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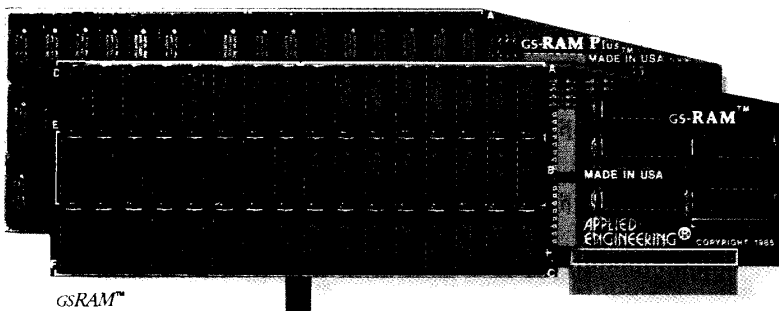
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Expand the IIGs RAM and ROM with the GSRAM or GSRAM Plus  
with ROM Pak. Available now with 256K to 8 MEG!

GSRAM Plus™



GSRAM™

Remember the 16K cards for the II+ and the 64K cards for the IIe? At the time, that much memory seemed like a lot. But when the owners of these memory cards came to us for more memory, many had to throw away their smaller Apple memory cards or try to sell them. Most of our customers told us that had they known about Applied Engineering's larger memory cards when they bought their Apple, they would have purchased them at the same time.

GSRAM and GSRAM Plus are available now, allowing up to 8 MEG of memory expansion. That's 8 times the memory capacity of Apple's card and just look at the benefits that only GSRAM and GSRAM Plus have over Apple's card:

- Lower cost
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- Has ROM expansion port
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- Expands AppleWorks internal limits
- Built-in Hi-Res self-diagnostic software
- 5 year hassle free warranty (Apple has a 90 day warranty)
- Made in USA

### GSRAM for More AppleWorks Power

Only GSRAM and GSRAM Plus eliminates AppleWorks internal memory limits, increasing the maximum number of records available from 6,000 to over 25,000 and only GSRAM and GSRAM Plus increases the number of lines permitted in the word processing mode from 6,000 to over 15,000. And only GSRAM and GSRAM Plus offers a built-in printer buffer so you can continue using AppleWorks while your printer is printing. GSRAM and GSRAM Plus even expand the number of lines in the clipboard from 255 to 2047 and will auto segment large files so they can be saved on two or more disks. You can

even have Pinpoint or Macroworks and your favorite spelling checker in RAM for instant response. GSRAM and GSRAM Plus will even display the time and date right on the AppleWorks screen. Nothing comes close to enhancing AppleWorks so much.

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Simply plug GSRAM into the IIGs memory expansion slot and you've got up to 8 megabytes of RAM at your fingertips—all of it instantly and automatically recognized by the IIGs. GSRAM is compatible with all IIGs software, including AppleWorks, as well as BASIC®, ProDos, DOS 3.3, PASCAL®, "C" and CP/M®.

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### GSRAM—for Normal Memory Requirements

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Steve Wozniak, the creator of Apple Computer

"I recommend Applied Engineering products wholeheartedly."

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GSRAM Plus can be expanded up to 8 MEG with an optional piggyback card.

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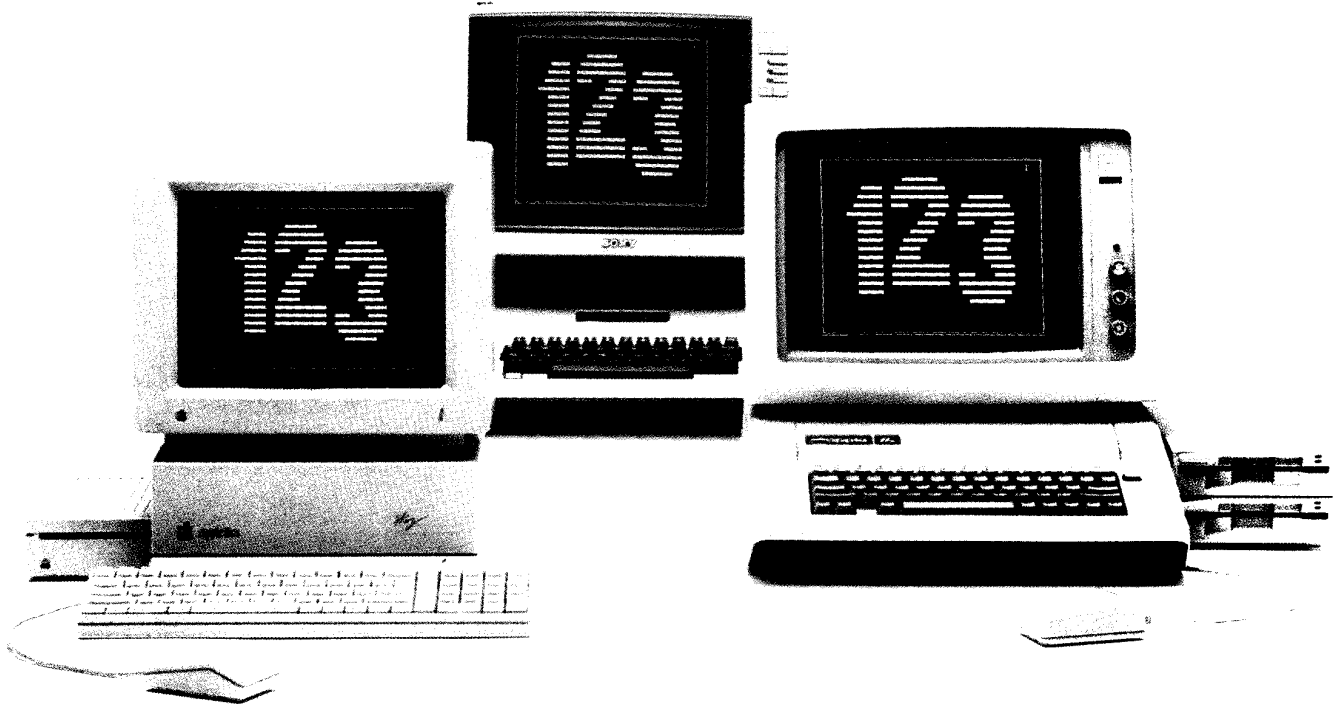
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An Apple Disk 3.5 Drive will support the new 3.5" disks whether they're IBM MS-DOS formatted or Apple ProDOS formatted. The PC Transporter acts like an Apple Disk 3.5 Drive disk controller for IIGs, IIe, and II Plus users.

PC Transporter supports up to 5 drives in a number of combinations.

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*PC Transporter controls Apple and IBM compatible disk drives. It supports 3.5" and 5.25" MS-DOS and ProDOS formatted diskettes.*



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PC Transporter reads MS-DOS and translates it into Apple native ProDOS. You can store IBM programs and data on any ProDOS storage device including the Apple 3.5 Drive, Apple UniDisk™ 3.5, Apple 5.25" drive, SCSI or ProDOS compatible hard drives. (You can use the Apple UniDisk 3.5 with its own controller card for storing programs and data, but not for directly booting an IBM formatted disk.)

You can even use our 360K PC compatible drive for ProDOS

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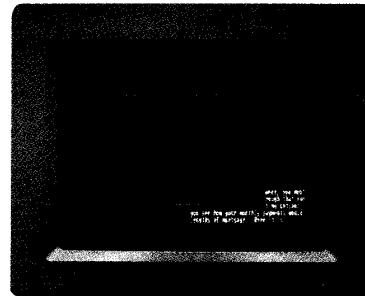
Note: The IBM mode is 128K less because the PC Transporter uses 128K for system memory.

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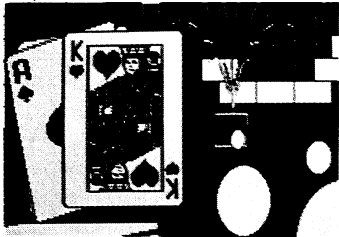
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### On the cover

Entertainment software has changed considerably from the days of Little Brickout depicted on our cover. Cover design produced on our IIGS by Mary Hubert.

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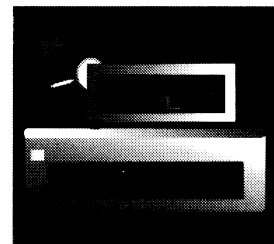
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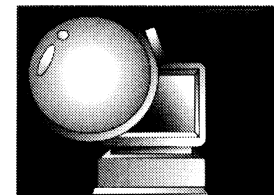
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Printed in U.S.A.

## the inside track

Kathryn Hallgrimson Suther

### in the lead:

Christmas time is just around the corner and November is an appropriate time to begin an examination of entertainment software for the Apple II and IIgs computers. Val Golding's **Entertainment Software Today: Brick Wars** is the first in a two part series of articles evaluating products for the Apple II. This month we'll just wet your lips, get you in the mood, and then tease you in the Marketplace. Keep tuned 'cause next month we shall continue this quest and also include IIgs game reviews.

### close behind:

We get down to serious business with Sean Nolan's proposed startup file standard. **SETUP.SYSTEM** describes a program which lets you easily install customizing routines, such as a RAM disk and clock card drivers, on boot up into ProDOS. Sean also updates his August review article of IIgs memory expansion cards. Part of this follow-up article examines MemorySaver from Checkmate Technology — a product highlighted at Applefest in September.

Are you interested in hard drives? Do you wonder how they work, what all those "funny words" mean, and what facts you should consider before purchasing one for your machine? Peter and Allen Baum tackle these questions in this month's **Speaking of Hardware**. They also finish their "All About Floppy Drives" discussion.

Wes Felty examines the internal operations of the IIgs in his **Getting Inside the Apple IIgs** (A Hobbyist's Tour). For those of you familiar with the IIe and IIc, Wes bridges the gap over to the GS. Additional operations, registers and softswitches available on this machine are examined. Wes also mentions a handy program—SoftSwitch—written by Ken Kashmarek. Jeffrey Jacques follows with a formal review in **A Review of SoftSwitch: Program Switcher for the Apple IIgs**.

There's lots more in this issue: Laurence Thompson's conclusion to **The Fast IIgs**, Bob Bishop's **Oscilloscope Subroutines for the GS**, and don't forget Charlie Stillman's contribution from the **Setting the Standards** APDA conference at Applefest.

### shipping & mailing:

We have made a few changes on how we bill credit cards for shipping charges: we used to bill all shipping charges when an order was entered. Now, if there are any back ordered items, we will bill the first shipment for the shipping costs of that shipment only, and the last shipment for the shipping costs for any and all back order shipments.

*Attention Canadian citizens!* 2nd class mailing is available to you for an additional \$5 fee (1st class add an additional \$18). If you wish to change your mail service, please do so when you renew your membership. Simply indicate 1st or 2nd class and pay the appropriate fee.

### Mary Hubert:

Everyone here at the Co-op extends many sincere thank yous to Mary Hubert, who has contributed to our organization since 1979. As art director, she brought our magazines where they are today. We have appreciated her guidance and tireless efforts.



# Applefest September 18, 19, 20

Kathryn Hallgrimson Suther

**E**very show we attend reassures us of the longevity of the Apple II line. This show was no exception. Many new products were unveiled by exhibitors. Desktop publishing programs such as *Springboard Publisher* (Springboard Software Inc.) and *The Personal Publisher* (Milliken Publishing Company) were popular attractions. These products are opening a whole new realm of productivity for Apple II owners. We will be examining desktop publishing programs in an upcoming issue of *Call -A.P.P.L.E.*

Peter and Allen Baum were on the lookout for significant hardware products and came away pleased with what they discovered. Look for future coverage on the *Zip Chip*, from Zip Technology, and *The Kache Plus* card from Ohio Kache Systems. Sean Nolan had time to check out *The MemorySaver* from Checkmate Technology and includes coverage in his GS Memory Cards Follow-Up article.

Of course any Apple Computer show would not be complete without the presence of Apple personalities. We would like to include parts of keynote addresses made by Del Yocam and Steve Wozniak. (Too bad we couldn't capture the historical footage shown on film — the early Dick Cavett commercials...

The headings are simply a creation of our editorial staff.

## Del Yocam

*Executive Vice President and Chief Operating Officer*

### Getting Started

- "The story of the Apple II is not just the story of a company that started small and later became a giant. It's also the story of how people have loved computers and how people have changed since 1977."
- "When we first started to sell computers we faced an interesting issue. We couldn't just sell Apples. We had to tell people what a computer can do, because the only people who had any experience with computers were either hobbyists or men in white coats locked away in the basement of a building with computers the size of a room. As you know, Apple was convinced they had a product that fit the budget and the needs of individuals. Not just people who tinkered with electronics. We had to tell people why in the world they would want to own such a thing as a computer."

### The Early Ad Campaigns

- "In 1980 we ran our 1st national TV advertising campaign featuring Dick Cavett. The way of talking to our customers began to emerge around this time. Simple, non-technical



Steve Wozniak giving his opening address at Applefest.

language everyone could understand. An attitude and tone called friendly. Apple's logo emerged also and you could actually hear the 'byte' being taken out of the Apple."

(ED—We viewed some of those old classics... Remember Dick Cavett interviewing the "Average American Kid and the Average Homemaker?" They were doing stuff like trend analysis and realistic forecasting — real average American. Definitely humorous, entertaining commercials.)

### Facing the Competition

- "It was the software that brought millions of new customers to the Apple II. The rest of Apple II history is largely a history built on software that we didn't even develop. Our chief competitive advantage was software."

### The Past in Perspective

- "Sometimes the greatest challenge in engineering isn't to come up with a new idea, but to prove that idea, over and over in a changing world. If you don't, you end up in a museum."
- "In the eight years I've been at Apple we've built five generations of Apples: the Apple II, the Apple II+, the Apple IIe, the Apple IIc and the Apple IIGS. In all that time there was never a doubt in our minds that there would be a next generation Apple II. There are over four million Apple II's in the world today, but you can still run Apple II software created in 1977 on an Apple IIGS. In my mind our greatest achievement is to advance the technology and take our customers with us."

### The Future

- "The Apple II has advanced. Already it's assimilated the intuitive characteristics of the Macintosh interface. It runs on the AppleTalk network and prints on the LaserWriter. This is an interesting lesson for all of us. It means that a second operating environment did not invalidate or weaken the Apple II concept. Instead, Apple II sucked up that technology right into its own environment."
- "Let me tell you what I see in the next 10 years. We'll look back and see technology of today from a more advanced point of view. Just the way we're doing right now. From Apple's point of view, I can tell you that in 10 years, the

*(continued on p. 31)*

# Entertainment Software Today: Brick Wars

Val J. Golding

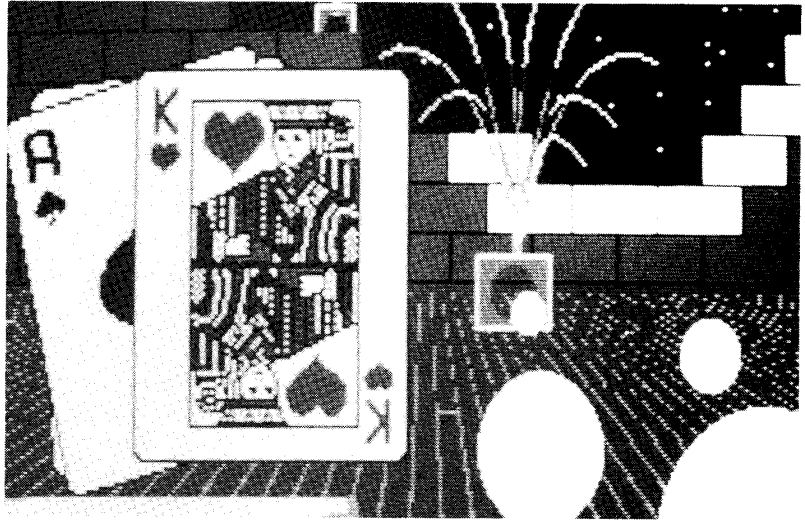
**H**ow many of you remember Little Brickout? If you do, you may be dating yourself, because it goes back almost ten years. A Lo-Res [gasp] graphics game played with the game paddles, Brickout's simple object was to knock bricks out of a wall with a bouncing ball. How far things have come since then!

Once upon a time, personal computers were thought of as little more than sophisticated toys, good only for playing games. Little did we know or foresee, the development of the Macintosh and Apple IIGS, machines capable of running complex graphics and application programs such as MacDraw, Pagemaker, 816/paint, AppleWorks and others.

Somewhere along the way, inspired by the pioneering Hi-Res graphics work of *Call - A.P.P.L.E.'s* own Bob Bishop and Penguin's Mark Pelczarski, gaming matured and expanded. Where once there were only juvenile text adventure and Lo-Res graphics games, there are now role-playing games with plots comparable to those of major motion pictures, playable for weeks at a time, arcade games (although less in vogue currently) that present the ultimate challenge in motor skills, programs which let you create your own games (Pinball Construction Set) educational games, puzzles and composites of all of the preceding. In short, "games" is no longer a sufficient description; "entertainment software" is.

Today, many of us purchase computers and justify the outlay with spreadsheet and checkbook programs to aid us at home and at work. But now, as much for ourselves as for our children, we find we cannot tear ourselves away from the compulsive thrill of winning a few games and beating the odds, or the perverse pleasure found in frustrating losses.

Before we know it, the holidays will be here, so to help counteract those pangs of wordprocessing burnout we all feel at one time or another, we'd like to offer a



few gift ideas (even for yourself!) in the form of a generous helping of our picks, and non-picks, from among some of the newest pieces of entertainment software.

