TechStep is a hand-held testing device that allows you to diagnose even non-functioning Macintosh computers and peripherals without opening the product case. You can check everything from SIMMs to floppy disk drives quickly, thoroughly, and accurately. TechStep weighs less than two pounds and is operated by simply hooking up the cables to the appropriate ports, then running the tests. Slide-in ROM packs contain the software for specific CPU and peripheral tests.

The MacTest Pro diagnostic software bundles are designed to check your entire system, running a thorough confidence test, providing system configuration information, and checking for software corruption problems like duplicate system folders. MacTest Pro allows you to assemble an array of tests from the test selection window, then start testing by clicking a single button. All test results are recorded for comparison, archiving, or printout. Three separate MacTest Pro bundles are available—Macintosh CPUs & Peripherals, Macintosh PowerBooks & Duos, and Macintosh Quadra & Centris.

Apple Service Guides summarize the essential information you need for troubleshooting Apple products. They are easy to carry and use, and contain exploded-view diagrams, error codes, and troubleshooting tables. The following service guides are currently available: *Apple Service Guide for Macintosh Computers, Volumes 1 and 2*, *Apple Service Guide for LaserWriter Printers*, *Apple Service Guide for Networking and Communications Products*, *Apple Service Guide for Monitors and Mass Storage*, *Peripheral Interface Guide*, and *Apple Service Module Identification Drive*. Additional guides are slated for future release.

These troubleshooting tools are for Macintosh experts who are able to perform support/troubleshooting activities on Macintosh CPUs, peripherals, and networks.

Ordering information about the tools is available on AppleLink (path—Developer Support:Developer Services Bulletin Board:Headlines for Developers), or you may call (800) 950-2442. ◆

## Editor's Note: Notes From SPA

**San Diego, March 5.** I'm just finishing up the Software Publishers Association (SPA) Spring Symposium, and I thought you'd like to hear a little about it. It's an annual meeting during which 1,200 software publishers (including a fair sampling of Apple developers) trade insights and techniques about their trade.

During a session this morning called "Taking on the Big Boys," I was reminded of the Classical Greek orator Demosthenes who, when asked what the most important factors in great speech-making were, he said there were three: "Delivery, delivery, delivery." No matter how valid one's point, no matter how well written, a speech could not be effective to Demosthenes (who, by the way, was known to practice his delivery with a mouth full of rocks) unless it was well delivered.

I was reminded of this old story by the important themes here at SPA: Marketing, marketing, and marketing. This may not be news to many of you, and maybe that's what you'd expect to hear from software publishers, but it never hurts to be reminded of a reality of commercial development: no matter how terrific a product is, how technically up-to-date, bug-free, and robustly featured it is, without good marketing, it probably won't be effective in today's market.

Perhaps this didn't used to be the case, but it's certainly the case today. It might have been enough five or ten years ago for a product to be simply technically on the ball, but today the market is larger, more crowded, and dominated by a company one speaker here could refer to only as the "M word."

One utilities developer who made a presentation provided a case in point: He said that just a few years ago utilities development was driven by technology; today, it's being driven by the market.

Being here is like reading an extended-play version of *Apple Direct's* Business & Marketing section. In fact, the symposium covers the business of software development from soup to nuts. Everybody stresses the importance of developing "best of breed" software, but top-notch development is only a part of the story here, and the technical aspects of development get almost no play at all. Speakers are talking about determining market needs, finding niches to fill, making the right strategic partnerships, building the right package (not the software, but the box it goes in), working with distributors, and so on.

One speaker neatly collapsed the process into four major areas:

- 1) Start with market need

- 2) Build great product that meets that need
- 3) Create awareness about that product
- 4) Make sure the product is available where customers can get it

He felt that a primary job of those trying to develop successful commercial software was, in his words, “end-user demand creation.” That is, commercial software developers are there to create demand and markets for their products just as much as to create whiz-bang software.

An interesting spin when you’re used to thinking mostly about the technical side of developing software, which I think many of us, both here at Apple and among our developer community, have been used to over the years.

If anything has been impressed on me this week, it’s just how much of a fledgling the business of marketing computer software is. The bottom line here seems to be that determining who customers are and reaching them is a complex enterprise, one for which tried and true techniques are only being developed. In an excellent session on designing effective packaging, this really hit home: it’s a sales truism that a package has to sell the product it contains, but in what other industry than ours is the outside of the box used so heavily as a sales vehicle? It’s almost as if software publishers feel there’s no other good way to get the word out about their products, so they load their packages with product information, endorsements, awards, and the like.

I think it’s worth adding here that Apple is here to help you with these issues. It’s a key initiative of the Apple Developer Group to be a business partner with developers, to help them not only create great products but to help them with “end-user demand creation” and all the other important factors in bringing products to market. That’s why we’ve been gradually adding more and more marketing content to our developer services, including offering more marketing sessions at the Worldwide Developers Conference, cosponsoring marketing seminars, and publishing materials like the Business & Marketing section of *Apple Direct*.

If you want to get a solid dose of marketing material, I can’t recommend the SPA Spring Symposium highly enough. It’s held next year from March 13–16 in San Francisco. For more information, write SPA, 1730 M Street NW, Suite 700, Washington, DC 20036.

*Paul Dreyfus*  
*Editor*

# Consistent, Versatile, Portable Color

The Macintosh PowerBook 165c

*By David Gleason*

The Macintosh PowerBook 165c computer is an example of Apple's commitment to developing meaningful new technology in a short period of time. Through incremental changes, Apple Computer continues to bring exciting new products to market quickly, raising customers' expectations—in this case, for portable computers—and offering customers a variety of choices to meet their needs.

As described in last month's strategy article, the PowerBook 165c computer has a passive-matrix liquid crystal display (LCD) that brings the same consistent Macintosh color that users enjoy in all other color Macintosh computers. With the PowerBook 165c, customers can take color images and QuickTime movies with them wherever they go, knowing that they can display them consistently and accurately. With the PowerBook dual display capability, customers can use the PowerBook 165c to drive color presentations on larger monitors or other devices, giving a color image of higher quality and fidelity than is possible on any other portable computer.

## **INCREMENTAL CHANGES**

Despite the dramatic addition of color, the Macintosh PowerBook 165c is an incremental design upgrade of its predecessors, and in fact has the same essential architecture as the Macintosh PowerBook 160 computer, but with enhancements that allow it to work well with color. For example, the Macintosh PowerBook 165c has a Motorola 68030 running at 33 MHz with a 68882 math coprocessor (the Macintosh PowerBook 160 has no math coprocessor and a 68030 running at 25 MHz). Also, the Macintosh PowerBook 165c comes with larger internal hard disks to give customers greater hard disk storage capacity (up to 120 MB) to handle color images, which inherently take up more room than their black-and-white counterparts.

The Macintosh PowerBook 165c also uses the same ROM software as the Macintosh PowerBook 160 and 180 computers. And because the PowerBook 165c ships with System 7.1 software, a system enabler file containing extensions to the system software to support the PowerBook 165c is all that is needed to provide full system software support.

But don't think that the PowerBook 165c doesn't provide exciting new features that cannot be found elsewhere—it does. Like the Macintosh PowerBook 160 and



180, the 165c has the ability to send video output to two different screens (to give a larger Macintosh desktop) and to do video mirroring (sending the same image to both the LCD and an external color monitor). To do this, the Macintosh PowerBook 165c contains two separate frame buffers and controllers, one for the LCD, and another for an external monitor. This feature (and the dual-screen desktop it makes possible) is not available in any DOS/Windows-compatible color portable computer.

When displaying the same screen image on two separate monitors, it is essential that the colors be consistent; seeing varying versions of the same color patterns can be a distinctly unpleasant experience. The PowerBook 165c provides this consistency to a degree that has to be seen to be appreciated.