## Pity Patter

If the name "Lucasfilm" evokes only memories of the Apple-created award-winning special effects in blockbuster movies like "2001" and "Star Wars," then you may be pleased to learn that Lucasfilm Games is a prolific producer of quality entertainment software. On reputation alone, one should expect wondrous things from this subsidiary, and we were

**Product:**  
Maniac Mansion  
**Company:**  
Lucasfilm Ltd.  
Games Division  
P.O. Box 2009  
San Rafael, CA 94912  
(415) 662-1800  
**Price: \$34.95**  
CIRCLE 39 ON READER SERVICE CARD

not disappointed. How things have changed from the early days!

Maniac Mansion at first glance appears to be a typical graphics adventure game requiring the usual amount of laboriously typed key verbs and nouns to move from place to place, pick up objects, etc. Nothing could be further from the truth.

Imagine running a contemporary mouse-based application, the ease of

clicking and double-clicking to indicate choices, etc. Now, by substituting a joystick for a mouse, comes a program that brings this concept to action/ adventure game-playing — Maniac Mansion.

On the primary display screen, where animated characters move in response to player commands, appears a "sentence line" composed of a verb from the two following lines and a noun, selected by clicking on the desired object. Items from the inventory may also be chosen by clicking on the appropriate inventory word. Control is switched from one character to another by selecting "new kid" and clicking on one of three names.

The setting is a mysterious mansion where some strange things have been occurring lately. Several story lines are possible, depending on the order taken by the exploration. From time to time, the story line is interrupted as related but noncontrollable scenes are interspersed. These "cuts" show "behind the scenes" action, just as a movie often cuts away from the main plot to present some pertinent side event.

The Maniac Mansion package includes a half dozen pages of well-written and easy to understand documentation plus a cutesy printed mockup of a campus "bulletin board." The program is on a two-sided diskette; one is protected. An Apple IIc or IIe with 128K is required. No mention was made of the GS, but we assume it might run on one. Play it safe and check with your dealer first. The only problem we ran into was in the game save

function when we inadvertently placed the wrong disk in the drive and the system hung.

We barely got into this exciting adventure before we had to quit and start writing. Pity. It's good for many hours of genuine first rate entertainment.

**Double Down**

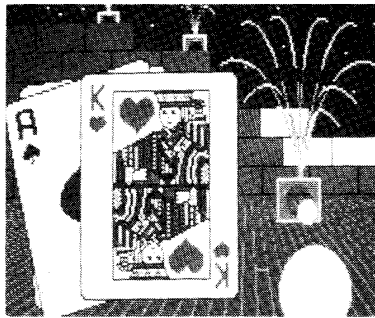
Applications Plus offers a pair of programs whose avowed purpose is to teach gaming table strategies. In this respect both do well. In most other areas neither meets what this reviewer considers reasonable software and documentation standards. Each program has a number of text files, helpful in content but because of their upper case-only display, somewhat difficult to read. Moreover, because they are written in Pascal, the speed of the Hi-Res text display leaves something to be desired. Neither program is copy-protected and both run on any model Apple.

Vegas Video Poker simulates video machines where payoff is based on winning hand odds and an initial "bet" of one to five dollars. In 25 hands of play, we retained only \$59 from a \$100 stake and decided to quit while we still had a shirt.

Play consists of dealing, discarding and drawing, using large excellently designed cards. An option for prompted

House at Blackjack contains virtually no program documentation, either on disk or in printed form. A main menu has four choices, two of which have three- and four-item sub-menus to select tutorial and strategy text files. Terms like "push" and "split," understood by a seasoned player, are not explained. A beginner might find that confusing.

After booting the disk, no way could be found to directly enter the game-playing mode. Only after exploring each of the main menu options in turn did we find a prompt line reading "Press return to start playing." Once familiar with the content of the parameter and text files, it becomes burdensome to select a menu item, wait for the the sub-menu to load, press return



and wait once more while the main program file loads.

The simple Hi-Res graphics display consists only of an outlined blackjack table. The miniscule cards used have space for only a single letter or number indicating their value. The letter "T" on one card stumped us for a moment until we figured out that it represented the figure 10.

It is not often that this reviewer says "thumbs down" on a product. Almost always it is possible to find some saving graces. In the case of Blackjack and Video Poker we did not. While much of the textual material was worthwhile, it can be found in books dealing with techniques and strategies of gambling, and at far less cost. In terms of pure game play, there are better programs.

**A Soft Spot**

An entertainment package which defies classification is Softdisk, a "magazine" on two double-sided disks. Softdisk appears monthly (the current issue is number 71, which tells us they are just about to celebrate their sixth birthday). It is available at book stores for \$9.95 or by subscription at six issues for \$39.95, 12 for \$69.95. Call (800) 831-2694 to inquire or order.

Softdisk's organization is like that of a

magazine, with an editorial, table of contents, letters to the editor and other textual material. But there the resemblance ends. The balance of this issue is made up of Print Shop™ images, an excellent animated adventure, a jig-saw puzzle, a clever anagram, a quiz, music program and Double Trouble, the feature game by John Besnard (Pensate, Arcade Boot Camp).

All of this is tied together with a highly effective operating system which offers menu choices for each program or feature plus text material concerning the programs. Rumor has it that a new and superior ProDOS-based operating system is in the works.

Double Trouble particularly caught our fancy. An assortment of five arcade games, two at a time are played using a common joystick; thus a move on one of the split screens also affects action on the other screen, fascinating, to say the least. Keeping track of both screens simultaneously is no small challenge.

Considering that you can pay \$29.95 up for a single game, Softdisk represents a real bargain to this writer. There are competing disk magazines as well, but none hold the proverbial candle.

**Mail Call**

Dyed-in-the-wool game fanatics may be interested in Computer Game Forum, a pun-filled, fun-filled non-machine-specific magazine covering many aspects of gaming with emphasis on gaming by mail, a practice of which we were unaware. We counted 15 features within its 26 pages. For more information, contact:

Golden Empire Publications  
515 S. Harbor Blvd., Suite C  
Anaheim, CA 92805  
(714) 535-4435

Christmas is not quite upon us so before you complete your shopping, wait for next month's *Call-A.P.P.L.E.* and plan to read about a really unusual model train program, a ski tournament construction set and a couple of space war arcade adventures, plus anything that may come our way in the next couple of weeks.

Bon aperiitif...

Please rate this article on the Reader Service Card by circling:

- 41 Excellent    42 Good
- 43 Fair         44 Poor

**Products:**

Vegas Video Poker  
Beating the House at Black Jack

**Company:**

Applications Plus, Inc.  
15720 Harmony Way  
Apple Valley, MN 55124  
(612) 432-5560

**Price:**

Vegas Video Poker \$29.95  
Beating the House at  
Black Jack \$34.95

CIRCLE 40 ON READER SERVICE CARD

play was judged helpful for beginners and can be selected from a boot menu. Once selected, it is not possible to change to the opposite state without rebooting. In this mode, pressing "S" after a deal displays a strategy screen with an analysis of the player's hand and possible action in priority order.

On-screen help was limited and no explanation was made of the mechanics of playing, either in the program or in the accompanying documentation which, although 20 pages long, was directed entirely to poker strategies and techniques.

Like its companion, Beating the

# SETUP.SYSTEM

## A Proposed Startup File Standard

Sean Nolan

**T**his article describes a program which lets you easily install customizing routines, such as a RAM disk and clock card drivers, on boot up into ProDOS. It mimics, under ProDOS-8, the SYSTEM.SETUP feature of ProDOS-16. It is emphatically placed in the public domain: I urge software publishers to take it and include it where appropriate with their own programs. I only ask that you take the program unmodified. It would be unfortunate if variants of the program spread around, each subtly incompatible with the others.

One feature which makes ProDOS-16 a more powerful operating system than ProDOS-8 is its flexible and complicated startup sequence. This includes the ability to boot up into either ProDOS-8 or ProDOS-16 based applications, as well as automatically installing, on bootup, patches in RAM to the Apple IIGS toolbox. ProDOS-16 accomplishes this by loading and executing all files found in the SYSTEM/SYSTEM.SETUP subdirectory. These files must include TOOL.SETUP, but may include other files for installing desk accessories, diagnostic and debugging routines, or anything else you can think of.

SYSTEM.SETUP is a nice idea. It allows you to specify what happens at boot up simply by placing the correct files in a particular subdirectory. Unfortunately, ProDOS-8 does not support SYSTEM.SETUP. If it did, it would be much easier to install IIGS RAM disk drivers, clock card drivers, and IIGS classic Desk Accessories on ProDOS-8 disks.

Suppose you have a large memory card in your IIGS, and you want a RAM disk driver for it to be installed automatically every time you boot. Here are a two ways you could do it:

1. If the RAM disk driver is a system program, you could place it first on the disk so that is automatically called on boot up. When the system program quits, you then type in the name of the next system program to run, such as "BASIC.SYSTEM".
2. If the RAM disk driver is a binary file, you can place BASIC.SYSTEM first, and have a BASIC program called STARTUP which BRUNs the RAM disk driver. This is fine, as long as you plan to boot up into BASIC.

If you have both a large memory card and a clock card, you may need to install drivers for both of them. Now things become more difficult for you, particularly if your memory card came with a SYStem file program to install the RAM disk, and your clock card came with a BINary file clock driver. SETUP.SYSTEM (note: not SYSTEM.SETUP) automates the bootup sequence for you. To use it, assemble it and make it the

first SYStem program on your disk whose name ends in ".SYSTEM". This ensures that it will be run on boot up. Then create a subdirectory called "SETUPS", containing the files which you want to be executed on boot up. That's all there is to it.

Many existing programs already work with SETUP.SYSTEM. I have used it with the RAMdisk drivers for both Applied Engineering's and Checkmate Technologies' IIGS memory cards, and with Diversi-Cache and Diversi-Hack (IIGS classic desk accessories by Bill Basham).

When run, SETUP.SYSTEM will search for the SETUPS subdirectory in the volume directory of the last disk accessed. It then loads and executes, in turn, each SYStem or BINary file in the SETUPS subdirectory. These files I refer to as "setup files." When all setup files have been called, SETUP.SYSTEM then looks for the second system file in the main volume directory whose name ends in ".SYSTEM", and runs that. This second ".SYSTEM" program is your main application. It can be BASIC.SYSTEM, your assembler, word processor, AppleWorks, or any other ProDOS application.

SETUP.SYSTEM was especially written to be compatible with already existing RAM disk drivers, clock drivers, and Apple IIGS Classic Desk Accessories under ProDOS-8. The rules for compatibility are simple. Setup files must be either BINary files or SYStem programs in the SETUPS subdirectory. This is in contrast to ProDOS-16's SYSTEM.SETUP, which uses new ProDOS-16 file types exclusively. You may place other file types in the SETUPS subdirectory, such as text files, but SETUP.SYSTEM will ignore them. BINary setup files may load anywhere in either memory range \$200-\$3EF or \$800-\$B8FF. They should exit with an RTS. You may also place SYStem programs in the SETUPS subdirectory. These SYStem programs, as usual, must load at \$2000, and must not exceed \$B8FF when loaded. SYStem setup programs should exit with a ProDOS QUIT call. Most SYStem programs do this, although there are exceptions. A few exit by looking for the next SYStem program to run by name, or look for and run the second ".SYSTEM" file on the disk. Programs which do this are incompatible with SETUP.SYSTEM. Among the few system programs which are incompatible for this reason, is the original version of the ProDOS FILER.

Once the setup program is in memory, it may use any memory except for pages \$BD and \$BE, which is where SETUP.SYSTEM lives in hibernation, and the ProDOS global page at \$BF00. Because of this memory restriction, some existing SYStem programs may not be used as setup files. You should not, for instance, place BASIC.SYSTEM in the SETUPS

subdirectory. BASIC.SYSTEM relocated itself to \$9A00-\$BEFF, overwriting SETUP.SYSTEM. If you do so, and then type "BYE" from BASIC, your Apple will explode into a fireball, destroying all life other than insects within a half mile radius. Really.

A third reason why system programs may not work in the SETUPS subdirectory is that they may require subsidiary files — which must also be placed in the SETUPS subdirectory. If these subsidiary files are BINary or SYStem files, SETUP.SYSTEM will eventually try to call them on their own. This problem happened to me when I moved the Apple IIGS System Utilities into my SETUPS directory. (Why? So I could copy some files onto my RAM disk on bootup.) The problem was solved by changing the file type of the three BINary files which the System Utilities needed. I gave them file type codes of \$03, which is a defunct Apple III Pascal Text file code. The point was, SETUP.SYSTEM cared what the file types were and the System Utilities didn't. I should point out that placing random system programs in your SETUPS subdirectory can be dangerous. By trial and error, I found that the GS System Utilities left the crucial pages \$BD and \$BE undamaged.

If you plan to write new setup programs, I recommend that you make them BINary files rather than SYStem programs. SETUP.SYSTEM temporarily redirects the ProDOS quit vector at \$BF03 into itself before calling any SYStem programs in the SETUPS subdirectory. Therefore, when the setup program executes a ProDOS quit call, control is returned to my code. This is not kosher programming, and may not work with future revisions of ProDOS. I added the feature solely so that many already existing SYStem programs could be used with SETUP.SYSTEM.

### Typing it in

Although the program below was assembled using the MERLIN PRO assembler, I tried to avoid as many MERLIN-specific psuedo ops as possible and present a generic assembly listing. In order to assemble it on other assemblers, some minor changes will be necessary: The psuedo-op "ASC" in MERLIN creates either high or low ASCII characters, depending on whether the string is surrounded by a single quote (low ASCII) or a double quote (high ASCII). I used both varieties. Users of EDASM, APW, or ORCA/M should add the MSB psuedo-op where needed. The last byte of the program is a checksum byte. It is the exclusive OR of all the previous bytes in the program. If you assemble the program using MERLIN, be sure to check that the byte you get is the same as the one in the listing. If it isn't, you made a typo.

If you are not using MERLIN, replace the last line with

DFB\$E8

and run the following program to check that the code is correct:

```
10 PRINT CHR$(4)"BLOAD
   SETUP.SYSTEM,AS2000,TSYS"
20 FOR X = 8192 TO 8703
30 SUM = SUM + PEEK(X)
40 NEXT
50 IF SUM = 84732 THEN PRINT "OK" : END
60 PRINT "ERROR"
```

### Program Logic

SETUP.SYSTEM is not a model of good programming practice. In order to get all the functionality I wanted into 512

bytes, I had to resort to self-modifying code. If the program went one byte over, to 513 bytes, the storage space on disk would mushroom from one block to three.

Among the first tasks of SETUP.SYSTEM is to relocate itself from its load address of \$2000 to its running address of \$BD00. SETUP.SYSTEM must move itself out of the way so that it can load other system programs without overwriting itself. Lines 56 through 62 in Listing 1 accomplish this. Next, the program (lines 75 through 86) tries to determine the name of the disk from which SETUP.SYSTEM was run. This name is saved so that the program can set the ProDOS prefix to the volume directory at a later time. The quit vector in the ProDOS global page is then saved (lines 88-91) so that it can be restored on exit.

Control returns to line 97, at the label "Mainloop," before and after executing each of the setup files. The reset vector and the quit vector are both redirected to point to Mainloop, to increase the chances of SETUP.SYSTEM regaining control after calling setup programs. The system bitmap is then cleared so that we can load the setup file (lines 107-115), and the machine is then put into as normal a state as possible (lines 117-124).

Lines 131 through 154 make sure that the original volume is in the disk drive, and sets the ProDOS prefix to that volume. If the disk isn't around, a warning message is displayed, and the user is given a chance to insert the correct disk.

Line 160 calls a subroutine called "NextFile," which reads the SETUPS subdirectory until it finds the name of the next BINary of SYStem program. It leaves that name in a known place. If it finds no more SYStem or BINary files it exits with the carry set. This will happen when all of the setup files have been loaded and executed — that case will be dealt with later.

If NextFile found the name of a setup file, we proceed to line 167. Here the prefix is set to the SETUPS subdirectory, and the setup file is loaded into memory by calling the subroutine "ReadFile," which starts at line 303. If there was no error when loading it, the setup file in memory is called. One way or another, control returns to MainLoop, either through the ProDOS quit call, the user pressing RESET, or the setup file exiting with an RTS.

Once all the setup files have been loaded, we go to line 176 and restore the original ProDOS quit vector. Lines 186 through 190 then modify the NextFile routine so that it works rather differently. Where before NextFile looked for either BINary or SYStem files, now it will look for only SYStem ones. NextFile used to look in the SETUPS subdirectory. It now looks in the volume directory. NextFile will now be used to find the name of the system program to exit to.

NextFile is called repeatedly, returning the names of all SYStem programs in the volume directory (line 192). Lines 194-201 make sure that the filename ends in ".SYSTEM". If it passes this test, we then check that it is not the first ".SYSTEM" file on the disk (lines 203-205). The first ".SYSTEM" file on the disk is presumably "SETUP.SYSTEM", and we don't want to run that, or we'd go into an endless loop. The system file is loaded, and called (line 206) with the same subroutine, ReadFile, which was used to load and call setup files. The difference is that this time we never come back, since the ProDOS quit vector has been restored to its original value.

(Listing begins on next page)

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LISTING 1

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SETUP.SYSTEM by Sean Nolan  
This program is in the public domain.

```
*
*
* This program mimics the ProDOS-16 SYSTEM.SETUP convention.
* It can be used to install RAM disk drivers, clock drivers,
* and Iles Classic Desk Accessories on bootup under ProDOS-8.
*
* This program loads and calls all BINary and SYStem files in
* a subdirectory named SETUPS. It then looks for the second
* system program in the volume directory whose name ends in
* ".SYSTEM", and runs that.
*
* This program was assembled using Merlin Pro.
```

```
TYP  $FF      ;save as a system file
ORG  $BD00    ;load at $2000, but run at $BD00
```

\*\*\*\*\* equates

```
CH      =      $24
IN2     =      $280
FileType =     IN2+16
AuxCode =     IN2+31
RESET   =      $3F2
IObuffer =     $B900
PRODOS  =     $BF00
QuitVect =     $BF03
DEVNUM  =     $BF30
BITMAP  =     $BF58
INIT    =     $FB2F
VTABZ   =     $FC24
HOME    =     $FC58
RDKEY   =     $FD0C
SETVID  =     $FE93
SETKBD  =     $FE89
SETNORM =     $FE84
```

\*\*\*\*\* boot code

```
VolName = * ;The first 17 bytes are overwritten with the
;name of the volume from which this was run.

BD00: A2 01 53 LDX #1 ;mark page $BD as free in the system bitmap
BD02: 8E 6F BF 54 STX BITMAP+23 ;so we can put Online result in our code.

BD05: CA 56 DEX ;relocate this program to $BD00-BEFF
BD06: BD 00 20 57 Loop1 LDA $2000,X
BD09: 9D 00 BD 58 STA $BD00,X
BD0C: BD 00 21 59 LDA $2100,X
BD0F: 9D 00 BE 60 STA $BE00,X
BD12: E8 61 INX
BD13: D0 F1 62 BNE Loop1
BD15: CA 63 DEX
```



## A.P.P.L.E. Co-op November New Products & Specials Prices Good Through December 15, 1987

### Product of the Month

#### MemorySaver

from Checkmate Technology, Inc.  
Apple IIGS

**\$119.00** | Code SGC1MS | Ship \$1.00

The new MemorySaver is a special card that converts all or part of the memory in your IIGS into a high-speed non-volatile ROM disk. Simply plug in one or two GS expansion RAM cards up to 4 megabytes, and choose how you want it "partitioned." Really comes into its own with a meg and a half or more. The memory cards are powered by the MemorySaver wall-mount transformer, not the GS power supply. Thus the ROM disk is intact when the computer is turned off. A battery backup power supply (uses 6 "AA" size Nickel-Cadmium rechargeable batteries - not included) protects against power failure for up to 2 hours (less with larger memory configuration.). The Ni-Cad batteries are recharged continuously by Memory Saver. Memory cards currently supported:

- Apple Computer IIGS Memory Expansion card
- Orange Micro RamPak 4GS™
- Applied Engineering GSRAM™

For a little excitement, copy your system disk to the new ROM disk, set startup slot to ROM disk and reboot your GS... Its totally awesome!

#### Thexder

from Sierra On-Line, Inc.  
Apple IIGS

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Thexder was created for second generation computers with 16-bit processors and advanced animation capabilities. The finely detailed artwork fully exploits the great GS graphics. The music, perfectly choreographed to reflect the action during play, will rival anything you've ever seen or heard before! Players are given the chance to pilot a robot through multiple attack scenarios. The battlefields include caves, vast cargo holds and spaceship interiors. The robot also has the unique ability to transform into a fighter jet (and back again) at the touch of a button. Over 20

different types of aliens will do battle with you, and the challenge and music will escalate as the game progresses.

#### The Desktop Manager™

from On Three  
Apple IIGS

**\$79.95** | Code SGOTDM | Ship \$1.00

The Desktop Manager is a powerful set of classic desk accessories that are designed to increase your productivity and enhance the way you use your Apple IIGS. Unlike accessory products for the Apple IIe, The Desktop Manager will work on virtually all Apple IIGS ProDOS 8 and ProDOS 16 applications without specific program patches! The Desktop Manager was designed to be expandable capable of handling 100's of DA's. DA's in this package include:

- **NotePad** - actually an easy to use word processor.
- **Appointment Calendar** - a time scheduling tool allows date entries up to 12/31/99.
- **Calculator** - an extremely powerful electronic workhorse includes full 16 digit accuracy, and transcendental functions. Includes on-screen tape and can total columns of numbers pasted from your word processor!
- **Printer Manager** - Allows you to easily control a variety of printers, interface cards and printing codes.
- **Envelope Labeler** - Lets you use IIGS to print mailing labels.
- **ASCII Chart** - Lists entire ASCII character set and equivalent keypresses.
- **Accessory Manager** - Lets you move, copy, delete, rename and install desk accessories into The Desktop Manager.

Also for Desktop Manager:

#### Communications Manager™ (DA)

Apple IIGS

**\$44.95** | Code SGOTCM | Ship \$1.00

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#### Disk Manager™ (DA)

Apple IIGS

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the Apple System Utilities program at the press of a key! (Requires The Desktop Manager.)

#### TML Pascal (Stand-Alone)

from TML Systems  
Apple IIGS

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- A fully integrated Pascal compiler and mouse-based, multi-window editing environment. Includes powerful editing features such as cut, copy, paste, window stack or tile and more.
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- Compiles over 6000 lines of source code per minute and supports separate compilation of Units.
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- Requires 768k of memory and one 3.5" disk drive.

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```

BD16: 9A      64          TXS          ;init stack pointer
                               65
BD17: 4C 21 BD 66          JMP      Enter      ;jump to relocated code
                               67
BD1A: 06      68      DirName   DFB      6          ;DirName and VolName must be in the same page
BD1B: D3 C5 D4 69          ASC      "SETUPS"
BD1E: D5 D0 D3
                               70
                               71
***** Get name of boot volume
                               72
                               73
                               74
BD21: AD 30 BF 75      Enter   LDA      DEVNUM   ;get name of last volume accessed
BD24: 8D BF BE 76          STA      OnlineN
BD27: 20 00 BF 77          JSR      PRODOS
BD2A: C5      78          DFB      $C5          ;ONLINE
BD2B: BE BE   79          DA       OnlineP
BD2D: AD 01 BD 80          LDA      VolName+1   ;insert a slash before the name
BD30: 29 0F   81          AND      #$0F
BD32: AA      82          TAX
BD33: E8      83          INX
BD34: 8E 00 BD 84          STX      VolName
BD37: A9 2F   85          LDA      #/
BD39: 8D 01 BD 86          STA      VolName+1
                               87
BD3C: AD 04 BF 88          LDA      QuitVect+1 ;save original quit vector
BD3F: 8D D2 BD 89          STA      QuitMod1+1
BD42: AD 05 BF 90          LDA      QuitVect+2
BD45: 8D D7 BD 91          STA      QuitMod2+1
                               92
                               93
***** Clean up before & after calling files
                               94
                               95
                               96
BD48: A2 02   97      MainLoop LDX      #2          ;point Reset vector and ProDOS
BD4A: BD CB BD 98      Loop3   LDA      Jump+1,X   ;Quit vectors to MainLoop.
BD4D: 9D F2 03 99          STA      RESET,X
BD50: BD CA BD 100         LDA      Jump,X
BD53: 9D 03 BF 101        STA      QuitVect,X
BD56: CA      102         DEX
BD57: 10 F1   103        BPL      Loop3
BD59: 9A      104         TXS          ;fix stack pointer (X=$FF)
BD5A: 20 85 BE 105        JSR      Close     ;close all open files
                               106
BD5D: A2 17   107         LDX      #23       ;clear system bit map
BD5F: A9 00   108         LDA      #0
BD61: 9D 58 BF 109      Loop2   STA      BITMAP,X
BD64: CA      110         DEX
BD65: 10 FA   111        BPL      Loop2
BD67: A9 CF   112         LDA      #$CF      ;mark pages 0,1, 4-7 as used
BD69: 8D 58 BF 113        STA      BITMAP
BD6C: A9 07   114         LDA      #%111     ;mark pages $BD - $BF as used
BD6E: 8D 6F BF 115        STA      BITMAP+23
                               116
BD71: AD 82 C0 117         LDA      $C082     ;Language card off
BD74: 8D 0C C0 118        STA      $C00C     ;40-column
BD77: 8D 0E C0 119        STA      $C00E     ;normal character set
BD7A: 8D 00 C0 120        STA      $C000     ;80STORE off
BD7D: 20 84 FE 121        JSR      SETNORM   ;normal
BD80: 20 2F FB 122        JSR      INIT      ;display text page 1
BD83: 20 93 FE 123        JSR      SETVID    ;PR#0
BD86: 20 89 FE 124        JSR      SETKBD    ;IN#0
                               125
                               126

```

```

127 *Make sure boot volume is around
128 *AND set prefix to the boot volume
129
130
BD89: 20 58 FC 131 VolMount JSR HOME
BD8C: 20 00 BF 132 JSR PRODOS ;set prefix to volume
BD8F: C6 133 DFB $C6 ;SET PREFIX
BD90: C5 BE 134 DA Pfx2P
BD92: 90 28 135 BCC VolOK
BD94: A2 0D 136 LDX #13
BD96: BD F1 BE 137 Loop6 LDA VolText-1,X ;print message "insert volume "
BD99: 9D AC 05 138 STA $5A8+4,X
BD9C: CA 139 DEX
BD9D: D0 F7 140 BNE Loop6
141
BD9F: BD 01 BD 142 Loop7 LDA VolName+1,X ;print volume name
BDA2: 09 80 143 ORA #$80
BDA4: 9D BB 05 144 STA $5A8+19,X
BDA7: E8 145 INX
BDA8: EC 00 BD 146 CPX VolName
BDAB: 90 F2 147 BCC Loop7
148
BDAD: A9 23 149 LDA #35 ;go to CH=35, CV=11
BDAF: 85 24 150 STA CH
BDB1: A9 0B 151 LDA #11
BDB3: 20 24 FC 152 JSR VTABZ
BDB6: 20 0C FD 153 JSR RDKEY ;wait for a keypress
BDB9: 4C 89 BD 154 JMP VolMount
155
156
157 ***** Get name of next file at IN2
158
159
BD8C: 20 15 BE 160 VolOK JSR NextFile ;get name of next file at IN2
BDBF: B0 0D 161 BCS ExitLoop ;if error, we're done with setup files
162
163
164 ***** Load and call setup file
165
166
BDC1: 20 00 BF 167 JSR PRODOS ;set prefix to SETUPS
BDC4: C6 168 DFB $C6 ;SET PREFIX
BDC5: C2 BE 169 DA Pfx1P
170
BDC7: 20 8E BE 171 JSR ReadFile ;read in file whose name is at IN2
172 ;and call it if there was no error.
BDCA: 4C 48 BD 173 Jump JMP MainLoop ;3 bytes here copied into ProDOS quit vector
BD8D: 18 174 DFB #$BD!$A5 ;3 bytes ending here are copied into reset vector
175
BDCE: EE F4 03 176 ExitLoop INC RESET+2 ;scramble reset vector
BDD1: A9 00 177 QuitMod1 LDA #0 ;restore original quit vector
BDD3: 8D 04 BF 178 STA QuitVect+1
BDD6: A9 00 179 QuitMod2 LDA #0
BDD8: 8D 05 BF 180 STA QuitVect+2
181
182
183 ***** Look for second system program on disk
184
185
BDD8: A9 00 186 LDA #0 ;modify NextFile routine so that it searches
BDDD: 8D 3E BE 187 STA Number+1 ;the volume directory for system files only.
BDE0: 8D 82 BE 188 STA ChekType+1
BDE3: A9 00 189 LDA #<VolName ;NamePtr+1 does not need to be changed
BDE5: 8D D2 BE 190 STA NamePtr ;since VolName & DirName are in the same page

```

```

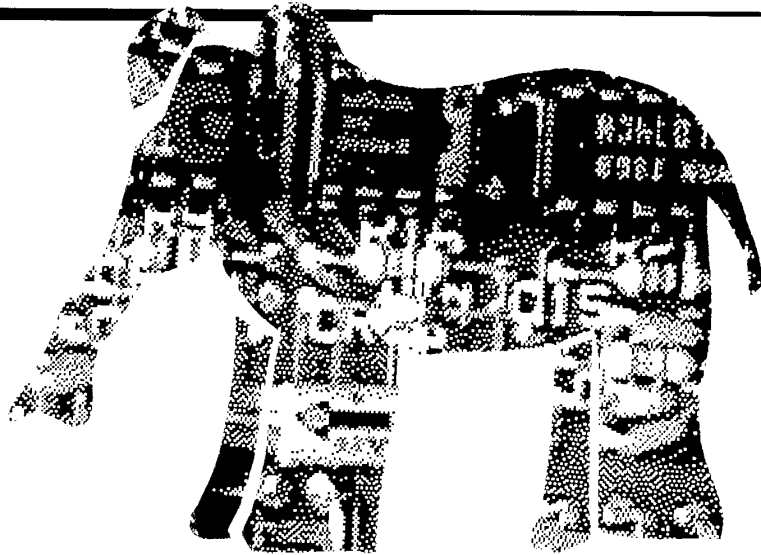
191
BDE8: 20 15 BE 192 NextSys JSR NextFile
BDEB: B0 1B 193 BCS Quit
BDED: AE 80 02 194 LDX IN2 ;see if file ends with ".SYSTEM"
BDF0: A0 06 195 LDY #6
BDF2: BD 80 02 196 Loop4 LDA IN2,X ;I expect pathname at IN2 in low ASCII
BDF5: D9 0E BE 197 CMP SysText,Y
BDF8: D0 EE 198 BNE NextSys
BDFA: CA 199 DEX
BDFB: 88 200 DEY
BDFC: 10 F4 201 BPL Loop4
202
BDFF: EE 02 BE 203 INC Mod+1
BE01: A9 FF 204 Mod LDA #$FF ;the first .SYSTEM program we find is this
BE03: F0 E3 205 BEQ NextSys ;one, so skip it and look for next one.
BE05: 20 8E BE 206 JSR ReadFile ;if successful, never come back
207
BE08: 20 00 BF 208 Quit JSR PRODOS
BE0B: 65 209 DFB $65 ;QUIT
BE0C: C8 BE 210 DA QuitP
211
BE0E: 2E 53 59 212 SysText ASC '.SYSTEM'
BE11: 53 54 45
BE14: 4D
213
214
215 * Get name of next system or binary file
216 *
217 * This routine is set up to look for both SYSTEM and
218 * BINary files in the SETUPs subdirectory. It is later
219 * modified to search for SYSTEM files only in the
220 * volume directory. The locations which are changed
221 * are ChekType+1, Number+1, and NamePtr (in the Open
222 * parameter list).
223 *
224 * Returns carry set if not found, clear if found.
225
226
BE15: 20 00 BF 227 NextFile JSR PRODOS ;open the directory
BE18: C8 228 DFB $C8 ;OPEN
BE19: D1 BE 229 DA OpenP
BE1B: B0 68 230 BCS Close
231
BE1D: AD D6 BE 232 LDA OpenN
BE20: 8D D8 BE 233 STA MarkN
BE23: 8D DD BE 234 STA ReadN
235
BE26: 20 00 BF 236 JSR PRODOS ;Read in first 39 bytes of directory to
BE29: CA 237 DFB $CA ;IN2. This gets the number of entries per
BE2A: DC BE 238 DA ReadP ;block and number of bytes per entry.
BE2C: B0 57 239 BCS Close
BE2E: AD A3 02 240 LDA IN2+35 ;save number of bytes per directory entry
BE31: 8D 54 BE 241 STA EntSize+1
BE34: AD A4 02 242 LDA IN2+36 ;save number of entries per directory block
BE37: 8D 44 BE 243 STA Entries+1
244
BE3A: EE 3E BE 245 NextEnt INC Number+1
BE3D: A9 00 246 Number LDA #0 ;Self-modified operand
247
248 *Retrieve catalog entry #A
249
BE3F: A2 FE 250 LDX #$FE ;build page index in X
BE41: E8 251 Loop5 INX
BE42: E8 252 INX

```

```

BE43: C9 0D 253 Entries CMP #13
BE45: 90 05 254 BLT Ok
BE47: ED 44 BE 255 SBC Entries+1
BE4A: B0 F5 256 BCS Loop5 ;always
257
BE4C: A8 258 Ok TAY
BE4D: A9 04 259 LDA #4 ;1st entry per directory block starts 4 bytes in
BE4F: 88 260 Loop10 DEY
BE50: 30 08 261 BMI Ok2
BE52: 18 262 CLC
BE53: 69 27 263 EntSize ADC #39 ;add size of a directory entry
BE55: 90 F8 264 BCC Loop10
BE57: E8 265 INX
BE58: D0 F5 266 BNE Loop10 ;always
267
BE5A: 8D D9 BE 268 Ok2 STA Mark ;save mark in file
BE5D: 8E DA BE 269 STX Mark+1
270
BE60: 20 00 BF 271 JSR PRODOS ;set the mark
BE63: CE 272 DFB $CE ;SET MARK
BE64: D7 BE 273 DA MarkP
BE66: B0 1D 274 BCS Close
BE68: 20 00 BF 275 JSR PRODOS ;read in directory info
BE6B: CA 276 DFB $CA ;READ
BE6C: DC BE 277 DA ReadP
BE6E: B0 15 278 BCS Close
279
BE70: AD 80 02 280 LDA IN2 ;make sure that file is not deleted
BE73: F0 C5 281 BEQ NextEnt
BE75: 29 0F 282 AND #$0F
BE77: 8D 80 02 283 STA IN2
BE7A: AD 90 02 284 LDA FileType ;make sure file type is correct
BE7D: 49 FF 285 EOR #$FF ;we look for system programs...
BE7F: F0 04 286 BEQ Close
BE81: 49 F9 287 ChekType EOR #6!$FF ;...and binary ones.
BE83: D0 B5 288 BNE NextEnt
289
BE85: 08 290 Close PHP ;close all files — do not change carry
BE86: 20 00 BF 291 JSR PRODOS
BE89: CC 292 DFB $CC
BE8A: CF BE 293 DA CloseP
BE8C: 28 294 PLP
BE8D: 60 295 AnRts RTS
296
297
298 * Read file and call it.
299 * Name should be found at IN2
300 * Prefix must be set.
301
302
BE8E: AE 90 02 303 ReadFile LDX FileType ;if a system program, set to read to $2000
BE91: A9 20 304 LDA #$20
BE93: E8 305 INX
BE94: F0 06 306 BEQ SetDest
307
BE96: AE 9F 02 308 LDX AuxCode ;else, set to read in file at address
BE99: AD A0 02 309 LDA AuxCode+1 ;found in the auxcode
310
BE9C: 8E EC BE 311 SetDest STX Read2D
BE9F: 8D ED BE 312 STA Read2D+1
313
BEA2: 20 00 BF 314 JSR PRODOS ;Open file
BEA5: C8 315 DFB $C8 ;OPEN
    