### **Hardware Features**

Color capability is provided on the PowerBook 165c by an LCD controller chip set that comprises a WD90C26 controller and a WD90C55 display driver, both made by Western Digital, and an Apple custom ASIC, called the Pangola bus interface chip, that translates signals between the WD90C26 and the 68030 bus.

The WD90C26 was originally designed to support color on IBM VGA monitors, which can display up to 16 colors on 640 x 400 screens; in the Macintosh PowerBook 165c, the external monitor displays the same 640 x 400 pixels that the color LCD does. Using this controller was a time- and cost-saving way for Apple to provide the quality that Macintosh users expect, without expending the resources to develop the technology specifically for the Macintosh PowerBook. See “The Macintosh PowerBook 165c Video Subsystem” below, for a block diagram video subsystem.

### **Selecting the Right Colors**

An LCD uses an additive process to display colors, as do color RGB monitors. However, LCDs are digital devices, whereas RGB monitors are analog, so there are significant differences between the digital and analog display technologies that make it a complex process to convert from RGB color to LCD color. If not done carefully, the result is often an unreliable transfer of color values, which can result in an inaccurate or unpleasant color on the display.

In RGB color displays, a gamma table is provided by the software driver of the video card to correct for the differences that occur in the way colors appear on

RGB monitors. The RGB gamma table provides the best color possible for a given device, converting from system software color to the RGB display.

Apple created a new gamma table for the Macintosh PowerBook 165c LCD display to provide the best color matching possible for the LCD display technology. As with RGB technology, the LCD gamma table is used to map the system Color QuickDraw colors from the color lookup table (CLUT) to the most appropriate color for the LCD display.

Here's how it happens: When a user selects a color in an application—say the color red—it is represented by three values: 65000 (red), 0 (green), and 0 (blue). These values are then mapped to one of the 256 colors available in the system color lookup table by QuickDraw. The color value that is determined—say, the color value 54—is then passed to the frame buffer of the controller. There, the color represented by the number 54 is again mapped, this time to the hardware color lookup table, where a new RGB value is assigned, as determined by the gamma table for the LCD.

The color lookup table supports a palette of 262,143 colors; however, many of the possible colors are not acceptable on the display. In LCD technology, some colors show an unpleasant flicker or are in some way unacceptable. The gamma table that Apple developed for the PowerBook 165c display provides colors that minimize flicker and make the best use of available colors. This gamma table contains 4096 entries; the colors in the gamma table are those that let the Macintosh PowerBook 165c color LCD most closely approximate the appearance of an analog RGB monitor.

The outcome is the best color possible on this particular LCD screen, and one that will very closely match the color that is displayed simultaneously on an external color monitor. Apple feels that no other passive-matrix color display can produce colors as faithfully as the Macintosh PowerBook 165c.

Because Apple has spent considerable time developing the gamma table for the PowerBook 165c, developers are encouraged to take advantage of the gamma table Apple provides, unless there is a specific need to replace it. If you decide to supply your own gamma table, you should take care to design it specifically for this display.

Also be aware that video mirroring is implemented using QuickDraw to catch calls to the screen. If your application (or extension) does not use QuickDraw, you will have to modify it to work with the video mirroring feature in the Macintosh PowerBook 165c.

For specifications and other details, see the fact sheet for the Macintosh PowerBook 165c that was included on page 12 of the March '93 issue of *Apple Direct*.

*David Gleason (AppleLink:DAVIDOVICH) is a regular contributor to Apple Direct.*

\*\*\*\*\*

## **Technical Summary: The PowerBook 165c**

The Macintosh PowerBook 165c computer is Apple's first color PowerBook. It has the same essential architecture as the Macintosh PowerBook 160 computer, but faster—a 68030 running at 33 MHz with a math coprocessor. It uses a passive-matrix LCD display, capable of displaying up to 256 colors. The colors are matched to a fixed gamma table that provides 4096 colors that are the most appropriate for this display technology.

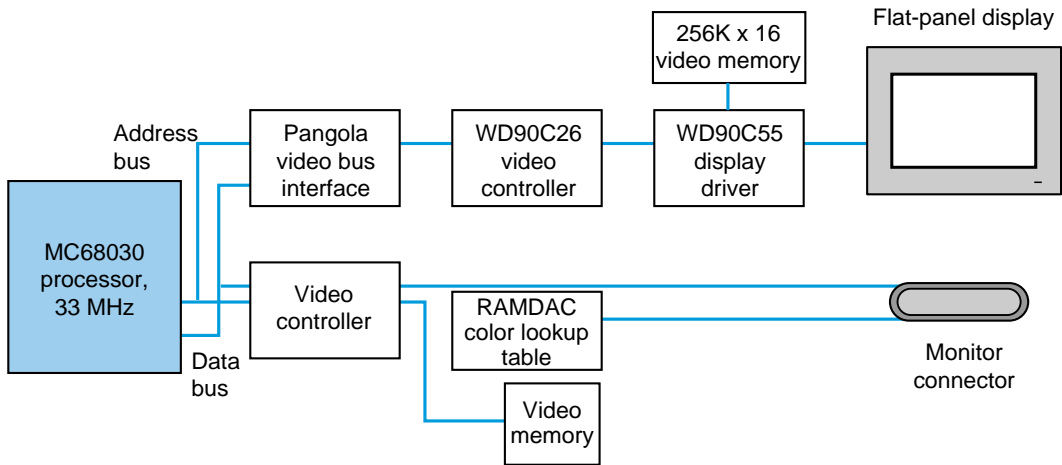
System software converts RGB colors to the best matching colors for the Macintosh PowerBook 165c computer display. It also provides two display modes—that is, the PowerBook 165c can project onto two separate screens simultaneously, either as two separate screens or as a mirrored display (the same screen shows on both displays). Video mirroring works by catching QuickDraw calls to the LCD and sending them to the external monitor; if your software bypasses QuickDraw when writing to the display, you may need to modify your code before it will work correctly with the Macintosh PowerBook 165c's video mirroring. ◆

\*\*\*\*\*

## **Macintosh PowerBook 165c Suggested Retail Prices**

Since the last issue, Apple has finalized the U.S. suggested retail prices for the Macintosh PowerBook 165c computer. With 4 MB of memory and an internal 80 MB hard disk, the U.S. suggested retail price is \$3,399. With 4 MB of memory and an internal 120 MB hard disk, the U.S. suggested retail price is \$3,759. (The internal hard disk option is 120 MB, no 160 MB, as incorrectly stated on page 12 of last month's *Apple Direct*.)

\*\*\*\*\*



***The Macintosh PowerBook 165c Video Subsystem.***

## **Developer Support Center Closes April 16-19**

Apple's Developer Support Center (DSC) will close from Friday, April 16, to Monday, April 19, while it moves to the new Apple R&D campus here in Cupertino. Developers will be unable to communicate with the DSC either by phone or electronic mail during that time. The DSC will return to full operation on Tuesday, April 20 at 8:00 A.M., Pacific Standard Time.

Here's how to reach the DSC: Apple Computer, Developer Support Center, 20525 Mariani Avenue, M/S 303-2T, Cupertino, CA 95014; phone (408) 974-4897; AppleLink: DEVSUPPORT. ◆

## Now Available From Apple

The following list shows APDA products that have become available to developers within the last several weeks. To get a full listing of all APDA products, check the current *APDA Tools Catalog*. For new product announcements and the most up-to-date price lists, check AppleLink (path—Developer Support:Developer Services:Apple Information Resources:APDA—Tools for Developers).