```

BEA6: E4 BE	316		DA	Open2P	
BEA8: B0 DB	317		BCS	Close	
BEAA: AD E9 BE	318		LDA	Open2N	
BEAD: 8D EB BE	319		STA	Read2N	
BEB0: 20 00 BF	320		JSR	PRODOS	;Read file into memory
BEB3: CA	321		DFB	\$CA	;READ
BEB4: EA BE	322		DA	Read2P	
BEB6: 20 85 BE	323		JSR	Close	
BEB9: B0 D2	324		BCS	AnRts	
BEBB: 6C EC BE	325		JMP	(Read2D)	;call the file just loaded
	326				
	327				
	328	*****		ProDOS MLI parameter lists	
	329				
	330				
BEBE: 02	331	OnlineP	DFB	2	;Online parameter list
BEBF: 00	332	OnlineN	DS	1	
BEC0: 01 BD	333		DA	VolName+1	
	334				
BEC2: 01	335	Pfx1P	DFB	1	;to set prefix to SETUP
BEC3: 1A BD	336		DA	DirName	
	337				
BEC5: 01	338	Pfx2P	DFB	1	;to set prefix to volume directory
BEC6: 00 BD	339		DA	VolName	
	340				
BEC8: 04 00 00	341	QuitP	DFB	4,0,0,0,0,0,0	
BECB: 00 00 00					
BECE: 00					
	342				
BECF: 01 00	343	CloseP	DFB	1,0	;close all files
	344				
BED1: 03	345	OpenP	DFB	3	;Open directory
BED2: 1A BD	346	NamePtr	DA	DirName	;pathname pointer
BED4: 00 B9	347		DA	IObuffer	
BED6: 00	348	OpenN	DS	1	;reference number
	349				
BED7: 02	350	MarkP	DFB	2	;set mark in directory
BED8: 00	351	MarkN	DS	1	
BED9: 00 00 00	352	Mark	DS	3	
	353				
BEDC: 04	354	ReadP	DFB	4	;read directory
BEDD: 00	355	ReadN	DS	1	
BEDE: 80 02	356		DA	IN2	;target address
BEE0: 27 00	357		DA	39	;length
BEE2: 00 00	358		DS	2	
	359				
BEE4: 03	360	Open2P	DFB	3	;open setup or system file
BEE5: 80 02	361		DA	IN2	
BEE7: 00 B9	362		DA	IObuffer	
BEE9: 00	363	Open2N	DS	1	
	364				
BEEA: 04	365	Read2P	DFB	4	;read setup or system file
BEEB: 00	366	Read2N	DS	1	
BEEC: 00 00	367	Read2D	DS	2	;destination of file is self-mod here
BEEE: 00 B1	368		DA	\$B900-\$800	;ask for largest possible that will fit
BEF0: 00 00	369		DS	2	
	370				
BEF2: C9 CE D3	371	VolText	ASC	"INSERT VOLUME"	
BEF5: C5 D2 D4					
BEF8: A0 D6 CF					
BEFB: CC D5 CD					
BEFE: C5					
	372				
BEFF: E8	373		CHK		;checksum - eor of all previous bytes



## GS Memory cards - A Follow Up

Sean Nolan

Since my review of Apple IIGS memory expansion cards appeared (*Call-A.P.P.L.E.*, August 1987), three new cards have come upon the market. Two of the cards offer a megabyte of memory at previously unheard of low prices. The release of the third, "MemorySaver" from Checkmate Technology, invalidates many of the conclusions about ROM disks made in my previous review.

If you have already purchased a IIGS memory card, read on. MemorySaver is not a memory card. It is a memory partitioner with an uninterruptable power supply which lets you add ROM disk capability to almost all existing GS memory expansion cards (with the exception, of course, of the card I purchased).

### The Cards Reviewed in August are:

- Apple IIGS memory expansion card. The plain vanilla contestant: \$129 for 256K of memory. No ROM disk support, expandable to a megabyte.
- RamPack 4GS. Comes with 512K standard for \$189. Expandable to four megabytes using 246K by 4 bit RAM chips. No ROM disk support.
- RamStack Plus. 256K for \$129, expandable to a megabyte. EPROM sockets provide ROM disk capability for no additional cost.
- OctoRAM

256K for \$150. Expandable to two megabytes using 256K SIMMs or to eight megabytes using megabyte SIMMs. A \$180 piggyback board, "ESP", provides a battery-backed up static-RAM ROM disk.

- GSRam. 256K for \$169, expandable to one and a half megabytes. ROM disk supported with an add on card and power supply.
- GSRam Plus. Comes with a megabyte of memory using megabit RAM chips, expandable to six megabytes. Supports the same ROM disk add-on as GSRam. Cost: \$459.

### The New Entries Are:

- MemorySaver, \$149.95 from: Checkmate Technology  
509 South Rockford Drive  
Tempe, Arizona 85281-3031  
(800) 325-7347
  - MegaRAM \$189.95 and MegaROM \$89.95  
Parallax, Inc.  
5249 Locust Avenue,  
Carmichael, California 95608  
(916) 721-5451
  - GS Juice, from:  
Applied Ingenuity  
14992 Ramona Blvd., Unit M  
Baldwin Park, California 91706  
(818) 960-4415
- |            |          |
|------------|----------|
| 0K         | \$69.95  |
| 256K       | \$99.95  |
| 512K       | \$129.95 |
| 1 megabyte | \$169.95 |

### MemorySaver

The MemorySaver is a piggyback card — it plugs into the memory expansion slot of the IIGS. Your old GS memory expansion card plugs into the MemorySaver. MemorySaver lets you hide some of the memory on your memory card and use it as a disk device names /ROMDISK. Don't be fooled by the name, /ROMDISK is really a RAM disk — you can save files onto it, boot off of it, just as you can any disk drive. The advantage of a RAM disk is speed. You can boot up the ProDOS-16 system in a few seconds. Unlike most RAM disks, however, this one survives when the power is turned off. You decide how much of the memory on your memory card is set aside for /ROMDISK. The rest of memory can be partitioned, as usual, between the normal /RAM5 RAM disk and regular addressable memory.

Another feature of MemorySaver is that it allows you to use two GS memory cards at the same time. One memory card goes in the piggyback slot on the MemorySaver card. The other, which must be an Applied Engineering GSRam or Checkmate's own MultiRam GS (available before year's end), attaches on the other side of MemorySaver by way of these cards' expansion pins. There are four restrictions — use of a second GS memory card prevents access to slot 7. This is a shame, as slot 7 is often the only free slot. Unfortunately, Applied Engineering's GSRam card attaches only by way of it's expansion pins: this means (restriction two) that slot 7 is inaccessible



if you use MemorySaver with GSRam. Restriction three: RamPack 4GS cannot be used in combination with any other memory card. This is not bothersome, as RamPack 4GS expands to a hefty four megabytes. Last, two GS memorycards are incompatible with MemorySaver: OctoRAM and GSRam Plus. With OctoRAM the problem is physical, as the connecting pins for the ESP ROM disk add-on get in the way. With GSRam Plus the problem, I can only presume, is spiritual.

There are some disadvantages to using MemorySaver to add ROM disk capability. One is that your ROM disk is not in addition to your RAMcard memory (as it is with OctoRAM and its ESPROM disk, for instance). Any ROM disk you add therefore subtracts from the memory otherwise available.

One GS program, the APW development system, requires a full megabyte of working memory. It may run out of memory when using MemorySaver's ROM disk on a 1-megabyte memorycard. The other disadvantage is that it needs to be plugged in (it comes with a transformer) to keep your ROM disk files alive. A battery pack supports the ROM disk memory if the power fails for less than a few hours. The battery pack takes six AA nicad rechargeable batteries (not supplied, cost about \$27), which are continually being recharged as long as wall current is supplied to the transformer. Where I live, blackouts are common, particularly in the summer. The manual recommends that you regularly backup / ROM DISK. I left by ROM disk size at 800K (the default), so that I could do a fast block-by-block copy onto a 3.5" disk.

The technical details of how MemorySaver partitions memory is interesting. The GS memory map consists of 256 banks of 64K each. Banks 0, 1, \$E0, and \$E1 are RAM; banks \$FE and \$FF are ROM. When you add a GS memory card, additional banks are added starting with bank 2 and building up. Apple has reserved banks \$F0 through \$FF for the ROM disk and future ROM expansion. The ROM disk driver is found at the start of bank \$F0, and is normally followed by data storage of the ROM disk files. The memory manager ignores this entire range of memory, and so normally does not have to deal with the ROM disk. But with the MemorySaver card, only the ROM disk driver itself exists up in bank \$F0. (in some battery backed up static RAM). The data storage of the ROM disk is in the memory banks contained on your GS memory expansion card. An advantage

of this scheme is that your / ROMDISK is not limited to the half a megabyte reserved for it in the memory map. Your /ROMDISK may be as large as the capacity of your memorycard.

For example, suppose you have a megabyte memory card. The memory card holds banks 2 through 17 inclusive. The memory manager knows about these banks, and tries to manage it intelligently. If you decide to use 4 banks of the memory card as a ROM disk, banks 14 through 17 must disappear from the watchful gaze of the memory manager. MemorySaver achieves this by write protecting these four banks — now when the memory manager starts up it is unable to modify this memory, and assumes that it doesn't exist. The driver for the ROM disk temporarily write-enables the ROM disk every time you save a file to it.

MemorySaver should appeal to the "power" user or programmer. If you still do not have a GS memory card, I recommend MemorySaver with a large capacity memory card. The Orange Micro RamPack 4GS seems to be the ideal choice — it provides lots of memory without getting in the way of slot 7.

### Cheaper Megabytes

Two other cards recently announced, should appeal to the more casual user. A ROM disk is nice, but not essential. On the other hand, nearly all IIGS owners need a memory card of some sort. Two new cards provide a megabyte of memory at remarkably low prices.

MegaRAM provides a full megabyte of memory for \$189.95. It is not expandable beyond a megabyte, but does support add-on boards to provide RAM expansion (not yet available) or ROM disk support. The ROM disk card, MegaROM, provides 896K of ROM expansion. This corresponds to banks \$F0 through \$FD. MegaROM uses 64K by 8 bit EPROMs. I have not used MegaRAM, but pictures indicate that the connecting pins for MegaROM will prevent MegaRAM from working with a MemorySaver.

Applied Ingenuity provides a card called "GS Juice," which provides a megabyte for \$169.95. Like MegaRAM, it expands to only a megabyte. It also lacks connecting pins for any add on RAM or ROM card. This turns out to be a blessing in disguise, as GS Juice, therefore, works with the MemorySaver. GS Juice is available in four sizes — zero memory, 256K, 512K, and a megabyte. Partially filled boards come with sockets so that you may fill them on your own. GS

Juice is the only memory card available with no memory. This is a plus to those who have leftover memory chips from discarded IIE memory cards.

### A Reply to Critics

I received a couple of complaints concerning the August review of GS memory cards. One writer pointed out that a comment I made about ProSEL, Glen Bredon's excellent program selector, was incorrect. I had stated that with a ROM disk and RAM disk installed, my 3.5" drives got mapped to slot 2, making them inaccessible from ProSEL. The latest release of ProSEL solves this problem.

The second writer berated me, in colorful language which unfortunately can not be reproduced, for a comment I made concerning Applied Engineering's AppleWorks modifier software. Applied Engineering's cards, GSRam and GSRam Plus, come with software which modifies AppleWorks, expanding its capacity and features. The software only works with their memory card, which prompted my comment, "This is vindictive programming... and you can tell the fat man I said so." The fat man, by the way, is Casper Gutman of "The Maltese Falcon."

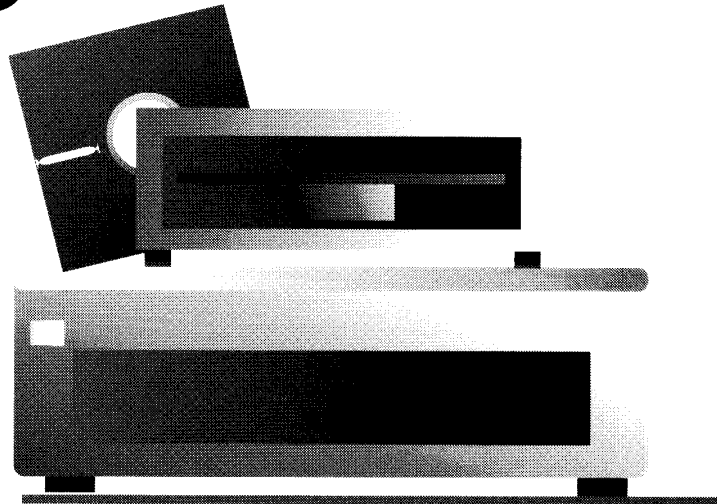
I believe that both Applied Engineering and their customers lose by this protection scheme. A case in point: a friend of mine who uses AppleWorks recently purchased an Applied Engineering GSRam card. He was pleased with the AppleWorks expander, and tried running his patched AppleWorks on a friends machine. Crash, Crash. A related case — the company I work for bought half a dozen memory cards for their IIE's. Half the cards came from Checkmate Technology, half from Applied Engineering. All cards came with AppleWorks expanding software. But the Applied Engineering software worked only on the AE cards. The Checkmate software worked on all machines. Since we shift computers around fairly often, this has created confusion. No illegal copying of software was done. We legitimately own every card and program we use. Yet, we were penalized by AE's protection scheme. AE has suffered as well. Since this episode, we have purchased cards solely from AE's competitors.

Please rate this article on the Reader Service Card by circling:

- 61 Excellent    62 Good  
63 Fair            64 Poor

# Speaking of Hardware

## A User's Guide to Floppy and Hard Disk Drives



### Peter and Allen Baum

To continue last month's discussion about disk drives, we'll start with some additional information on floppy disk drives, and then move on to some of the alternatives, such as hard disk drives, and tape backup systems.

For those of you who want to make your own cables for the drives, the DB-19 connector is available from AMP. The part numbers are:

Female Receptacle	Part #
Ribbon Cable (standard mount)	747304-5
Ribbon Cable (4-40 threaded inserts)	747305-5
Snap-in Contacts	745772-1
(Need Contact Pins 1-66505-0 for 24-28 AWG)	
Male Plug	Part #
Insulation Displacement Crimp Contacts	1-745664-0 [-1]
(For 26-30 AWG [22-26 AWG])	

AMP probably won't sell small quantities directly to you, so you'll want to order through one of their distributors, such as Powell.

### 5.25" Third-Party Drives

There are several companies which manufacture Apple compatible 5.25" drives. Most of the 5.25" Apple compatible drives are sold by mail-order at prices that are substantially lower than Apple's. We have seen drives priced as low as \$77 with a 1 year warranty. (Including a "Japan Quartz Watch movement and water-resistant!") We're not very familiar with any specific manufacturer, so we suggest talking to a local user group for a recommendation if you want to buy one. Otherwise, you may want to purchase one through a local dealer. Remember, there are two different types of connectors for the 5.25" drives: one is a 20-pin dual row connector that plugs into the old Disk II controller card, and one is a 19-pin D-shaped connector for the IIc and current 5.25" disk controller card. Drives with the

19-pin connector are usually more expensive, so be sure to specify the right one. In addition, none of the third-party drives that we are familiar with have a daisy-chain connector. This means that only one drive (DB-19 or IIc version) can be connected to the current 5.25" disk controller card or daisy-chained onto the IIGS.

### 3.5" Third-Party Drives

We have seen 3.5" drives from only a few different manufacturers. You should be very cautious when buying a 3.5" drive for the Apple II. Here are a few points to consider:

- As usual, not all 3.5" drives are Apple compatible. Apple pulls some funny tricks by varying the speed of the motor to increase the capacity of the drive.
- Don't buy a single sided 400K drive, unless you're getting it for free (look for a Mac owner who has upgraded a system to an 800K drive). To use a 400K drive, you'll have to buy a UDC card from Central Point Software (to be covered in a future column), but you still won't be able to trade disks with anybody else. The best reason we've heard for buying a 400K drive is to provide a low-cost backup device for a hard disk.
- Nobody makes a drive which is compatible with the Unidisk 3.5. Therefore, the only double-sided 800K disks that can be connected to a IIc is Apple's Unidisk 3.5 Drive.
- All of the other 800K 3.5" Apple compatible drives emulate the original Macintosh external drive and do not work when plugged directly into the IIGS (neither will Apple's original external drive for the Macintosh). The only way to use the original Macintosh 800K external drive or a compatible third party drive is with the Central Point UDC card. The current 800K drive shipped by Apple, called the Apple 3.5 Drive, works with both the IIGS and the Macintosh. It includes a daisy-chain connector, which none of the third party drives have, and a disk eject button. Also, the circuitry inside this drive is subtly different than that of the original 800K drive. It provides a few extra features such as the capability for the IIGS to detect if a disk has been ejected.

(For those of you with Unidisk 3.5" drives connected to the IIGS, we've been told that programs which seem to keep the drive's disk-in-use light on continuously are checking to see if a disk has been ejected or swapped.)

## Hard Disks

We'll start by explaining some terms that hard disk manufacturers love to throw around in advertisements for their drives, such as access time, seek time, average latency, and data transfer rate. Then we'll explain which of these are important to consider when buying a drive.

### What Do All Those Funny Words Mean, Anyway?

As we explained last month, a hard disk uses basically the same mechanical scheme as a floppy disk drive. A hard disk drive, like a floppy drive, contains a head mechanism which reads and writes data stored as concentric circles (called tracks) of information on the spinning media. The media on hard drives usually consists of multiple disks, which are referred to as platters. A head positioning mechanism, usually a stepper motor in a floppy drive, moves the head across the media between the different tracks.

However, there are also a number of implementation differences between floppy drives and hard drives, which account for the speed and capacity differences between the two types of drives. Hard disk drives will often have multiple heads and platters. The typical Apple II hard disk drive has a storage capacity between 10 and 40 megabytes, contains two platters, and has one head on either side of each platter, for a total of four heads per drive. Most floppy drives contain two heads, one for each side of a single disk, although the 5.25" drives used by the Apple II contain only a single head.

In a floppy drive, the head mechanism rests on top of the floppy disk surface, while in a hard drive the head "floats" above the surface. Because there is no friction, the hard drive can spin the platter much faster and spin it continuously, without wearing out the surface of the media. In a floppy drive, the media will only spin when the disk is being accessed. This prolongs the life of the media considerably. Typically, a hard disk spins at least 10 times faster than a floppy, which allows it to get to any piece of data on a track faster than a floppy. For example, if the head on a hard disk is already positioned to the right track, then the drive will be able to read any piece of data on that track in less than 17 milliseconds. On a floppy drive, the drive motor must be turned on, the disk must come up to speed, which typically takes at least 1/2 a second, and then it may take up to 200 milliseconds to read the data.

To enhance reliability, most hard disk drives have a special place to put the heads when the drive is not being used. This special disk zone doesn't contain data. The drive can "park" the heads above this special zone, so that if the head "crashes" onto the disk surface, no data is lost. At the rates at which hard disks spin, a head can destroy large amounts of data if it accidentally touches the disk surface for even a tiny fraction of a second, which may happen if the drive is shaken or bumped.

Hard disk drives are not necessarily portable devices like floppy disk drives. Be sure to park the heads before you move a hard drive. In some drives, the heads will automatically park themselves if they haven't been recently accessed, or when the drive is powered off. Other drives only park the heads upon user request.

Because a hard disk doesn't have to account for removable disks, it can specify tighter tolerances. A hard disk will put the

tracks close together, resulting in more tracks per inch (TPI) across the disk. The higher TPI of a hard disk results in higher capacity and faster performance for the drive, since the head doesn't have to travel as far to get between tracks.

### Seek Time

The seek or access time of a disk specifies the amount of time the head takes to move to a new track and read the data. This consists of the time for the stepper motor to start up, for the head to move between tracks, and for the head to stop and settle on a track. A floppy disk drive has these same constraints.

Hard drive manufacturers will specify up to three different seek or access time parameters for their drives. The track to track time specifies the time it takes for the head to move from one track to the next. The maximum access time defines the worst case time it takes between any two pieces of data on the disk. This covers the time it takes for the head to move from the last track on the outside of the platter to the first track on the inside of the platter. The average access time covers the time for a typical disk access in which the head must move halfway across the platter.

Hard drives may have more than 300 tracks on a platter, but the maximum access time is not just a linear extrapolation of the track to track time. This is because once the head has started accelerating, it can move between tracks very quickly. The head settling time only comes into play when the drive gets to its final destination track — it does not stop at any tracks in between. This same principle holds for floppy disk drives, although there are considerably fewer tracks. A 5.25" drive has 35 tracks, while a 3.5" drive has 80 tracks.

### Latency

Since the media of the disk drive spins underneath the drive head, the drive must wait for the right block of information to move underneath the head before it can read the data. The time that the drive must wait is called latency and is directly related to the speed at which the drive spins. The average latency of a drive is the time it takes for the media to spin 1/2 turn, since on the average, the data will be halfway across the disk. Most hard disk drives for the Apple II spin at 3600 RPM, which generates an average latency of 8.3 milliseconds. As a comparison, a 5.25" disk spins at 300 RPM and has an average latency of 100 milliseconds.

### Data Transfer Rate

The data transfer rate of the drive specifies the rate at which data is transferred from the drive to the computer. This number can be derived from two possible sources. The drive can only get data as fast as it can read it from the platter. However, if the drive has an internal RAM buffer that already contains the data requested by the computer, then the drive can transfer the data much faster than it can read data from the drive. Some drives specify the media data transfer rate, while others specify a buffer data transfer rate. However, in most cases the data transfer rate is limited by the system or the disk interface transfer rate. For example, while a hard drive can read data from the platter at approximately 500K bytes per second, the system processor can read the data in at only 100K bytes per second. You can calculate the rate at which a drive can read one data block from the media by dividing the amount of data on a track by the time required for one complete disk revolution. A floppy drive transfers data at approximately 40K bytes per second (~8K per track & 200 ms. per revolution).

**Interleave**

All Apple compatible floppy drives and most hard drives do not read a complete track of data in a single pass of the disk. Since the operating system typically requests only a single block at a time, and because the media continues to spin, the next block on the disk goes past the head before the operating system makes another request. Rather than having the media rotate all the way around so that the skipped block can be read, disk drive manufacturers have adopted a technique, called interleaving, to make data transfer more efficient. Interleaving spreads consecutive blocks around the disk, placing a fixed number of blocks between consecutively numbered blocks. This technique gives the system time to process the first block without skipping past the next block. By setting the interleave properly, you can optimize a drive so it spends a minimum amount of time waiting for data to rotate until it is underneath the head. (Figure 1) The total time it takes for the computer to read data from a disk drive can be expressed as follows:

$$\text{Total Time} = \text{Motor-On} + \text{Seek} + \text{Latency} + \text{Data Transfer}$$

In a hard disk the motor is always on, so the motor-on time is 0. In an Apple II, the data transfer time is usually limited by the system processor or by the bus used to transfer the data. The latency delay is a function of the disk's rotational speed, which is the same in most hard disks. The biggest variable between different disk drives is the seek time.

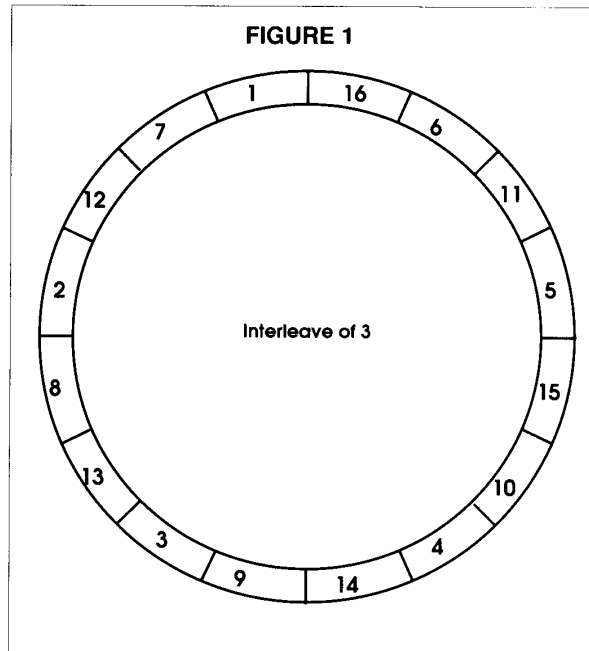
If you put all of these specifications together, it appears that in the typical application the seek time has the largest influence over the speed of disk accesses. An intelligent operating system can take advantage of this situation by storing data in a consecutive fashion on the disk, so the head doesn't have to bounce from track to track to get the data. If the data is fragmented all over the disk, then the time it takes to read a file will be much greater than if it is stored close together on the disk.

In a floppy disk drive, the average access time can be very misleading, since the major factor is the drive motor startup time. If the motor is off, then the disk will take more than 1/2 second to get the first block of data. However, if a second block is accessed while the motor is still on, then it can be retrieved considerably faster. Again, an intelligent operating system can use this to affect the disk performance more significantly than upgrading to a faster drive would.

When purchasing a drive, a buyer has four major factors to consider: reliability, price, performance, and software support. While reliability cannot be determined from a specification sheet, it is a very important factor to consider when you choose a disk drive. Software support provided by the manufacturer will affect the usefulness of the drive with application software. If the drive doesn't support your applications, then it is useless to you. However, since disk performance is affected more by the operating system than by the hardware performance, hardware specifications such as seek time should be considered the least important factor of the four.