### Apple

#### **Books**

*Programmer's Guide to Apple Scanners*, second edition

R0464LL/A

\$25.00

*Macintosh Developer Note #3: Macintosh Color Classic, Macintosh LC III, Macintosh PowerBook 165c, Macintosh Centris 610, Macintosh Centris 650, and Macintosh Quadra 800*

R0461LL/A

\$30.00

#### **Tools**

Virtual User version 2.0

R0454LL/A

\$150.00

### Third-party Products

MacWireFrame

T0560LL/A

\$299.00

## Ordering Information

To place an APDA order from within the United States, contact APDA at (800) 282-2732; in Canada, call (800) 637-0029. For those who need to call the U.S. APDA office from abroad, the number is (716) 871-6555. You can also reach us via AppleLink; the address is APDA. If you're outside the United States, you may prefer to work with you local APDA contact. For a list of non-U.S. APDA contacts, see the "International APDA Programs" page in the *APDA Tools Catalog*.

# Spotlight On...

## Tools for commercial developers

### **SCSI VIEW**

With SCSI View you can capture SCSI Manager traps and view them in convenient formats. The circular buffer allows continuous or one-shot captures. Since multiple shots can be open, various documents can capture and report at one time. You can view SCSI activity by command or by trap.

*APDA Product Number: T0562LL/A \$165.00*

### **MACWIREFRAME 4.0**

MacWireFrame is a library of 3-D wire-frame rendering tools that can be called from any application. MacWireFrame's tools provide isometric, top, front, side, and custom view perspectives as well as rotation on any axis. It includes a graphics editor for stand-alone operation, testing, and prototyping. The manual features an introduction to 3-D object modeling.

*APDA Product Number: T0560LL/A \$299.00*



# It Shipped!

Through the It Shipped! program, you can announce new and revised third-party products in *Apple Direct*. It Shipped! listings are also made available on the 3rd Party Connection AppleLink bulletin board. You can obtain an It Shipped! application by downloading it from the AppleLink network (AppleLink path—Developer Support:Developer Services:Apple Information Resources:Developer Program Information:It Shipped! @ Program). Or call Chloe Freeland at (408) 974-8974 (voice) or (408) 974-7084 (fax).

Once you've completed the application, send it to Engineering Support, Apple Computer, Inc., 20525 Mariani Ave., M/S 42-ES, Cupertino, CA 95014, Attn: It Shipped! Program. Or send it by AppleLink to IT.SHIPPED.

These products shipped in February, 1993.

<b>Publisher</b>	<b>Product (version)</b>
<b>Absoft</b>	MacFortran II 3.2
<b>Advanced A. I. Systems, Inc.</b>	AAIS Full Control Prolog 3.1.1
<b>BeachWare</b>	A Zillion Sounds 1.0
<b>Bookup</b>	Bookup 2.0
<b>Don Johnston Developmental Equipment, Inc.</b>	Ke:nx 2.0
<b>Dynamic Engineering</b>	PortableRam 1.0
<b>Equilibrium Technologies</b>	DeBabelizer 1.4.02
<b>Foundation Solutions, Inc.</b>	EHelp v3.0 for HyperCard 2.1
<b>Ghost Software, Inc.</b>	Video Store Manager 1.1
<b>HyperBole Studios</b>	The Madness of Roland 1.0
<b>Koyn Software</b>	Exceptions For C
<b>Language Engineering Corp.</b>	Ambassador F/J 1.0
<b>Language Systems Corp.</b>	TSiGraphics 1.0
<b>Lapis Technologies</b>	Lapis L-TV Lapis L-TV Pro 1.21
<b>Logical Solutions, Inc.</b>	Chameleon 2.0.3 7th Heaven 2.5
<b>Mainstay</b>	MarcoPolo 2.0

**Maui Software**

**MBS Technologies, Inc.**

**Multipoint Technology Corp.**

**Neotech**

**Orange Micro Inc**

**Pacific HiTech, Inc.**

**Qdea**

**Santorini**

**Stevens Creek Software**

**Taras Linguistic Systems, Inc.**

**Useful Software Corporation**

**Viale Software Group**

**New Media**

MacFORMation 2

FileRunner 1.0

Multipoint Z 3D Mouse or Z Mouse 1.0

Neotech Image Compressor 1.0

OrangePC 1.0

Masterpiece Library CD-ROM 1.0

Synchronize!

Server Manager Ships 1.0

PlotView 3.4

The Athlete's Diary 2.0

The Language Tutor 3.2

Useful Voice Processor Lite for Macintosh  
1.1v4

Research Assistant Upgrade 2.0

**Warner**

Clinton: Portrait of Victory (CD) 1.0

# Preferences, Persistence, and the Soft Machine

*By Peter Bickford*

*Doc, Could you please address the question of preference settings? Back in the old days, it seemed that most programs just had one or two preferences. Now my word processor comes with eleven whole screens full of preferences to set! This seems excessive, but on the other hand, I've always thought that we should try to make our programs as flexible as possible. Are there any guidelines on this?*

*By the way: What menu does the Preferences item belong under?  
Thanks for your help,*

*Christopher Karas  
Human Computing*

Dear Christopher,

One popular doctrine of human interface design is that we should provide users with as many choices for configuring the system as possible. That way, users will be able to make the system work exactly the way they want it to, and they'll be a lot happier.

This doctrine, unfortunately, is complete rubbish. I wish I could find the people who came up with that ludicrous idea and throttle the life out of them. Better yet, I'd make them try to configure my word processor.

In our desire to be infinitely flexible, we've managed to burden the user with countless options and hidden behaviors that must be memorized and understood in order to master the program. If we're not careful, we may make our programs so "flexible" that they become entirely unusable.

## **MAKE YOUR OWN DESIGN DECISIONS**

There are three main parts to the preferences problem. The first is that preferences are often an excuse for the design team to avoid making decisions about the way a program should operate. Can't decide whether text should appear black-on-white or white-on-black? Just make it a preference setting! That way everyone will be happy, right?

Wrong! All we're really doing when we let our design arguments degenerate into preference settings is burdening the user with another hidden configuration setting, longer documentation, and a design decision we should have had the courage to make ourselves. In deciding what should be a preference setting, the decisions should always be made for the user's convenience—not the design team's.

## **SETUP CHOICES**

The second part of the problem is that many preferences aren't really "preferences," but "setups." The difference here is that users absolutely must make setup choices in order to make a program work, whereas preferences are optional. For instance, AppleLink operates fine whether or not incoming text is set to auto-scroll, but it won't work at all unless your network is set up properly. Such setup information should be handled separately from any preference settings.

## **DEFAULT SETTINGS AND THE SOFT MACHINE**

The last part of the preferences problem regards the "default settings" for the way the program operates. Should MegaWrite open new documents in "Mega mode" or "Hyper mode?" What should the default format for a spreadsheet cell be? Over the years, we've developed the practice of letting users specify such default settings through countless preference settings. In doing so, we've let the user at least partially say how they want the program's defaults to operate, but we've done so at a huge price in usability.

Luckily, there is a better way to handle these settings. For the answer, we should look at the ground-breaking human interface research of Nakatani and Rohrlich.

Working in the early 80s, the pair thought of a better way to give parameters to a computer program. Instead of typing in abstract lists of settings, they came up with the idea of modeling the computer's controls graphically, then manipulating those controls directly. So, for instance, instead of making the user set the speaker volume by typing in "SOUNDLEVEL = 7," you could just show them a "volume slider" on the screen, and let them manipulate the volume by moving the slider.

Nakatani and Rohrlich called their idea of such an interface the "soft machine," and it has become one of the most influential ideas behind interfaces like

Macintosh. It also provides us with a crucial clue to dealing with the problem of preference overload.