**Third Party Hard Disks**

There are a variety of companies selling hard disk drives for the Apple II, IIe, and IIGS. Most Apple II hard disks are sold with their own controller cards that work in an Apple II, IIe, or IIGS. There are several hard disks sold for the Apple IIc. ProAPP sells 10 and 20 megabyte drives that connect to the second disk drive port of the IIc. The Quark QC-10 and QC-20, now sold by Sun Remarketing, are also 10 & 20 megabyte drives that connect to



the second disk port.

Most of the other drives are sold as SCSI compatible drives which work with their own controller cards in an Apple II, or which plug directly into the SCSI port of a Macintosh. However, these same drives may not work with Apple's SCSI adaptor card for the Apple II. This will be a limiting factor in the future as more peripherals that can plug onto the SCSI bus are introduced.

Most SCSI cards and drives only support ProDOS. For example, both CMS Enhancements and Apple only support ProDOS with their SCSI drives and controller cards. However, other drive manufacturers, such as First Class Peripherals, support a variety of operating systems, including ProDOS, DOS 3.3, Apple Pascal, and CP/M. If you're in the market for a hard drive, then you should consider whether a ProDOS only drive will be enough to support your application software.

At the time that ProDOS was announced, Apple's Profile hard disk drive, which was originally sold for the Apple II/, was adapted to the Apple II using a peripheral card. This drive has its own special protocol and is not compatible with any other drives or controller cards. Be careful if you upgrade to a IIGS, since some Profile interface cards won't work properly in the GS (Sidebar 1, next page.).

I've been told by a reliable source that the First Class Peripheral Siders that were shipped in the past can be upgraded to the new SCSI compatible units by changing a ROM inside the drive. Although First Class has no plans to market such a ROM, other companies have expressed interest in selling it. If you're interested in upgrading your Sider to run on the Macintosh, then send us a note and we'll forward it to whichever company ends up marketing this ROM.

**Tape Backup**

Since hard disk drives may occasionally lose data, just like a floppy disk, a backup of the data should always be made. On a floppy disk, a backup is easily made by just copying the disk onto another one. However, a hard disk backup is much more difficult, since it can require many floppy disks to perform a

complete backup. For example, a backup of 15-megabytes of data requires twenty 3.5" floppies or over a hundred 5.25" floppies. A tape backup device can copy the data from a hard drive onto a single tape cartridge and can save untold grief if you experience a hard disk crash.

First Class Peripherals sells a backup drive, called the Sider T6, which plugs onto the back of the Sider hard disk drive and records up to 60 megabytes of data. It comes with a backup program. Other companies sell SCSI tape drives, although you should make sure that the one you buy works with one of the Apple II SCSI cards (preferably before you buy it).

### Putting It All Together — A Strategy for Expanding Your Disk Devices

Here are a few more considerations to take into account when you purchase disk drives — if you own an Apple II, IIe, or IIc, with one or two 5.25" drives, or if you're spending a lot of time swapping disks or waiting for data to be read from a disk drive, then you should consider adding another drive to your system. There are four options: another 5.25" drive, a 3.5" drive, a large RAM card which can be used as a RAM disk, and a hard drive.

- If the only reason you need another drive is to copy disks, then you should consider buying a RAM card instead of another drive. A RAM card can be used very effectively to copy a disk, and it can be used to speed up program operation as well. Try to buy a RAM card that will allow you to configure it as a 140K RAM disk. The floppy disk can then be quickly copied onto the RAM disk using the volume copy routine of a copy program, such as the Filer or the System Utilities. Volume copy routines work much faster than file copy routines, but can only be used between drives which are exactly the same size.
- You should also consider buying a RAM card if most of your idle time is spent waiting for the 5.25" drive to read in programs. While a 3.5" drive or a hard drive can speed up disk accesses, a RAM disk generally does a better job. This is done by copying your programs onto a RAM disk and running them from there, assuming that your programs are not copy-protected. However, if most of the waiting time is spent reading and writing data to disks, then you should consider getting a battery-backed RAM card or one of the larger drives. Using a RAM disk to store data, without battery-backup, is a risky proposition.
- If you spend a lot of time swapping 5.25" disks then you should consider buying a 3.5" drive. The 3.5" drive will allow you to store the equivalent of six 5.25" drives. Later, if you find that this amount of storage is still not enough and you are still swapping disks frequently, then get a hard drive. You'll find that the 3.5" drive is invaluable when you make backups of the hard drive. If you own an abundance of application software that you use frequently, then you might consider skipping the 3.5" drive and buying the hard drive. However, we've found that very few Apple II owners meet this description.

### Moving up to the IIGS

If you have a IIe or IIc, but plan to move up to a IIGS someday, then you may want to consider the following strategy. A IIGS requires a 3.5" drive since all IIGS software is distributed on it. Buy one now for your IIe or IIc; they're wonderful and you can carry the disks in your shirt pocket.

### Modification of the ProFile Interface Card for use with the Apple IIGS

Some ProFile Interface cards will not work properly when installed in the Apple IIGS. ProFile directory information might become damaged and cause the user not to be able to access data stored on the ProFile. If ANY ProFile Interface Card is to be installed in an Apple IIGS, check first to see that a jumper, made of 22-24 gauge multistrand wire is installed between pin 12 of IC C6 (2716 EPROM-Apple Part# 341-0299) to pin 1 of IC B4 (74LS368-Apple Part# 305-0368) on the non-component side of the board. If needed, the jumper should be installed by a knowledgeable technician to assure proper operation of the ProFile when interfaced with the Apple IIGS.

If you own a hard drive and you've upgraded to the IIGS, you may want to call the manufacturer of your hard drive and find out if it's possible to speed up accesses to the drive by changing the interleave of the disk. However, this is not a simple proposition since it requires you to completely backup the drive, reformat it, and then restore the data to it.

When you purchase a IIGS, buy the largest RAM card you can afford. You'll find that the system runs much (!) faster if you boot from a RAM disk. You'll be much more efficient if this RAM disk is configured to 800K, since it can be quickly copied onto a 3.5" floppy. Since the system also needs to have at least 512K of the RAM card reserved so that it can run most of the new application software packages for the IIGS, you'll find a RAM card with a capacity above 1.5 megabytes very handy.

### Moving up to the Macintosh

If you have plans to upgrade to a Macintosh, then make sure your hard disk is SCSI compatible. If you own a IIGS, then buy the Apple 3.5 drive, not a Unidisk 3.5 drive (which doesn't work on the Macintosh). On a IIe and IIc you have no choice, since only the Unidisk 3.5 currently works with these machines. Someday, perhaps, a third party or Apple will introduce a peripheral card that allows the Apple 3.5 Drive to work on the Apple II and IIe. (Sidebar 2.)

We had a good time at Applefest and saw lots of interesting products to cover in future installments of our column. These products include:

- The Zip Chip, from Zip Technology, which replaces the microprocessor to speed up an Apple II to run up to 4 times faster than the original design.
- The MemorySaver from Checkmate Technology, which converts part of your Apple IIGS memory expansion card into a non-volatile disk and allows it to emulate Apple's IIGS ROM disk protocol.
- The Cache Plus card from Ohio Cache Systems, which can speed up your floppy disk access like a RAM disk, but circumvents the volatility problem associated with RAM disks by writing to the disk.

If anyone saw another interesting product at Applefest and

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### Why Buy a Hard Disk Drive?

While a hard disk drive may save you a lot of time when you run programs, you may find that the savings are negated when you back it up on 5.25" floppies. A better strategy might be to buy a 3.5" drive first, and see if that fills your needs. It can run faster than a 5.25" drive, although not as fast as a hard drive. However, if after you have purchased the 3.5" drive, you still find yourself frequently swapping floppies, then buy a hard drive. The 3.5" will still come in very handy during backups. If you do not swap disks frequently, but the system still runs slowly because it always accesses the drive, then you should buy a RAM card. (You can determine this by watching the disk light and checking if it is always on). For example, there are accounting packages for the Apple II, which, although they fit comfortably on an 800K disk, can be accelerated considerably by using a RAM

would like to know more, then drop us a line. If you have comments or questions about disk drives that we didn't cover in the last couple of columns, send us a note. Periodically, we will review current trends in the mass storage arena. See you next month.

### Companies referred to in this article include:

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Central Point Software  
 Portland, OR 97219  
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 1989A Palomar Oaks Way  
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*(A.P.P.L.E. Co-op sells a variety of CMS hard drives. See our catalog for more information. -Ed)*

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## Applefest (from p.11)

technology will be to today's technology what the IIGS technology is to the Apple I Woz built for the Homebrew Computer Club."

- "As you might imagine, a company like Apple has lots of research brewing in our product development labs. Let's look at some of the things we're working on:

"In the future we'll advance the Apple II in networking and communication, performance and new types of peripherals, and in systems software and programming tools. The Apple II will have more power and flexibility. We'll expand and broaden the ways you can operate computers, merging media and advancing tools like hypercard. You've heard about hypercard for the Macintosh. It allows someone at a computer to organize information in a mode in which 'she relates to that.' This allows learning to happen through a vehicle, with the learner, that the learner can best drive via pictures, words, or sounds.

"We're working on multimedia CD ROMs and video disk technology and our research on multimedia is stimulating third party developers to deliver integrated computer and video courseware and hyper media systems for the GS."

### Steve Wozniak

Apple Fellow and Co-Founder

*(ED—Steve Wozniak always adds insight, humor and flavor to any Apple get together. Here are a few excerpts containing a little of his history and philosophy, prompted from the question and answer section of his presentation.)*

### An Apple II Revival?

**Question:** "10 years ago when I first purchased my Apple II with 64K of RAM for \$1298 — which was really cheap back then — you were operating out of Stevens Creek Blvd. Cupertino, building and designing computers for hobbyists like myself. Atari was designing video games, IBM didn't know what a personal computer was and didn't care. Now Apple is a big business and basically pushing another computer which you didn't design... millions of Apples out there now, and your name is a household word. Any regrets?"

**Steve Wozniak:** "I've got to thank this gentleman for his comments. He's describing all these computers that were bought 10 years ago. We were starting out. IBM didn't know what we were back then. Atari wasn't interested in us. As a matter of fact we offered our computers to Atari. 'Naw... we've got our hands full with video games.' Offered 'em to Commodore. Commodore said, 'Naw, we'll take an extra four months and design our own. We don't need color and we don't need paddles, we don't need sound and we don't need memory.' We were trying to finance the Apple II that way. But anyway, over all these years, I guess it's sort of like the comment — Apple supporting another computer (the Macintosh) over the Apple II. It seemed like that for about the last seven years. But it's really interesting, espe-

cially in the club scene. Reading all the newsletters, reading the stories about what's going on with this Apple II software, how you do this... that, to see how much interest there still is. It's a fun side of the world that still exists. I think it's going through a revival right now. There's a lot of newcomers comin in that hadn't gotten into computers for quite a long time — maybe the last five years or so — cause they sorta missed out on the start."

### Ham Philosophy

**Question:** "I understand that early on you were involved with Ham radio. What kind of Ham radio, and how has it affected you?"

**Steve Wozniak:** "Well, it turns out I read a book when I was very young called *SOS at Midnight*. I was in the fifth grade. And, there was a Ham radio operator that knew how to write radio circuits and he got kidnapped. And, somehow he figured out how to take a few parts out of the kidnapper's TV set and wire them together so he could tap out a special code signal at midnight on a certain night when he knew all his Ham operator friends would be listening. And sure enough, they traced him and they came and saved him. He used technology to over turn the crooks. And I went to school the next morning and went on the safety patrol and told this friend of mine I'm going to become a Ham radio operator. By sixth grade I was a Ham operator. That means you soldered together your Ham radio kits in those days, you learned Morse code, you learned how circuits worked — you took a test and passed it and became a Ham radio operator. It was very, very important 'cause Ham radio operators are very giving and sharing — trying to set up lots of community services. A lot of my life had this essence, both in starting Apple, going to Homebrew Computer Club — we came to share. We gave to help people. A lot of that had the same mentality or philosophy of the Ham operators. We had some expertise that we wanted to give to the world."

### Sharing/Copy Protection

**Question:** "Given your interest in sharing, what is your opinion of copy protection?"

**Steve Wozniak:** I had a fun time with this one in Boston where I was on a piracy panel, so I put on a pirate's hat. I started by pointing out the software publisher's point of view that 'these criminals are copying so many programs per week, costing so many billions of dollars' and I had a little phone next to me. I pushed the button and it rang. Picked it up — 'Hi Steve, yeh... Yeh, you'll find it on my desk. Be sure to use synchronized tracks.' Then I went on with my speal about the publisher's being ripped off and we've got to have stronger laws and the phone rang again and this time it was Mike Markala from Apple. I pointed him out and told him which parameters to use... So pretty much my opinion was as it is now, that it was an overblown issue. Copy Protection for the most part is pretty much dead."

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# The Fast IIGs

## PART 3:

# Memory Shadowing

Laurence A. Thompson

In Part 1 of this series, we summarized the six goals of the Apple IIGs design team. They were to improve performance, achieve better sound and graphics, more addressable memory, reasonable cost, and compatibility. This last item, compatibility, is particularly complex and difficult to achieve, especially in the Apple II world. There are tens of thousands of software programs and hundreds (if not thousands) of hardware devices which must work if a new machine is to sport the Apple II name on its case. Given this fact, it is almost impossible to make *any* change that does not affect someone somewhere, and the Apple IIGs represents a major change in the Apple II architecture.

Much effort went into making the GS as compatible as it is, especially on the part of the GS software engineering team — it was a little easier for those of us in hardware. In either case, the GS achieves its remarkable level of compatibility largely because its designers considered their work to be a labor of love.

The design problem for the GS hardware team can be summarized as follows: design a computer which acts like an Apple II from the point of view of the existing software, but at a higher performance level (like an Apple II with an accelerator card). Also, provide a means to switch the hardware into a “native

mode” so that software written for the machine can take full advantage of its new features. Memory shadowing provides part of the solution to these design objectives.

### What's Shadowing?

Memory shadowing implies that data written into RAM by the microprocessor goes into two physical locations, while data read from memory comes from one physical location. This technique is also known as memory write-through.

In the GS, shadowing applies to specific areas in the address space: video display buffers, memory mapped I/O, and language card. (The term “language card” is a relic from the days of the Apple II and II+ when the language card RAM was actually on a card; its function was integrated onto the main logic board in the IIe, IIc, and IIGs.)

At this point it should be noted that the use of the word “banks” in the context of an Apple IIe or IIc is different from its use in an Apple IIGs. The GS has a 65C816 microprocessor with a 24 bit or 16 megabyte address range. The 65C02 (or 6502) used in other Apple II computers has a 16 bit or 64K address range. In other words, the 65C816 can directly address 256 times the memory of the 65C02. You could think of this expanded address range as being composed of 256 “banks” of 64K each. The upper or most significant 8 address bits select a particular bank while the lower 16 address bits select a location within a bank. A 128K IIe or IIc

also has up to 32K of ROM and 4K of I/O, and all of it mapped into 64K of address space. These machines use a technique known as “bank switching” to flip various chunks of the total memory in the machine into the smaller address space of the 65C02 microprocessor.

Figure 1 shows how the 256K of RAM on the GS logicboard is configured if shadowing is enabled. The shaded areas represent the ranges in the address space that can be shadowed. The RAM is divided into four 64K banks; the two left most banks are labeled 0 and 1 and the two on the right are E0 and E1. These are the bank addresses used in the GS. At the bottom of each bank is a “Main” or “Aux” label. This is the way the two banks (128K) in a IIe or IIc are referenced.

Notice that the two left banks look identical to the two right banks. The 256K of GS RAM is divided into two 128K chunks, each of which contains identical data for the shadowed areas. Software written for earlier Apple II's will run in banks 0 or 1. But, if writes to the video frame buffers, I/O, or language card occur, then the data will go into banks 0 or 1 *and* E0 or E1. (See Figure 1.) If data is read from the Hi-Res buffer, it will come from bank 0, but a write to the Hi-Res buffer will go into both bank 0 and bank E0.

### What Good is Shadowing?

At this point you may be wondering why we went to all the trouble to design memory shadowing into the GS. After all,



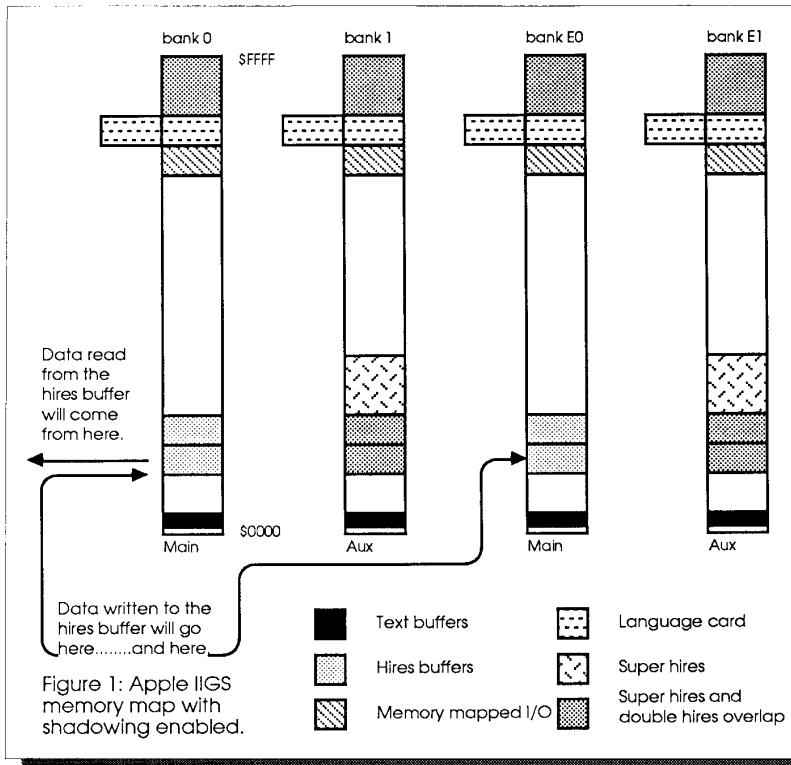


Figure 1: Apple IIGS memory map with shadowing enabled.

we started with 256K of perfectly good memory, then divided it and put the same data in both halves.

Shadowing is primarily used when running software written for earlier Apple II's which can't make use of the extra memory in the GS. Furthermore, banks 0 and 1 are on the fast side; code running in these banks can run at 2.8MHz. Banks E0 and E1 are on the Mega II side which must run at 1MHz for reasons of compatibility, and because video memory cycles must be interleaved with microprocessor memory cycles. (This was explained in greater detail in previous installments of this series.) In other words, the hardware that reads data from the frame buffers and converts it into a video signal gets data from banks E0 and E1 — always.

Memory shadowing in the Apple IIGS is handled entirely by hardware in a manner that is transparent to software. Therefore, programs written for earlier Apple II's don't have to "know" they are running on a GS to take advantage of the performance improvements.

On the other hand, memory shadowing can be disabled or turned off by software written specifically for the GS. If this is done, then banks 0 and 1 can be reclaimed and become clear, unobstructed memory. The video, language card, and I/O functions are accessed by

directly addressing the appropriate locations in banks E0 and E1.

### Conclusion

Memory shadowing is one of the features built into the Apple IIGS hardware which help the machine meet our design goals. It allows the GS to run existing Apple II software faster, and presents GS specific applications with an expanded feature set.

This concludes the final installment of a three part series about the Fast Side of the Apple IIGS hardware. My intention has been to initiate an appreciation for the Apple IIGS hardware without writing a hardware reference manual. I have painted the subject with broad strokes, generalized a great deal, and, for the most part, refrained from going into all the excruciating details.

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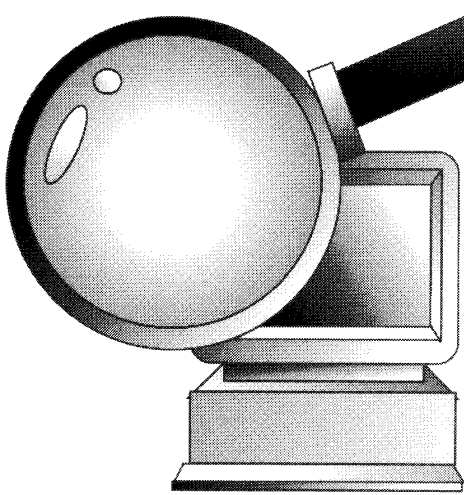
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# Getting Inside the Apple IIGs

## A Hobbyist's Tour

Wesley Felty

In my first article, I explained how to set up the Apple IIGs and described some special types of disks for more efficient operation. This month I'll examine the internal operations of the GS — bridging the gap for those familiar with these operations in the IIe and IIc. Many of the operations are identical, but the IIGs has a number of additional operations, registers and soft switches that add a lot of power.

This article will deal primarily with the new controls that are introduced or significantly improved in the Apple IIGs. For example, to run a machine language program from the monitor on the IIe or IIc, you use a command like "addrG" with an address and "G" for Go to run it. On the Apple IIGs, this approach only works in Bank \$00. Therefore, the IIGs needs additional commands to deal with multiple banks. It has two additional run commands, "R" and "X". "Bank/addrX" is used to run a program in another bank and expects an "RTL" (like an RTS but ReTurns Long from another bank to the original bank) at the end of the program. An "R" at the end of the address resets the active bank to the bank being jumped to and does not expect an "RTS" or "RTL".

### Improvements in the System Monitor

Let's look at some improvements in the system monitor so that we can make use of them in poking around memory. The Apple IIGs still has all of the earlier monitor functions. Several of them have been improved, and a number of useful new ones have been added. You can still enter an address and press Return to see the value stored at that address and continue pressing Returns for the following data as well as entering the address followed by "I" for a disassembled listing. But something has been subtracted and something new has been added. The monitor no longer prints "\$" in front of numbers.

This should not cause problems since the monitor can only deal with hex numbers and it doesn't need to tell you what form of number it is displaying. It is still a good habit for you to use the "\$". When using most full assemblers, the "\$" does matter, so it is a good habit to always write hex addresses with the "\$".

### Using Bank Numbers

For the something new added by the IIGs monitor, notice that

the address starts with two additional digits as in "00/300". This is the bank number. Bank "00" is very much like an Apple IIe's main memory and bank "01" is like the IIe's auxiliary memory. Also, banks "00" and "01" are the IIGs's fast RAM. Banks "\$FE" and "\$FF" are the system ROMs. And "\$E0" and "\$E1" are very important — the slow Mega II RAM and the "shadow" RAMs. Also the Battery RAM is on bank "\$E1" from \$2C0-\$3BF.

If you use an address without a bank number, you will just continue reading or writing in whatever bank the system was last in. This can get you in trouble if you aren't careful. You can still enter something like "300:20 20 03 ..." from the monitor, *but* if you were just in bank "\$E1" looking at something, like the Battery RAM values, then you would be entering your program at "\$E1/300" not "\$00/300". You would be entering your program inside the Battery RAM right on top of the "Language look-up table" and the "Keyboard layout look-up table." Not a good thing to do!

If in doubt, include the bank number, "\$00/300" and stay in bank zero until you know what you are doing. Remember to use the "/" when specifying the bank number in immediate mode monitor commands. In assembler commands, no bank number implies bank zero, and "/" is never used in the assembler. You do, however, often have to "pad" addresses with zeros. For example, if you were trying to read the Battery RAM's value for the screen's border color which is stored at \$02DC, you could use the assembler command "LDA E102DC". But, if you ignored the leading zero on the address \$02DC and entered "LDA E12DC", you would get "LDA 0E12DC". Not at all the same thing — the wrong bank and wrong address. You still can use commands to move (copy) memory and verify, but you now can, and sometimes must, include bank numbers as well.

For example, if you wanted a better look at the Battery RAM values, you might want to move them over into bank zero. So, let's move the values in bank "\$E1" from \$02C0 through \$03BF into bank zero starting at \$22C0. Our move command on the IIGs looks like:

```
"00/22C0<E1/02C0.E1/03BFm"
```

Of course the "m" may be upper or lower case. It is in lower case here for readability. One thing to watch out for after this command is that you will be in bank "\$E1" since that was the last

bank accessed, not bank 00 where you probably issued the original move command. If you entered "22C0.23BF" to look at the Battery RAM values after entering the move command, you would *not* see them. You would see values in bank "\$E1", \$E1/22C0 through \$E1/23BF. This is why the monitor *always* shows you the bank number. It is very easy to get switched into another bank and obliterate data in the wrong bank. You've got to get used to always checking the bank number.

This move data command is particularly important due to the fact that data can only be read to and from disk into or out of bank zero. Therefore, to move data in or out of another bank to or from the disk drive, load it into bank \$00 from the disk drive and memory move it to the other bank or memory move it from the other bank into bank \$00 and save it to disk from there.

### The Zap Command

The IIGS also has a very nice "Zap" command. This command allows you to insert one byte all through a range of memory and is set up very much like the move data command. In fact, it replaces the old "move command bug" method of filling a section of memory by inserting a value and then copying it with an overlap between the source and destination addresses. For example, "2000:FF n 2001<2000.3FFEm" will write a \$FF at \$2000 and then fill the whole range \$2000-\$3FFF with \$FF's.

But, to do the same operation with the Zap command, just enter "FF<2000.2FFFz". The fact that I didn't specify a bank number does *not* mean that bank zero will necessarily be used, but the *last* bank that I was working on will be used. The complete command including banks has the syntax "Byte<bank/Start Address.End AddressZ".

### Entering Text into RAM Memory

ASCII text may also be directly entered through the Apple IIGS's monitor in a method that is much simpler than in the IIc and enhanced IIe. We enter it just like hex with an address and colon, but inside quote marks. So, entering from the monitor '300:"This is Text!'" will enter the ASCII values into memory in upper and lower case as written with the high bits set (negative ASCII).

This same method works from the mini-assembler's "!" prompt. A cruder version of this text entry involves using the single quote mark to enter reversed text. Entering "300:'Text'" will put you into memory at \$300 "tXeT". Unfortunately, this technique has a maximum of four characters. And finally, it is easy to display any text in memory. Just do a hex dump and any ASCII will be automatically displayed at the right of the hex values. Entering "300.310" will display all of the text in the above examples.

### Searching through RAM Memory

The IIGS monitor has also improved its search routines. The general syntax for a search is "\search data\start addr.end addrP". The "P" stands for a Pattern search and bank information may be included as always in the address. No bank given implies the active bank. You may *not* search starting in one bank and ending in another one. But what really adds power to this search routine is the fact that there are three different types of searches. To search for a group of hex bytes, enter the bytes between the "\ marks separated by spaces as is normal for monitor data. For example, to search all of bank zero for a "JSR \$FDED" command (M/L code is "29 ED FD"), you would enter "\20 ED FDN00/0000.BFFFp". You should not search \$C000 through

\$C0FF since that could flip the soft switches and have unpredictable results. And, of course, if your search includes page \$2, memory locations \$200-\$2FF, you will always find the pattern at \$201, since that is the input buffer where the search pattern you entered resides.

To search for ASCII code, surround the text with quote marks and place the text between the "\ marks, like '\This is Text!\<00/0000.BFFFp'. The ASCII search is case sensitive. And, as before, using single quotes allows you to search for reversed text. "\!tXeT si sihT'\<0.BFFFp" would search for the same text as the last example, except there is no reason to do it this way.

Some text, such as the "DISK VOLUME" message in DOS 3.3, is actually stored in reverse order so that a counter can be decremented down to zero in printing the text backwards. For short messages being poked to the screen, it is easier this way.

### Text and Quit Commands

An interesting command is Ctrl-T for text. If you are in the monitor, flipping soft switches to get into Hi-Res graphics (\$C050, \$C052, \$C054, and \$C057 put you into graphics, full page, page 1, and Hi-Res are a lot easier to remember than 49232, etc.) and want to return to text, just enter Ctrl-T (for Text) and Return. That is a lot easier than entering the four soft switches to return.

Another interesting new monitor command for the IIGS is "Q" for Quit from the monitor. If ProDOS or DOS 3.3 is loaded, entering "Q" or "q" and Return returns you to BASIC. You can still use Ctrl-C or Ctrl-B for a warm-start or cold-start return to BASIC as before, but the "Q" command actually does a jump to the DOS vector at \$00/3D0 (\$00/3D0G).

### Step and Trace???

If you enter an "S" or "T" from the monitor, you see "Step" or "Trace" written to the screen. These are old commands right out of the original Apple II that single-stepped through a machine language program, showing you the values in each register at each step running without stopping, but again showing the values in each M/L register after each step.

Unfortunately, these commands have not been implemented yet. The command structure is there to activate them, but it won't be until some later ROM update that they will be actually available. At this point, they are tied to jump vectors at \$E1/0074-\$E1/0077 for the Trace command and \$E1/0078-\$E1/007B for the Step command. At these positions, there are currently jump commands to \$FF/B498.

At that position there is a SEC command to set the carry bit and a RTL to return to the calling routine. If the caller routine clears the carry bit, then the program continues. If it doesn't clear the carry bit then the word "Trace" or "Step" is printed to the screen and the program continues. You can use these routines yourself by pointing the vectors at \$E1/0074 and \$E1/0078 to your own routines and activating them with the "T" and "S" commands, similar to using the Ctrl-Y vector.

### Words, Bytes, Nibbles, and Bits

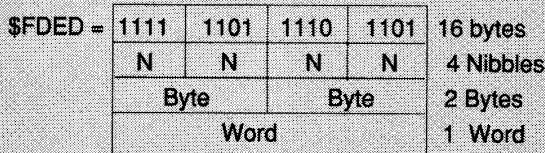
In the Apple IIGS, it is much more important to understand the structure of hexadecimal numbers. To make use of the more advanced modes, you have to understand all the way from words down to individual bits and you have to know how to work with these individual bits, turning them each on or off. To work with individual bits, we have to be able to easily convert decimal and

hexadecimal numbers to binary.

First of all, let's look at the overall structure of hex numbers. In full native mode the IIGS registers mainly work with 16 bit numbers called words. A 16 bit word can be looked at as two hex bytes used together. (Table 1.) Addresses, like \$FDED, are hexadecimal words. The IIGS, when working in full native (16 bit) mode, can load full words into the accumulator and X and Y registers, not just 8 bit bytes like the Iie and Iic were limited to.

**TABLE 1**  
Hexadecimal Number Structure

Number	Type	Width	Made of
\$FDED	1 Word	16 bits	2 bytes
\$FD & \$ED	2 Bytes	8 bits	2 nibbles
\$E & \$D	2 Nibbles	4 bits	4 bits
\$D = 1101			



Each byte has two digits called nibbles. For example, "\$ED" has a high nibble "\$E" and a low nibble "\$D". "\$FDED" has four nibbles, "\$F", "\$D", "\$E", and "\$D". Nibbles are the simplest, most basic unit of a number that can easily be used to convert a hex number to binary. No matter how long and complex the hex number is, it can be taken apart into individual nibbles, the nibbles can be easily converted to bits, and the bits can be strung together into one long binary number. And the process works even easier the other way. A long binary number should be broken into groups of four digits, starting from the right, and each group converted into a nibble. For example: "1100110101001011" breaks up into "1100 1101 0100 1011". Using Table 2, we find 1100 = 12 = \$C, 1101 = 13 = \$D, 0100 = 4 = \$4, and 1011 = 11 = \$B. Therefore the number is \$CD4B.

**TABLE 2**  
Nibble Bit Values  
Bit Values in a Nibble

1	1	1	1	Bit
8	4	2	1	Value

**Examples**

\$ 0 1 0 0      Nibble  
0+4+0+0 = 4 = \$4

\$ 1 0 1 1      Nibble  
8+0+2+1 = 11 = \$B

There is a simple method for converting decimal numbers into binary bits. It is a bit obscure, but works well. It is part of a process called "Russian Pheasant Multiplication." (An illustra-

tion follows this paragraph.) First, you start by writing the number, 243 in this example. And then you halve the number, throwing away any remainder, and write the new number below the previous ones. Keep halving the numbers until you reach "1". Then go back to the top of list of numbers and write a zero beside any even number and a one beside any odd number. Finally, read your answer from the bottom up becoming left to right

Convert 243

243	=>	1
121	=>	1
60	=>	0
30	=>	0
15	=>	1
7	=>	1
3	=>	1
3	=>	1
1	=>	1
243	=	%11110011

**Detecting and Turning On and Off Individual Bits in a Hex Byte**

In working with the IIGS, it is important to be able to tell if each individual bit of a hex byte is on (=1) or off (=0) and to be able to turn each of them on or off without affecting the other bits. We need to be able to do this in machine language without even knowing the hex number being worked on. As an example, if we need to know if the Option key is being pressed on the IIGS from inside a running program, we can check the Modifier Register soft switch at \$C025 (Table 3). If bit number six is on, then the option key is being pressed. If bit four is on, then a Keypad key is being pressed. If both bit four and bit six are on, then both keys are being pressed.

**TABLE 3**  
Value of Each Bit in the Modifier Register Byte

Bit	Key	Value	Dec	Hex
7	Open-Apple key	128	\$80	
6	Option (Solid Apple) key	64	\$40	
5	Modifier key latch has (1) or has not (0) been updated	32	\$20	
4	any Keypad key	16	\$10	
3	auto-repeat feature active for a key	8	\$08	
2	Caps lock key	4	\$04	
1	Control Key	2	\$02	
0	Shift Key	1	\$01	

**The "BIT #XX" Command**

The M/L command to test whether a bit is turned on or not is the "BIT #XX" command. This command only tests bits, but doesn't change them. It tests the value in the accumulator against XX where XX is the value for the bit or bits in question. For example, to test just the sixth bit, XX would be the second bit in the high nibble or \$20, so you would "LDA C025" and "BIT #20". If you want to test for either the fourth or sixth bit, then you need %00101000, or 0010 1000, which is \$2 and \$8 for a final value of \$28. So, if the fourth or sixth bits are on, the hex value is \$28. And, conversely, if the byte value is \$28, then the fourth and sixth bits are tested for and no others. If the first bit were also being tested for, then the hex value for the byte would be \$29.

The "BIT #XX" command ignores all other bits. It doesn't tell you anything about each of the bits, just whether any of the ones that you are testing for are on.

The way that the "BIT #XX" command works is by doing an "AND" logical operation. If none of the bits that are on in the accumulator match any of the bits that are on in \$XX, then the zero flag is set and a "BEQ" branch can be used for no match. If any of the bits match, the zero flag is cleared, so a "BNE" branch can be made if a match occurred.

### The "AND #XX" Command

The following commands, "AND" and "ORA", do not just test the bits in the accumulator against a number \$XX, but changes them also. The machine language command "AND #XX" compares each bit in the accumulator against each bit in the operand \$XX. "AND" returns a one to the accumulator if and only if both bits are ones and returns a zero if either or both bits are zero. The following example shows how a value of \$C5 in the accumulator and a "AND #F1" command returns "%11000001" or \$C1. The accumulator would end up with \$C1 in it, but the value \$C1 is not as significant as the binary representation "%11000001".