## **HARD MACHINES, PERSISTENT PREFERENCES**

In our daily life, we interact with many “hard machines”: real machines whose settings are controlled by the positions of physical buttons, knobs, sliders, and other controls. One important feature of such machines is that when you move a control to a certain setting, it generally stays at that setting until you move it. Usually, the setting stays at the position you indicated even with the power switched off. So, for instance, your mechanically tuned stereo switches on to the same station and plays at the same volume level as you had chosen before you turned it off after using it the last time. In other words, hard machines have persistence.

Unfortunately, it takes extra effort to make our computerized soft machines persistent. As a result, we’ve adopted the strange custom of having our soft machines “reset” to some default setting every time they’re used. It’s as if your stereo tuned to a Muzak station and picked what it thought was an appropriate volume level whenever it was switched on.

This same lack of persistence in computer software is the reason behind much of the confusion with preferences. For instance, my word processor has somehow decided that—although I almost never write in New York font—it should switch back to that font whenever I begin a new document. This means that every time I begin to write, I need to first change the font setting to something more appropriate.

What we really need is for our soft machines to be generally persistent. Whenever we choose a setting in a program, it should remember what we did, and use that setting next time—even if we start a new document or switch off the power in the meantime.

Programs that work with text should remember the font, style, size, etc. that I last chose, and use those settings as “defaults” the next time I use text. When I insert a column into a spreadsheet, the new column should receive the format of the one it displaced—not some default “general” format. And if I want to import information into a database, the import dialog box should default to offering the same record and item delimiter characters that I used last time.

## DISAPPEARING PREFERENCES

In a program with persistent settings, users are able to work quicker and more naturally, instead of fighting the system for control. As a developer, you'll find that a great number of your preference settings can safely disappear—simply have the application remember how the user set it last time, and when the program quits, save the setting for use when the user starts up again. That gives the user the extra benefit of not having to make sense of a nest of crowded preference dialogs.

Of course, just as hard machines can have “reset buttons,” it may be a good idea to provide your users with a way to use “standard options” or to make a “plain” new document. The difference is that instead of wresting control away from the user by overriding their settings every time they start up your application, you leave the decision to reset up to them. That way, users get the feeling of security that comes with “factory default settings,” but never lose their control over the way the system works.

Electronic interfaces are already moving toward becoming more persistent. Electronically tuned televisions now typically remember the last channel you watched instead of powering on to Channel 2. The better ones even recall your preferred volume, brightness, and contrast settings. And, in a revolutionary breakthrough in usability, VCR clocks are starting to remember the last time to which they were set instead of blinking “12:00” after a split-second power outage.

Part of the Macintosh Operating System works this way: The Finder remembers your window positioning, each window's “View by” setting, and even the exact position of the icons within a window. Control panels remember your mouse, keyboard, monitors, and other settings even if you restart your machine.

If applications were generally persistent, we would no longer need separate preference settings for anything the user chooses in the normal course of using the program. In fact, just about the only preferences that would remain would be those options that don't have any other direct way to be set.

For instance, a word processor might still have a preference setting to control whether straight quotes ( " ") or curved quotes ( “ ”) should be used. Note that any such preference settings should themselves be persistent. They should apply to the system as a whole, and carry over from document to document until the user changes them.

To wrap up, let me address the question of where to place setup items and preferences in the interface. If there is a long list of setup information, you might

consider making it its own menu. Otherwise, try to put the setup as close to the place it is used as possible. For instance, Page Setup... goes right next to Print. If neither of these two scenarios applies, my advice is to put an <Application Name> Setup... item under the Edit menu to do your setting up. Finally you should generally put Preferences... (for the few that should remain) under the Edit menu.

*'Til next time,*

*—Doc*

*AppleLink: THE.DOKTOR*

---

*Pete Bickford runs the Human Interface Lab at Apple's IS&T (Information Systems and Technology) Organization*

# GetNextEvent

The "\*\*\*" indicates the trade shows/events at which Apple Computer, Inc. is scheduled to exhibit as of press time. This list may be incomplete. If you have information about a show that you want listed here, contact Developer Technical Communications, 20525 Mariani Avenue, M/S 75-3B, Cupertino, CA 95014. For further information check the Events folder on AppleLink (path—3rd Party Connection:Events).

## **April 1 through 4**

**\*\* NSTA**

### **National Science Teachers Association**

Kansas City, MO

Contact: Kenyon Scott

AppleLink: SCOTT.K

(408) 862-7677

NSTA (202) 328-5800

Extensions 31 & 51

## **April 12 through 15**

### **Microcomputer Show**

Tokyo, Japan

Contact: Jeida

(03) 3433-4547

AppleLink: JEIDA

## **April 12 through 15**

**\*\* FOSE**

### **Federal Office Systems Exposition**

Washington, DC

Contact: Patty Nation

AppleLink: NATION1

(408) 974-8910



**April 12 through 15**

**\*\* NCEA**

**National Catholic  
Educators Association**

New Orleans, LA

Contact: Martha Rolley

AppleLink: ROLLEY.M

(408) 862-7663

NCEA (202) 337-6232

**April 13 through 17**

**\*\* TESOL**

**Teachers of English to Speakers of Other Languages**

Atlanta, GA

Contact: Javier Villalobos

AppleLink: VILLALOBOS1

(408) 862-6426

TESOL is (404)636-9711

**April 14 through 16**

**\*\* Seybold**

Boston, MA

Contact: Tara Vincent

AppleLink: TARA

(408) 974-4464

**April 26 through 30**

**\*\* IRA**

**International  
Reading Association**

San Antonio, TX

Contact: Pam Anderson  
AppleLink: AP.ANDERSON  
(408) 974-8587  
IRA (302) 731-1057

**May 10 through 14**

**\*\* WWDC**

**Worldwide Developers Conference**

San Jose, CA

Contact: CMI

(415) 705-8050

**May 4 through 6**

**\*\* DB Expo**

San Francisco, CA

Contact: Russ Havard

AppleLink: HAVARD1

(408) 974-4371

**June 5 through 8**

**\*\* CES**

**Consumer Electronics Show**

Chicago IL

Contact: Dave Billmaier

AppleLink: BILLMAIER1

(408) 974-4371

**June 28 through 30**

**\*\* NECC**

**National Educational  
Computing Conference**

Orlando, FL

Contact: Sue Collins

AppleLink: COLLINS3

NECC (503) 346-3537

# Selling Off the Page

## Guidelines for Creating Successful Direct Response Ads

*By Leigh Marriner, Marriner Associates*

Advertising is often the first thing that comes to mind when a company develops a marketing plan for a product. At first glance, it seems to be a natural, high-profile choice. But let me go on the record saying I believe that automatically relying on advertising as the foundation of a marketing plan is a lazy—or uninformed—approach.

Advertising does play a useful role as part of a *balanced*, carefully crafted marketing plan. One thing advertising can accomplish is raising customer awareness of your company and product (creating an image). However, this kind of advertising can be expensive, because to create significant awareness—and see a tangible result—you must run an ad many times during a relatively long period. Therefore, if your total marketing budget is under \$100,000, awareness advertising will eat such a large piece that it may not be a wise allocation of your money.

But another kind of advertising may make more effective use of a small budget: You can sell products directly “off the page” using direct response ads. These ads are intended to close a sale and give customers a way to place an order (such as by using a mail-in coupon or toll-free telephone number). Well-executed direct response ads that are run at the right times in appropriate publications can give you a tangible, immediate result—revenue. And when used in tandem with other communications strategies, direct response advertising can contribute to building product and company awareness.

Of course, choosing the most appropriate publications in which to run an ad and having an adequate infrastructure to handle inquiries and orders effectively are a must for a successful direct response campaign. But the foundation for a successful campaign is *an effective ad*.

The details of what makes good direct response ads would fill a book. However, there are some rules of thumb that can aid you in evaluating the quality and potential efficacy of the ads you produce.