```

Example "AND #F1"
with A = $C5
$C5 = 11000101
$F1 = 11110001
-----
"AND" 11000001
    
```

The "AND #XX" command is used to turn off certain bits while leaving selected bits on. "AND" can not turn bits on. It can only turn them off wherever there is a bit value of zero and make no changes wherever there is a bit value of one. For example, to change the color of the border on the IIGS, you must first read the CLK/BORDER soft switch at \$C034 ("LDA C034"). But unfortunately, this byte contains information in the upper nibble for the clock that must not be changed as well as the border color in the lower nibble. Therefore, you need to erase the lower four bits of the value that came from \$C034 and leave the upper four bits intact. An "AND #F0" command will do this since \$F0 is "%11110000". The upper four ones leave those values unchanged and the lower four zeros erase that nibble to four bits of zeros each.

### The "ORA #XX" Command

The "ORA #XX" command does just the opposite as the "AND #XX" command. It is used to make sure that certain bytes are turned on. When the bits from the accumulator are ORA'ed with the operand \$XX, the bits in the accumulator are changed. The accumulator bits are turned on if either the original accumulator bit OR the operand bit is on. The command name "ORA" means "OR" the operand bits with the "A"ccumulator, or return a bit value of one if the operand OR accumulator has a bit value of one. Unlike an addition command, like "ADC #XX", there is no turning off a bit if it were on or changing the next higher bit with a carry.

```

Example "ORA #F1"
with A = $C5
$C5 = 11000101
$F1 = 11110001
-----
"ORA" 11110101
    
```

In the previous example of changing the border color using "LDA C034" to pick up the clock/border byte and using "AND #F0" to erase the lower nibble, we still need to put in a new color. For a Light Green, we need to set the lower nibble to \$C, leaving the upper nibble intact. Therefore, we use the command "ORA #0C" to set the color to Light Green. After that, we just need to write the rebuilt byte back into the CLK/BORDER soft switch with "STA C034".

### The IIGS Machine Language Registers

You can still Examine the value held by each machine language register by entering a Ctrl-E from immediate mode in the monitor. Notice that many of the registers (A, X, Y, S, and D) are now two bytes wide when the IIGS is in 16 bit "native" mode. These registers remain one byte wide when in 8 bit "emulation" mode.

Three additional new flags in the status register, the e, m, and x, are very important to the dual operations of the IIGS. These three registers, which *must* be accessed as lower case letters, control whether the IIGS operates as a 16 bit IIGS, as an 8 bit IIGS, or a strange hybrid of the two. If "e" is set to 1, the IIGS is in emulator mode. In this mode, the A, X, and Y registers are automatically in 8 bit mode. When the "e" register is set to 0, then the IIGS is in native mode. In that mode, the A, X, and Y registers width are controlled by the "m" and "x" flags. The Accumulator, A, width depends on the value in "m"; 0 = 16 bit and 1 = 8 bits. And the X and Y registers's widths are controlled by the value in "x"; 0 = 16 bits and 1 = 8 bits for both. It is possible, but not usually advisable, to mix modes when "e" is set to 0 for native mode operation. Either "m" or "x" can be set to 1 to give an 8 bit wide accumulator or X and Y registers.

### Changing the Machine Language Registers

It is very easy to change any of the Apple IIGS registers from the monitor. The syntax is "Byte=Register" with the register to change on the right of an equal sign and the value to change it to at the left. And, of course, the value must be in hex. There must also be no extra spaces and you have to be exact about upper and lower case letters for the registers, but not for the hex values. For example, "01=X" sets the X register to one but "1=x" sets the IIGS to use the X and Y registers to 8 bit mode. And "e1=A" puts an "\$E1" (ASCII character "a") in the accumulator. Finally, entering a Ctrl-R from the monitor returns all of the machine language Registers to their normal values.

### Switching Operating Modes While a Program Is Running

It is very simple and often desirable to switch a running M/L program back and forth from emulation mode to native mode. The main reason that you might want to do this is to use a TOOL Call and that can only be done in full native mode. So, a program can be running in emulation mode, a switch to full native mode made, a TOOL Call made, and then emulation mode can be switched back in. Unfortunately, this mode switching can't be done from BASIC, just from machine language, but then the TOOLS can only be called from M/L anyway. To switch modes to full native mode, use the M/L program (The address is not important here. This is relocatable.) Notice that there is not an M/L op-code like "LDE" to set the state of the "e" flag. But there is an "XCE" which is eXchange the Carry bit with the "e" flag.

Therefore, by doing a "CLC" or "SEC" to CLear the Carry bit to zero or SET the Carry bit to one first and then doing an "XCE", we can set "e" to zero or one (in just two bytes of code). The "REP" op-code resets the status bits of the processor status register for 16 bit operation. A "REP #10" sets the X and Y registers only. A "REP #20" sets the accumulator only. And therefore, a "REP #30" sets the X, Y, and A registers to 16 bits.

```

PROGRAM 1
Machine Language Code to shift into full Native Mode
00/0300 18 CLC ;clear carry bit to 00, "0=e" for
;native mode
00/0301 FB XCE ;eXchange Carry bit ($00) for
;"e" flag
00/0302 C2 30 REP #30 ;set A, X, and Y registers to
16 bit wide
    
```

```

PROGRAM 2
M/L Code to switch into Emulation Mode
00/0300 38 SEC ;set carry bit to $01, "1=e" for
;emulation mode
00/0301 FB XCE ;eXchange Carry but ($01) for
;"e" flag.
    
```

Notice that to switch into emulation mode, we don't need to do anything with the register widths. Setting emulation mode automatically sets the widths to 8 bits, the only allowable width for the registers. We had to set the widths going into native mode since native mode may operate with the X and Y, or A registers in 8 or 16 bit widths in a "mixed mode." This is not usually a good practice.

### Reading and Setting the Date/Time from the Monitor

The Time/Date from the built-in clock can be read from the monitor in a manner similar to reading the registers. Just enter "=T" and Return to see the date and time in whatever format you have set up in the Control Panel. To reset the Date/Time from the monitor, you must use the following format no matter what format you used in the Control Panel. "=T=mm/dd/yy hh:mm:ss". You must use the "/" in the date, ":" in the time, there must be one space between the date and time, and the time must be in 24 hour format.

### Decimal/Hexadecimal Conversions and Hex Math From the Monitor

Finally, the Apple IIGS has a system monitor that can do decimal-hex conversions in both directions and hexadecimal math. The format is similar to the ones for the register changes and the time display with the equal sign. You just have to remember that the hex always goes on the left side and the decimal numbers always go on the right side of the equal sign ("Hex=Dec"). Leave blank the side that you want to convert to. For example, to convert \$FA to decimal, just enter "FA=". To convert the decimal number 250 to hex, enter "=250". You can convert any decimal number up to 4,294,967,295 or hex up to \$FFFFFFF.

To do hex arithmetic, you separate the two hex numbers with +, -, \*, and \_ signs for addition, subtraction, multiplication, and division. The division is the only operation that is a little strange.

You use the underline symbol, not the "/" and the answer comes out in a Quotient and Remainder format. But then, how else would you express a hex division answer? With a decimal point? Is there a hexadecimal point?

### Some New Soft Switches:

#### Detecting Special Key Presses With the Modifier Register SoftSwitch

On the IIGS, it is quite easy to determine if any special keys have been pressed. The "Modifier Register" soft switch at \$C025 can show key presses for the Open Apple key, Option (Closed Apple) key, keypad keys, shift key, caps lock key, Control key, and the auto-repeat function on the normal keys. The BASIC and M/L programs below are continuous loops that read the "Modifier Register" and display the value found. The value found may represent more than one special key being pressed simultaneously. Normal keys return a value of zero. The BASIC program prints to the screen the decimal value and the M/L program prints the Hex value. The M/L program is fully relocatable.

```

PROGRAM 3
A BASIC Program To Detect Special Key Presses
10 PRINT PEEK (49189) : POKE 49168,0 : GOTO 10 : REM
;$C025 ^ $C010 ^ Hex values for the BASIC program.
    