To help you do this, here are two groups of “rules” (there are always exceptions, of course). The first group focuses on how an ad looks without any consideration of content; these rules therefore apply to most ads, not just direct

response ones: the role of the headline, visuals, and copy, and the purpose of the ad. The second group of rules addresses the specific elements that make up a successful direct response ad.

### **Achieving “The Look”**

The following set of guidelines about how ads should look applies to both awareness and direct response ads.

- *Ads shouldn't be art for art's sake.* The purpose of a direct response ad is to create desire for a product and generate an order—not showcase artistic creativity. There's nothing wrong with running an ad that is aesthetically beautiful or unusual, if it sells the product. But if a prospect can't read the name of your product, or thinks “my, what a beautiful picture” and then turns the page, or doesn't understand the message, you won't accomplish your objective.

This is one of the most difficult lessons to learn. The experts whose advice you most heavily depend on—ad agencies or freelance graphics and advertising professionals—usually lean toward being highly creative: Their orientation and training are usually geared to creating interesting or beautiful ads. Your job is to help them remember that the purpose of your advertising is not to be pretty, unusual, or to win awards, but to sell. Your agency should try to temper its natural bent toward creativity, artistic trend, and visual beauty with a clear understanding of an ad's marketing objective. (Even the best agencies sometimes lapse into creating sublime form at the expense of function.)

- *Make sure the headline conveys the main point, and does so in the form of a well-defined customer benefit.* The headline's purpose is to grab the attention of as many people as possible and coax them to read the ad. This is important because the statistics say that most readers won't notice your ad at all; some people will look at the headline or visuals, very few will read subheads, and even fewer will read body text.

If the headline, alone, captures readers' attention and communicates that the ad is about a product that will solve a problem they face (that is, if the headline describes the user benefit), they'll be more likely to continue reading. For example, if your drawing application is particularly easy to install and learn, a headline such as “It's a piece of cake” doesn't give readers a clue about whether the ad is about something they need. On the other hand, “Complete your first drawing within one hour of installation” broadcasts a clear benefit message.

- *Headlines shouldn't require mental effort on the reader's part, and headline language should be clear.* Most readers just page casually through a magazine, and often aren't looking for anything in particular. If they don't immediately grasp that your ad is about a product of interest to them, they won't stop to read it. Headlines such as "Don't seek and you shall find" can be annoying and propel readers right past your page.

Likewise, use clear language. Don't brag, use cute plays on words, or be indirect and still expect readers to follow you. "We sell straight lines" tells readers nothing except that the ad agency was trying to be clever. Instead, refer back to the rule above: Make your main point in the headline.

- *Short headlines aren't always best.* If clearly stating a well-defined user benefit requires three lines of text, and the wording is as clear and concise as possible, so be it. The objective is to stop readers as they flip by your ad and entice them to read more of it.

- *Good headlines often mention a product by name.* This helps build and reinforce reader awareness of your product. It is also a cue to interested readers who have already heard of your product that it may be worth the effort to read on.

- *Use visuals that complement the headline.* The headline and visual each should clearly communicate your main point, and they should work together to reinforce the user benefit. For example, a photograph of a handsome man or beautiful woman holding your product doesn't give readers information about the product's value, unless it's an ad for such things as clothing, hair care products, or a dating service.

On the other hand, a picture of someone climbing out of a combat tank, dirty and smiling, speaks volumes if your product is a World War II tank-simulation game. Visuals that have a problem-solving, storytelling quality are most effective.

- *The body text should communicate information directly and clearly.* Readers approach an ad with an innate skepticism about its honesty. To help counteract this, your choice of words should be honest, realistic, and clear. Don't use lyrical prose or boastful verbiage. If you give readers any reason to think you're exaggerating or overplaying your hand, they'll flip the page.

For example, telling readers that your product will "make your personal computers do all those wonderful things you expected them to do in the first place" won't convince them of anything except that you and your product proposition are naive. In that case, you've paid good money to give the reader a negative impression.

- *Body text should provide adequate information and benefits.* It's difficult to err by giving readers too much information, *as long as the ad is easy to read.* Tell readers all the sales points and benefits needed to kindle or confirm their interest, but be specific about product facts. If you have won awards, show them; if you have done research demonstrating that using the product increases productivity, cite it.

However, make sure not to rant on; there's a fine line between giving readers information they need to make a decision and bogging them down in too much irrelevant detail.

- *Make the text easy to read.* If an ad is hard to read, most people won't go to the trouble to do so. The danger signs include text that extends from the left margin of the page to the right margin without a break, lack of either white space or subheads between blocks of text, and white text on a black or dark background.

Blocks of unbroken text are deadly, no matter how well written the ad or how much white space it contains. Use subheads to break up the text; they are easy for readers to skim, and subheads help them decide if it's worthwhile to read the entire ad. Using subheads also gives you an opportunity to call attention to a major point.

When it comes to legibility, while white type on a black background (called "reverse type") occasionally works for a headline, this combination is less legible than black-on-white. Reading an entire block of text in reverse type can give people headaches.

Also, it's tempting to reduce the type size so that you can squeeze in more text. When you feel the temptation, don't give in. Instead, prioritize the product benefits and eliminate a few from the ad.

### **Guidelines Specifically for Direct Response Ads**

The guidelines just given apply to almost any kind of ad, including direct response ads. But as you'll soon see, when it comes to direct response ads, looking good falls lower on the priorities list; conveying the specific information needed to sell a product is the primary objective. Here's how you can accomplish that.

- *Don't go it alone; hire an individual or agency with direct response advertising expertise.* The purpose of a direct response ad is to convince readers to order your product. As you can imagine, since an ad's text, not its

artwork, conveys most of the key information, art direction is less important than copywriting. And because direct response copywriting is a special skill, a good, general advertising copywriter or agency is definitely not right for this job. Instead, I suggest choosing an agency or writer who is experienced in direct response techniques.

Likewise, it wouldn't make sense to try to create these ads yourself. The elements of effective direct response advertising are specific, and the details can make the difference between success and failure. (For more information about the components of a direct response ad, see "The Anatomy of a Direct Response Ad" below.) If you don't have the budget to pay for good direct response talent, don't do the ad; you'll probably waste your money.

• *Give your proposed ad the acid test.* Before you sign off on a particular layout and text, test your ad—even if you do so informally with a few company outsiders—to determine if it meets your objectives. Generally, you should determine the following:

- Does the ad follow the guidelines suggested here?
- Does it contain all the necessary elements?
- Does it drive home the one main selling point?
- Overall, does your ad make people want to do business with you?

If you can't answer these questions affirmatively, it will be well worth your time and effort to correct any problems. But if you can truthfully, objectively answer "yes" to each question, you're probably ready to launch the ad.

As you can see, you may get the most from a small advertising budget by using direct response ads in lieu of awareness-building ones. If you clearly understand the product benefits that will "sell" your customers—and effectively communicate this information to them—selling off the page can be a winning strategy. ♦

*Leigh Marriner is the managing partner of Marriner Associates, a firm located in San Rafael, California, that develops competitive strategies and marketing programs for personal computer software companies.*

\*\*\*\*\*

## **The Anatomy of a Direct Response Ad**



All good direct response ads contain some common, necessary components. Here are the elements that are mandatory for an effective direct response ad:

- *A thorough yet concise description of the product and the user problem it solves.* It's important to offer sufficient information for readers to make up their minds. Most people are somewhat hesitant to buy a product they haven't actually seen, so anything you can do to offset this misgiving will work in your favor. (For example, a photo of your product usually works well.)

Give readers plenty of information to help them make a decision, including all key benefits, features, specifications, and hardware and software requirements. Try to address any objections customers may have. Also, don't assume readers know more than they do. For instance, don't try to advertise an add-on product without describing what the base product does.

- *A substantial promise about product performance or user benefit.* Back your promise with facts that are focused on your target audience and the benefit and value you offer. For example, if your promise is that your product compresses files "on the fly," tell users that they can save 50 percent of their disk space and also open files as fast as they could if the files weren't compressed.

- *Price.* Display your price prominently. Don't frustrate potential customers by making them search your ad with a magnifying glass to find the all-important product price.

- *A money-back, full-satisfaction guarantee.* Offering a guarantee is crucial to fostering a feeling of customer confidence. It implies that you have confidence in your product and that purchasing it is a no-risk proposition. Successful direct response ads remove all barriers to purchase, and a guarantee will eliminate a lot of customer hesitation. If you're not confident enough in the product to offer a guarantee, then your product will probably fail regardless of whether your ad is effective.

In some geographic areas, federal or state regulations dictate whether you must offer certain terms to mail-order customers, such as a money-back guarantee. Ensure that your policies are in tune with these regulations (and those of other countries or states, if you're shipping across borders or state lines).

- *A special offer.* Give readers a reason to believe they are getting an especially good deal if they buy your product now. Most successful direct response ads rely, in part, on impulse buying, and a special offer can help

close the sale. Make sure it is somehow related to the product and that it appeals to your target audience. However, if you also sell this product in retail channels, don't make the total offer (the product plus the special offer) much better than what the retailer can offer, or you'll hear complaints from the channel.

- *Magic words.* Use language that will tempt customers to buy and that reduces the perceived risk of ordering "sight unseen." Examples of effective wording are "free," "no risk," "special offer," "guaranteed," "limited-time offer," and "breakthrough." (However, make sure that what you say about your offer is true.)

- *A call to action.* Be clear about what response you expect from the reader. Come right out and ask for the order. Use motivational phrases such as "Yes, I want to order Product XYZ!"

- *A toll-free telephone number for placing orders and making inquiries.* Studies show that offering a toll-free telephone number increases the response to an ad. It's important that readers be able to interact with your company or sales agent immediately (while the desire to buy is high), so contacting you to order or make inquiries should be easy. This is especially important if your target customers are home or small business users, who must foot the bill for a telephone call themselves.

- *Multiple ways to order.* To make ordering as easy as possible, offer as many options as you can, such as telephone, fax, and mail.

- *Information that will facilitate the purchase.* Let readers know everything needed to place an order. For example, there should be no question of what days and hours your telephone line is staffed; from what countries or areas the toll-free number can or can't be used (for example, most U.S. toll-free numbers can't be called from other countries, and vice versa); what forms of payment you accept; and the product stock number (if required by your sales center when customers order). Also, if customers are purchasing upgrades and will need to offer proof-of-purchase, such as a serial number, tell them up front.

- *A code that will allow you to track where responses come from.* In direct response advertising, as in direct mail, you have an opportunity to determine if you are achieving the needed return from your investment—probably the most important part of a campaign. For example, you can put a code number somewhere on the order form (coupon) or add a bogus extension number to a toll-free telephone number. It doesn't matter what the code is, as long as it

corresponds uniquely to each ad placement. In other words, an ad run in November would have a different code than the same ad run in December, and ads in *Macworld* magazine would have a different code than the same ads placed in *MacUser*.

With the appropriate tracking system, the first time you run an ad you can determine if it is generating sufficient orders. After you gain experience, six to eight weeks into a campaign you'll be able to predict the total revenue that will be generated.

Tracking responses is particularly important when you've placed your ad in more than one trade magazine or run it in more than one issue of a publication. You'll need to know which publications draw the most customers (or what months of the year work best) and alter your strategy accordingly.

**Other Elements That Can Help Sell.** There are several additional elements that can be especially effective in selling off the page. You don't need to use each one in every ad, but you should use these as the situation dictates:

- *A coupon.* Consider including a coupon—a mini-order form—in your ad, even if you don't expect readers to order by mail. It identifies the ad as a direct response one—an important visual clue for readers. The coupon also gives you a place to summarize the offer and ask for the order, and tells readers what information they'll need to give you when they call to place an order.

- *Photo of the product package and its contents.* Magazine readers don't have the opportunity to hold your package and examine it. A photo of the package and its contents will help readers to visualize what they are buying.

- *Screen shots or samples of printed output.* These things will help customers visualize what they are ordering. The more information you can give and questions you can answer, the more likely customers are to buy your product. ◆

# The Making of a Bundle

## How T/Maker Bundles for Success

*By Diane Kreyenhagen, T/Maker Company*

Over the last three years bundles have significantly contributed to T/Maker's bottom line. Bundling our products with those of other companies has been an effective way to increase our market penetration and marketing clout, more quickly take advantage of hot market opportunities, and offer customers increased value for their software dollar.

Our strategy evolved from a need to penetrate today's ultracompetitive market: When customers walk into reseller stores or open mail-order catalogs, they encounter several software titles that offer similar functionality. A customer interested in a word processor, for example, must choose between at least seven products with a wide range of prices.

Faced with this plethora of competitive products (some of which are produced by giant, resource-rich companies), T/Maker, which produces the WriteNow word processor and ClickArt ready-to-use graphics, had to resort to using creative tactics to attract customers. Bundling was our solution.

### **BUNDLING BENEFITS**

Bundling can be an effective marketing tactic because it creates a winning situation for you, your "partners," resellers, and customers, in the following ways:

- *A bundle helps differentiate your product and therefore draws more customer attention.* Bundling is a good way to differentiate your product within its own category and make it stand out in today's more competitive market. A well-thought-out bundle offers customers more of a "whole product solution"; for example, instead of receiving only your word processor, customers also get additional programs and tools that greatly increase the effectiveness or extend the use of your product. This more complete offering will therefore help differentiate your product from competitive ones that stand alone, and may also attract more customer attention than your stand-alone product might otherwise receive.

Bundles also can help you reach new or novice computing customers. For example, in the home computing market, novices often aren't sure what individual

package to buy and may hesitate to plunk down several hundred dollars for a product that meets only a single need. But if your bundle offers customers a range of attractive products that fills multiple needs at a reasonable price, you may close the sale.

- Bundles can help extend your marketing clout. Many smaller companies have terrific products—but small marketing budgets and little or no distribution networks with which to reach resellers and mass merchants. By bundling with a better-known product or company, a smaller company in essence can use its larger partners' marketing clout and distribution contacts to promote the bundle and help establish its own product in a channel. And if the bundle is a hit, the reseller may be more open to stocking the individual products.

- *Bundling can help you take advantage of a hot market opportunity more quickly.* To explain what I mean, I'll recount how T/Maker first entered the bundling business. Several years ago we saw a market need for integrated packages (and at that time Microsoft Works was just about the only package available). We knew other companies were hurrying to bring their integrated packages to market, and we were faced with a decision: How to quickly seize this opportunity?

The alternatives boiled down to either pouring resources into developing our own integrated package (which, being a smaller company then, meant diverting precious resources from other key initiatives), or finding another way to fill the needs of customers who wanted several-products-in-one. Our solution was to create a bundle with existing packages: The SmartBundle was born, which included T/Maker WriteNow, Aldus SuperPaint, Ashton-Tate Full Impact, and Software Discovery RecordHolder Plus.

This bundle allowed us to nab sales in the integrated package market more quickly and less expensively than we could have by developing a totally new integrated product. Similar opportunities may also await you; the key is to recognize a market trend and position yourself to act quickly on it.

- *Bundling can help reduce marketing risks.* Depending on how the deal is structured, a bundle can spread the marketing risks and investment among the participating companies. A smaller company can dramatically reduce its risk if it chooses the right partner. For example, in some cases T/Maker, as the larger partner in a bundling deal, may assume much of the responsibility for marketing the bundle, such as through direct mail; we often pay most costs, such as for the design, production, printing, and mailing of the campaign. (We ask participating

developers to supply sales text, product photos, screen shots, and their company logos.) In return for its larger share of the risk and expense, T/Maker takes a larger portion of the revenues.

- *Bundling can help a multiplatform developer strengthen its case for increased or continued Macintosh development.* For example, if the Macintosh is not your company's "first" platform, by bundling with other Macintosh developers you may be able to boost the sales and market presence of your Macintosh product. Internally, this can help solidify the case that your Macintosh product is an important part of your offering—and thereby boost management interest in your company's Macintosh development efforts.

- *Bundling can increase a reseller's profits.* Resellers can also profit from bundles. In our experience, resellers are very receptive to bundles because bundles help them differentiate their inventory from the guy's across the street. Also, as resellers' CPU margins shrink, bundles are a good way to add profit to a sale. By offering a bundle to the CPU buyer, the reseller both provides the customer with great product value and increases its own margin. We usually pitch two or three bundle ideas to various resellers each quarter, and frequently modify bundles to make them dovetail with resellers' promotions.

- *Bundles can offer customers increased value.* If you've assembled a good bundle, customers win because they get not only a more complete computing solution, but also a package of tremendous value. The most successful bundles are aggressively priced, and users get a group of products for much less money than if they bought the products separately.

## **THE ANATOMY OF A BUNDLE**

We've found that a bundle is more successful if it focuses on the needs of a particular customer group, instead of being just a bunch of products sold together. We've tried both strategies and have experienced much greater success with focused groups of products.

One example of a focused bundle is the T/Maker PowerBundle, targeted at Macintosh PowerBook buyers. We felt that PowerBook buyers, like most other customers, would want more of a whole-product solution that would help make the most of their PowerBook purchase. From a myriad of possible products we chose those that we felt would be naturals for the "user on the go." A word processor (T/Maker WriteNow), an address book product (PowerUp Address

Book Plus), an expense report application (ChipSoft Business Expense Reports), a communications product (America OnLine), 40 fax cover sheet templates (ClickArt FaxMania) for users with a portable fax modem, and a carrying case for the PowerBook itself. We have also created bundles for SOHO (small office/home office) that included WriteNow, Address Book Plus, and Intuit Quicken.

## **BUNDLE SHELF LIFE**

Choosing the right channels and “shelf-life” for your bundles is as important as choosing what products to include. For instance, we currently have two types of bundles: long-term and short-term. We sell long-term bundles through retail and catalog (mail-order) channels and short-term bundles directly to customers through direct mail efforts. We also offer exclusive bundles to particular reseller chains.

**Long-Term Bundles.** As a company, we make a strong, long-term commitment to the success of retail and mail-order bundles. We create long-term bundles with the intention that they’ll remain in our product line for an extended period, usually more than a year. Examples are the PowerBundle, SmartBundle (both previously mentioned), and the WriteNow WorkShop Bundle (WriteNow, Reference Software Grammatik Mac, and WordStar American Heritage Dictionary and Correct Quotes).

Because of their strategic significance, we allocate the commensurate marketing and advertising funds to support these bundles, and produce special packaging for them. In addition, our sales force devotes as much time and effort into marketing these bundles as they do our individual, unbundled products.

**Short-Term Bundles.** Direct mail is a very important part of T/Maker’s overall sales strategy. Throughout the year we assemble a variety of short-term bundles and market them directly to customers through direct mail campaigns. Last year T/Maker offered more than 12 different product bundles to its installed base and prospects by direct mail. Some bundles included only one other developer’s product, and others bundled as many as four. This year we plan to offer well over 20 different product combinations through various direct mail projects.

Direct mail plays both a tactical and strategic role in our bundling strategy. While direct mail is a marketing tactic that’s an end in itself (direct sales), it’s also

a strategy for testing which bundles are most popular; once we find a combination that works, it becomes a long-term bundle candidate.

Direct mail is a complex, sophisticated science, and it can be expensive (and frustrating) for a small company to experiment with. Companies therefore are often interested in learning more about the dynamics of direct mail and want the revenues it could yield—but they don't have the resources to risk a first-try themselves. By bundling with a more experienced direct mailer such as T/Maker, they can experiment without the up-front cash risk. If the mailing is successful, they then feel more comfortable trying their own program.

There's another benefit that direct mail bundling partners receive: a mailing list of campaign respondents. Partners can use this information to conduct their own direct mail campaigns, such as to promote new products or offer upgrades.

## **DOING THE BUNDLE THING**

Putting together your first bundle won't be a piece of cake, but the experience you gain will probably make subsequent efforts easier and more streamlined. The first steps you should take are to decide which of your products to build the bundle around (based on marketing goals and opportunities), who potential customers are and what they need, and in what channel to market the bundle. Once you've nailed these things down, it is much easier to decide what other products would make sense in the bundle.

When it comes to choosing other companies' products, I should point out that the bundling business works in both directions: We constantly look for partners to participate in bundles that T/Maker initiates, but we also troll for opportunities to become someone else's "third party." The latter opportunities can be hiding anywhere—not only in the third-party development community.

For example, we were approached by PaperDirect, a company that supplies papers and related presentation products to personal computer customers for use with laser and ink jet printers. They presented us with a unique bundling opportunity targeted to small businesses that want to print their own stationery, documents, presentations, and other marketing materials using desktop publishing and word-processing software.

PaperDirect sells a variety of preprinted stationery, including a series of coordinated letterheads, envelopes, brochure mailers, and other items. It also sells software templates (that are compatible with several word-processing and



desktop publishing applications) that allow users to more easily lay out their own text and graphics on PaperDirect's preprinted papers. T/Maker's ClickArt is bundled with the templates, which offers users an even more complete solution. This has been a tremendous, successful opportunity for us—with a partner outside the third-party development community.

**Bundling Caveats.** Here are some general guidelines that should help you ease into bundling:

- *Start simply.* If you are new to bundling, it's much easier to work with only one other company or product. The more products and companies involved, the more complicated the process becomes. If you have too many variables to juggle the first time through, you'll quickly become overwhelmed and frustrated.

We learned this lesson the hard way. Our first bundle, the SmartBundle mentioned earlier, was a trial by fire. Not only did we have to negotiate contracts with three companies (each having, of course, its own agenda and issues), but we also had to contend with creating special packaging, putting together a complicated SKU, formulating a price that would not undermine any of our partners' channels, and handling a variety of other situations that were compounded by the number of companies involved.

The successful end product was worth it. But we recommend cutting your teeth on a less complicated deal, especially if you're a small, resource-limited company.

- *Put adequate resources behind the bundle.* If you plan to launch your bundle (which you should treat as a product unto itself) into retail and mail-order channels, make sure you allocate enough advertising money, sales staff, and other support to make it a success. Bundles are a major component of our lifeblood, and therefore we treat them as we would any other major product—giving them their due when it comes to resources.

- *Don't overlook international partners, and find partners with international know-how.* Don't limit yourself to only the domestic market: There often are opportunities to sell your product in other markets. Furthermore, a partner that already is established in another country can provide you with a good launching pad into that market, much in the same way that a larger, more experienced domestic partner can help you take better advantage of your home market with its presence and know-how.

T/Maker frequently seeks partners and channels outside the United States. We have been particularly successful in Australia, the United Kingdom, and New Zealand; these markets are easier and less expensive for us to infiltrate with a bundle because they are English-language countries. If a bundle offers customers good value, is well priced, and contains strong products, the U.S. versions sometimes will do quite well in these countries.

We make it a point to start investigating international possibilities at the beginning of every bundle negotiation. If a company we are considering has a U.K. or other localized version of its product, we try to arrange an international bundle at the same time we negotiate the U.S. one.

- *Create solid contracts.* I can't emphasize enough how important it is to negotiate solid, realistic contracts with all parties involved in the bundle. While there are too many facets of a contract to cover in this article, there are some key considerations to keep in mind as you begin negotiating.

For instance, bundling contracts are as critical as contracts with any other business partner. They should be specific and should clearly spell out the terms of every facet of the deal. We constantly clarify issues in and add sections to our contracts, based on what we've learned from previous bundling deals.

One warning: You should have a signed contract in hand before spending any marketing and sales money. Like any other business deal, the bundle could fall apart at the last minute for almost any reason.

Also, it's important to treat bundling partners as you would any important contributor to your business. We enter contract negotiations with the attitude that our partners are a key factor in our long-term marketing and product strategy—and long-term success. We try to go the extra mile to ensure everyone is satisfied with the bundle and that all parties concerned are kept well informed during the negotiation process.

Once negotiations are concluded and the contract is signed, communication shouldn't stop. It's important to get your partners' feedback on the marketing pieces you produce, keep them involved in the campaign's progress, and share sales results with them. Because we know there will be more opportunities to work with these companies in the future, we work at building strong partnerships now.

- *Make it clear to customers which company supports what product.* You should tell customers exactly where to turn for help with each product in the bundle. If you don't, customers may assume that your toll-free number is the one to call with

questions about your partners' products. Furthermore, if customers call you and you then ask them to call yet another number, they will feel as though they've been "shuffled off" and may perceive your company to be incompetent, uncaring, or both.

## POTENTIAL PITFALLS

While bundling can be a winning marketing strategy, that's not to say there aren't several potential "gotchas" to avoid. Here are some of the important risks we've encountered:

- *Low pricing can create channel conflict.* Bundling can cause channel conflict and pricing confusion. How you price the bundle compared to the price of each individual product is important. For the bundle to sell well, customers must perceive they're getting a good deal on the package. However, the price shouldn't be so low that the bundle cannibalizes a reseller's sales of your individual products. Also, if the bundle and individual product price are too similar, this also causes confusion in the channel and can cause both your individual product and bundle to fail.

One way to help avoid this problem is to speak with resellers and mail-order companies before you set the bundle price. This has worked well for us; the discussion helps clue us in to what the channel's pain threshold is regarding price, and gives us an opportunity to clearly explain what we're doing, why, and address channel concerns.

- *You may get "stuck" with a large inventory of another company's product.* On several occasions T/Maker has had to purchase a large quantity of another developer's product at one time to receive a lower original equipment manufacturer's (OEM) price. In most cases these units must be specially produced (for example, no product box, only disks and documentation shrink-wrapped together), and the other company won't allow us to return any unsold products to them. If the bundle doesn't sell, we're left holding a sizable inventory of other companies' products.

It also pays to plan ahead for disaster: Keep some creative ideas waiting in the wings. For example, if you're left with a large inventory of another company's products, you may try to sell a previously retail-only bundle through direct mail. Or, you might rework the bundle to include different products and try again.

- *Sometimes contracts expire during a hot selling streak.* Another problem arises when you've created a blockbuster bundle—and your contract with the other developer runs out. If others don't wish to renew the contract (for whatever reasons), you must drop this revenue generator from your product line—a frustrating situation at best. In these cases we try to renegotiate the contract. (We've renewed some contracts as many as four or five times.) However, if we can't renew the deal we try to take a positive attitude, knowing that there are always new bundles to be created.

- *Putting inadequate resources behind a bundle will kill it.* Before committing to a bundle, you should think about the considerable level of resources and energy needed to effectively promote and sell the product. If you don't put adequate resources behind a bundle, of course it won't do well.

It's important to ask yourself if you are willing to put the time, marketing money, and personnel resources into a product that may not be in your lineup for more than six months or a year. This is especially important, as we all are operating in a recession economy and on limited resources and staff.

- *Bundling entails complicated logistics.* There are many logistic issues that can make bundling complicated, so it's important to think through the entire process of creating, producing and shipping a bundle, and the implications to all areas of your company. For example, you'll need to add a new SKU to your product line (which is often tricky because of the large number of products in a bundle). You also must clearly inform distributors and other direct customers about this new product offering, and make sure they understand how it will affect them.

Another consideration is whether to purchase a product from the other company or instead pay a royalty—and duplicate the disks and print the documentation yourself. If you plan to keep the bundle in your product line for several months and expect to sell a large number of units, you may want to consider doing the production yourself. Depending on the royalty agreement established in the contract, this alternative may be less expensive for you.

There are benefits as well as pitfalls to bundling, but it has been well worth the effort and risk for us. By combining our products and resources with those of other companies, we've boosted our bottom line and reached new customers. Our experience is that if you enter the process with your eyes wide open, you'll be in a good position to take advantage of the bundling opportunities on the horizon this year and beyond.

Bundle, anyone? ◆

---

*Diane Kreyenhagen is vice-president of OEM and direct sales for T/Maker Company, a word-processing and ready-to-use graphics software developer located in Mountain View, California.*

# Apple Direct

*Apple Direct* is Apple's monthly developer newspaper, covering business and technical issues for decision makers at development companies. It is published by the Developer Support Information Group within Apple's Developer Press.

**EDITOR:**

Paul Dreyfus (AppleLink: DREYFUS.P)

**TECHNICAL WRITER/EDITOR:**

Gregg Williams (GREGGW)

**BUSINESS & MARKETING EDITOR:**

Dee Kiamy (KIAMY)

**PRODUCTION EDITOR:**

Lisa Ferdinandsen (LISAFERD)

**CONTRIBUTORS:**

Juan Bettaglio, Suzanne Dills, Chloe Freeland, Sharon Flowers, Andi Galt, Mark Johnson, Stacy Moore, Rilla Reynolds, Caroline Rose, Anne Szabla, Jessa Vartanian, Liz Westover, Diane Wilcox

**MANAGER, DEVELOPER PRESS:**

Dennis Matthews

**MANAGER, DSI:**

Greg Joswiak

**PUBLICATIONS AREA MANAGER:**

Hartley G. Lesser

**PRINTER:**

Wolfer Press Co., Inc.

Los Angeles, CA

© 1993 Apple Computer, Inc., 20525 Mariani Ave., Cupertino, CA 95014, (408) 996-1010. All rights reserved.

Apple, the Apple logo, APDA, AppleLink, AppleShare, AppleTalk, LaserWriter, LocalTalk, MacApp, Macintosh, MacTCP, MPW, Newton, SANE, and StyleWriter are trademarks of Apple Computer, Inc., registered in the U.S. and other countries. AppleCD, Apple Desktop Bus, AppleScript, Apple TechStep, At Ease, Centris, ColorSync, develop, Finder, FinePrint, GrayShare, KankiTalk, Macintosh Duo, Macintosh Quadra, MacTest, MoviePlayer, PhotoGrade, PowerBook,

QuickDraw, QuickTime, ResEdit, System 7, and TrueType are trademarks of Apple Computer, Inc. Adobe and PostScript are trademarks of Adobe Systems Inc., which may be registered in certain jurisdictions. Claris and HyperCard are registered trademarks of Claris Corporation. Classic is a registered trademark licensed to Apple Computer, Inc. NuBus is a trademark of Texas Instruments. All other trademarks are the property of their respective owners.

Mention of products in this newspaper is for informational purposes only and constitutes neither an endorsement nor a recommendation. All product specifications and descriptions were supplied by the respective vendor or supplier. Apple assumes no responsibility with regard to the selection, performance, or use of the products listed in this newspaper. All understandings, agreements, or warranties take place directly between the vendors and prospective users. Limitation of liability: Apple makes no warranties with respect to the contents of products listed in this newspaper or of the completeness or accuracy of this publication. Apple specifically disclaims all warranties, express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.