```

```

PROGRAM 4
A Machine Language Program To Detect Special Key Presses
00/0300: A0 25 C0 LDA C025 ;get the value from the
;Modifier Register
00/0303: 8D 10 C0 STA C010 ;clear the strobe
00/0306: 20 DA FD JSR FDDA ;print the Hex value
00/0309: A9 8D LDA #8D ;load a carriage return
00/030B: 20 ED FD JSR FEED ;PRINT the RETURN
00/030E: 80 F0 BRA 0300 (-10) ;branch back to read again
    
```

In Table 3, for each bit in the "Modifier Register" byte, a value of 1 shows a key being pressed and a value of 0 shows the key is not being pressed. To check each individual key for a press in machine language, you may use the "BIT" command. For example "BIT #02" would "BNE" if the "Control Key" key is pressed. A "BIT #03" would "BNE" with either a Control Key or Shift Key.

In BASIC, a value of 128 or more shows the "Open-Apple" key pressed. If so, then subtract 128. If the remainder has a value of 64 or more, then the Option key has been pressed. If so, subtract 64. If the value is then 32 or more etc. Therefore, to decode the BASIC keypress value, you must check for the highest bit value from the table above, subtract that bit value from the keypress value, check for the next lower bit value, subtract it if the keypress value is greater, etc. If the keypress value was greater or equal to the bit value, then that particular key was pressed. Unfortunately, to detect a particular key press, you have to first check all of the ones above it on the table and subtract their bit values if they exist.

**PROGRAM 5**

A Basic Program Subroutine to "Filter Out" Special Key Presses

```

100 KEY = PEEK(49189): REM Detect Special Key Press
110 IF KEY = 0 THEN RETURN: REM no special key press
120 POKE 49168,0: REM Clear Strobe
130 IF KEY > 127 THEN KEY = KEY - 128: OA = 1: REM Open-Apple key pressed
140 IF KEY > 63 THEN KEY = KEY - 64: OP = 1: REM OPTion key pressed
150 IF KEY > 31 THEN KEY = KEY - 32: ML = 1: REM Modifier Latch is updated
160 IF KEY > 15 THEN KEY = KEY - 16: KP = 1: REM a KeyPad key was pressed
170 IF KEY > 7 THEN KEY = KEY - 8: AR = 1: Auto-Repeat is on
180 IF KEY > 3 THEN KEY = KEY - 4: CL = 1: REM Caps Lock is on
190 IF KEY > 1 THEN KEY = KEY - 2: CTRL = 1: REM ConTRoL key is pressed
200 IF KEY = 1 THEN SK = 1: REM Shift Key is pressed.
210 RETURN
    
```

**Getting Colorful:**

Using the TBCOLOR and CLK/BORDER Soft Switches

It is very easy to change the colors on a running IIGS from inside a program using the TBCOLOR (\$C022 or 49186) soft switch. The two nibbles in TBCOLOR control the text mode background color and text color. Also, the low nibble of CLK/BORDER at \$C034 (49204) controls the background color. The values for each color comes from the table below. When in text mode, the background color for the screen comes from the low nibble of \$C022 and the text color comes from the high nibble of \$C022. It is quite easy to set these colors from M/L. You simply build a byte from the two nibbles needed. For example, if you wanted White text on a Dark Blue screen, using the color table below, you would get \$F for the White text and \$2 for the Dark Blue background and put together the value \$F2 to put into byte \$C022. In BASIC, you would have to construct a value by taking  $16 * (\text{text color}) + (\text{background color})$ . For the above example  $16 * 15 + 2 = 242$ . Notice also that you would never want to construct a byte with the same low and high nibble, like \$CC. This would write Light Green text on an identically colored Light Green background and be invisible. Actually, you could use this to make some text appear and disappear by switching either the background or text colors to be the same or different values.

**PROGRAM 6**

Changing the Text and Background Color From Machine Language

```

LDA #F2 ;nibbles => (Text color) = $F White (background)
           = $2 Dark Blue
STA C022 ;store the color byte in the TBCOLOR
RTS ;Done
    
```

**PROGRAM 7**

Changing the Text and Background Color From BASIC

```

10 COL = 16 * 15 + 2: REM 15 => White Text, 2 => Dark Blue background
20 POKE 49186, COL: REM POKE into TBCOLOR the combination color value
    
```

**TABLE 4**

A Color Table For Text, Background, and Border

\$0 - Black	\$4 - Dark Green	\$8 - Brown	\$C - Light Green
\$1 - Dark Red	\$5 - Dark Gray	\$9 - Orange	\$D - Yellow
\$2 - Dark Blue	\$6 - Medium Blue	\$A - Light Gray	\$E - Aquamarine
\$3 - Purple	\$7 - Light Blue	\$B - Pink	\$F - White

**Setting the Border Color**

The border color is a bit different from the text and background colors in a couple of respects. For one thing, it is active in both text and graphic modes. And it has the added complication of sharing a soft switch, the CLK/BORDER byte, with some clock information that must *not* be changed. Any changes made here must be to just the low nibble which is the border color nibble leaving the high nibble intact. So, we just change the low nibble to whatever value we want from the color table, preserving the high nibble. To do this in M/L, we can read the original byte and "AND #F0". This logical OPERATION will completely erase the low nibble and preserve the high nibble.

We can then "ORA #0 color value" to set the low nibble. With this "ORA", the high nibble MUST be zero and the low nibble on the right will be the one for whatever color we want.

**PROGRAM 8**

A Sample M/L Program to Set the Border Color to Orange

```

LDA C034 ;get CLK/BORDER
AND #F0 ;clear color nibble leaving clock nibble alone
ORA #09 ;set color to Orange (must be $0 for left nibble)
STA C034 ;write it back to CLK/BORDER
RTS ;Done
    
```

It is a bit harder to change the border color from BASIC due to needing to preserve the clock nibble. It is possible to do it though by simulating a M/L operation, LSR (Logical Shift Right). If we get the original value from CLK/BORDER with "PEEK (49204)" and divide it by two four times, throwing away any remainders, we clear out the low nibble. Then multiplying it by two four times restores the clock nibble to its correct place. Of course, we will just divide and multiply by 16 to do this and use the BASIC "INT()" function to throw away the remainders. And, after doing these operations, we just add the color value needed for the border color and write the new byte back to CLK/BORDER.

**PROGRAM 9**

A BASIC Program To Set the Border Color To Orange

```

10 BYTE = PEEK (49204): REM Get the current CLK/BOR DER value
20 CLBT = 16 * INT (BYTE/16): REM Shift right 4 then left 4 to clear color
30 NWBT = CLBT + 9: REM NeWBByTe= CLock ByTe + 9, 9 => Orange border
40 POKE 49204, NWBT: REM put newbyte with old clk value and new color back into CLK/BORDER
    
```

**Setting Color Vs Monochrome**

It is also very easy to change this setting from a program. The high bit of the MONOCOLOR soft switch byte at \$C021 does the whole job. The high bit being set (\$80 or 128) sets the IIGS

for monochrome and the high bit not being set (00) puts the IIGS into color mode. These setting are only supposed to effect the color operation of a composite monitor enabling it to show better gray scales in the monochrome setting. But I have found that setting this soft switch to monochrome sometimes prevents a color bleeding problem on an RGB screen, especially when returning from the Control Panel. Having a program available to change this setting could be very useful when working with 80 column text on the Hi-Res Graphics screen.

```

PROGRAMS 10 & 11
Setting the IIGs for Monochrome on a Composite Monitor

From Machine Language          From BASIC
LDA #80 ;80 => high bit set    10 POKE 49185, 128: REM
STA C021 ;store in MONO       128 => High bit set,
COLOR                          49185 => %C021
RTS ;Done                      MONO COLOR
    
```

```

PROGRAM 12 & 13
Setting the IIGs For Color on a Composite Monitor

From Machine Language          From BASIC
LDA #00 ;00 => clear high bit  10 POKE 49185, 0: REM 0
STA C021 ;store in MONO       => high bit clear, 49185
COLOR                          => %C021 => MONO
RTS ;Done                      COLOR
    
```

**Using the Read Only Soft Switches**

The Apple IIGS has added the capacity to determine which of a number of operating modes is currently active in the IIGS. By reading a number of switches, we can determine the operating modes. These are read only switches and do not set the condi-

**TABLE 5**  
A Table of Read Only Soft Switches

Address		Switch	High Bit	High Bit
Hex	Decimal	Name	Set	Not Set
%C01A	49178	RDTEXT	Text	Graphics
%C01B	49179	RDMIX	Mixed Text and Graphics	full screen mode
%C01C	49180	RDPAGE2	Text Page 2 active	Text Page 1
%C01D	49181	RDHIRES	Hi-Res active	Lo-Res or Text
%C01E	49182	RDALTCHARSET	alt char set active	normal char set
%C01F	49183	RD80VID	80 column hardware enabled	80 NOT enabled

tions, they just detect the conditions. The Iie and Iic had no way to determine these very useful conditions. But we can now tell from within an operating program whether the IIGS is in text or graphics mode, in mixed or full screen mode, in Hi-Res or Lo-Res mode, whether text page 1 or text page 2 is active, whether the alternate character set is active or not, and whether the 80 column hardware is enabled or not. Each piece of this information comes from checking the high bit of six different soft switches.

In M/L, you would "LDA SoftSwitch", "BIT #80", and "BNE" for the bit set or "BEQ" for the high bit not set. In BASIC,

you would just use "VAL = PEEK (SoftSwitch)" and if "VAL > 127" then the high bit is set or if "VAL < 128" then the high bit is not set.

**SoftSwitch:**

**A Tremendous Program For the IIGS**

Just as using the new IIGS soft switches can greatly improve your control over it, using the new Roger Wagner Publishing program "SoftSwitch" can greatly improve your productivity and fun. SoftSwitch is a program switcher for the Apple IIGS that allows you to have three ProDOS/8 or DOS 3.3 programs in memory at the same time and switch back and forth with a few key strokes. For example, when writing this article, I had my word processor, an assembler, and a BASIC work area all in memory at once. To check out an operation that I was describing, I would just switch over to the assembler or BASIC area, check the operation, and switch back to my word processor. It was like having three computers sitting side by side. And, if three people all need to use the same IIGS at different times of the day, then you could have all three of their programs hiding in memory concurrently to be called up and stored back into memory without erasing and rebooting each time there was a shift of people using the same computer.

An interesting thing that you can do with SoftSwitch, that you couldn't do with three computers sitting side by side, is to revert to a previous state of a program. For example, in an adventure game, you could store the game at three different places as you proceed and if you get killed, just re-enter SoftSwitch and pick any of the three earlier places to re-enter the game. You can also save to disk any of these stored images from memory and re-enter the running program at a later time just where you interrupted it.

SoftSwitch probably got its name from some special graphics functions that it has. When looking at a graphics display or even a display that you might not be sure whether it is text or graphics, you can enter SoftSwitch and display the text screens (40 or 80 columns), the Hi-Res graphics screens (Pages 1 and 2), or Double Hi-Res graphics screen — all in color or monochrome. You can then determine just what kind of text or graphics you are dealing with. SoftSwitch also allows to "cut and Paste" graphics or text. You can "cut" a graphic display from a DOS 3.3 program, switch SoftSwitch over to a ProDOS/8 program, and "paste" the graphics there. Or you can "capture" a text or graphics screen displays for inclusion into an article.

SoftSwitch does have a couple of limitations. It requires an Apple IIGS, a 3.5" disk drive, and at least 512K RAM memory expansion. It takes 133K of memory for each stored image, so at least 399K is needed by SoftSwitch if you want to be able to store three programs at the same time. Yet, another really nice thing about SoftSwitch is that it doesn't grab up any of this memory when you Boot it. It just takes what it needs as you activate it showing you what it is taking and what is left. So if you don't store any programs with it, it doesn't use up any of your RAM memory. At the present, SoftSwitch can not store ProDOS/16 programs and can not display Super Hi-Res. It only works with programs that allow you to get to the Desk Accessories (where the Control Panel is) since that is where you activate it.

SoftSwitch is copy protected, but it has the most beautiful copy protection ever devised. (I never thought that I would ever call any copy protection beautiful.) You can make unlimited copies using any copy program, but the copies will only install SoftSwitch on your own IIGS. Programs from your SoftSwitch



disk will load and run on someone else's IIGS, but not the SoftSwitch program itself.

But what if you wanted to demonstrate SoftSwitch to an interested group or a friend? You can use your master disk to set up SoftSwitch on any IIGS, you just can't leave a copy of it to be run later.

This copy protection is unusual for Roger Wagner Publishing, but there is a good reason for it. SoftSwitch operates in a "transparent" mode. You don't even know it is there unless you know exactly where to look. And you don't have to use the SoftSwitch disk each time you want it. The master disk allows you to install the SoftSwitch program onto any of your 3.5" disks that you want to. (I believe that it takes 26K of room on the disk to get it on.) After that, it is automatically loaded and ready to go each time that you Boot the disk. This is why the protection is needed. It would be very easy to give copies of legitimate disks to friends and not even remember that SoftSwitch is on it. You can't even see SoftSwitch on the disk Catalog or anything. If you give a copy of the disk with SoftSwitch on it to someone else, all of the programs run completely normal, but SoftSwitch doesn't get installed when they Boot the disk.

When you first install SoftSwitch onto a disk, the master disk is somehow "imprinted" with your machine. From then on, it can only install the SoftSwitch program onto disks using the same IIGS. And the installed disks can only operate SoftSwitch from the same IIGS. The master disk can operate the SoftSwitch program on any IIGS but can not install itself onto disks on other machines. So, whatever you do, don't try out the program disk that you are buying at the store or with another computer. It will get "imprinted" to that computer.

What if you have two IIGS's? When you return your registration card to Roger Wagner Publishing, they send you a free second disk. This second disk is either a backup for the first machine or a master for the second machine, its choice. So if you have a lab full of IIGS's, you will need to buy a copy of SoftSwitch for every two machines. Those interested in this product, please see "A Review of SoftSwitch" on page 42 of this issue.

Hopefully, this article has helped you move from your IIE to you IIGS. Next time we shall appeal to the programmers interested in "Using Tools on the Apple IIGS."

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CIRCLE 6 ON READER SERVICE CARD

## Solid-Apple



**Open-Apple** is Tom Weishaar's monthly newsletter for knowledgeable Apple II users. It's thin but packed tight with Apple II lore, humor, letters, tips, advice, and solutions to your problems. Compared to other Apple II publications, **Open-Apple** has the highest new-idea-per-issue ratio, the clearest writing, the funniest cartoons, the longest index, the only warranty (all your money back if you're not satisfied), and it takes up the least shelf space. The only thing it doesn't have is the most subscribers. Yet.

### Il cue #23

Many people have trouble finding the AppleWorks insert cursor on the screen, particularly with low-contrast portable screens for the IIC. This is both because of the character used for the cursor (the underline), and because of the way it blinks. To change these characteristics, see "Blink and its gone" in the May 1987 **Open-Apple**, page 3.32, and "Changing the blink speed" in September 1987, page 3.63.

### From our fan mail:

I am an applications-only **Open-Apple** reader. I speak a little BASIC, but try not to. Nevertheless, I really enjoy **Open-Apple**, and read almost all the articles each month. When the \$57B's get too heavy, I scroll forward to the next paragraph. A nice blend of articles, intelligently (well, mostly) written.

Matt Cole  
 Lakewood, Colo.

**Open-Apple**

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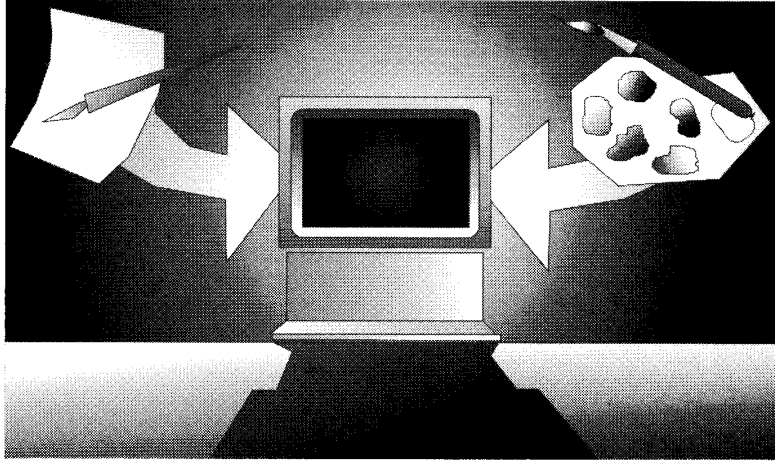
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CIRCLE 7 ON READER SERVICE CARD

# A Review of SoftSwitch: Program Switcher for the Apple IIGS



**Jeffrey M. Jacques**

**Product:**  
SoftSwitch  
**Company:**  
Roger Wagner Publishing  
1050 Pioneer Way  
Suite P  
El Cajon, CA 92020  
(619) 442-0522  
**Price:** \$59.95

CIRCLE 100 ON READER SERVICE CARD

Now that the GS has been on the market for about a year, you have probably been through most of your Apple II software and have decided which programs you prefer.

In addition, you have been watching for new and exciting GS software. You probably use the Desktop as a means of getting from one program to another, a nice feature as long as all your software is in ProDOS. With the increase in speed and power of the GS and its applications, and the improvement in the Desktop human interface, you have a fine machine for accomplishing most of your professional and household tasks.

But, even with these improvements, you probably still find going from one program to the next a tedious and time consuming activity. Furthermore, you know that with your megabyte of RAM, there is little reason that you should not be able to store several of these programs concurrently, since most of them take up less than 256K. What if I told you that there is a way to have several of your favorite programs stored on your expanded memory card? And what if I told

you that you can:

1. Store as many as three separate programs.
2. Easily switch between any three programs, including programs with different operating systems (ProDOS, DOS 3.3).
3. Copy screen displays, including graphics, from one application to another.
4. Save the current state and contents of a program (e.g., your program, a game, etc.) and, at any time be able to pick up where you left off.

All this is available to you with *SoftSwitch*, a new product from Roger Wagner Publishing, and written by *Ken Kashmarek*.

## Performance

### What You Need

In order to use *SoftSwitch*, you need an Apple IIGS, preferably a RAM megabyte for most current and future applications, a monitor, and at least one 800K disk drive. The software you are planning to load onto the RAM card must be a ProDOS 8 or DOS 3.3 application and must allow access to the Desk Accessory Menu.

### How It Works

Installation is simple. First, set your RAM disk size to the most appropriate amount. Setting it to 0 will enable *SoftSwitch* to use all the RAM disk for storing applications. This is the appropriate choice if your RAM disk has only

512K and/or your applications are very large. If you have 1 megabyte of RAM and are using ZBasic, MouseWrite, or other software which will use a RAM disk, then segment your RAM disk to the minimum amount necessary for these programs to work without degradation. Finally, if you are planning to use the RAM disk as a temporary storage location (i.e., as a clipboard to move data between programs), then remember to leave additional room for this activity. With my 1 megabyte, I set my minimum and maximum RAM disk to 256K. This insures sufficient room for both programs which use the RAM disk and temporary file storage. (Remember, if you are changing your RAM disk size, you must reboot your IIGS from a cold start. This is the only way to reset your default RAM settings.)

Second, install *SoftSwitch* as a Classic Desk Accessory and access codes on a working disk, one which is not copy protected and has ProDOS 16 on it, and place the original in a safe place. All you do is boot from the *SoftSwitch* working disk, choose the "Install SS" from the "Selector" option of the Desktop menu bar and choose "Install." An entry of the target disk name, a quick press of Return, and *SoftSwitch* is installed. Now that you have made a *SoftSwitch* working disk, reboot from a cold start using this new disk. If everything worked correctly, *SoftSwitch* will be installed in the Desk Accessory Menu.

Before you blindly jump in, do the third step: determine which applications/programs you wish to store in RAM and access through *SoftSwitch*. While this

sounds easy, after you use SoftSwitch, you will wish that you could store more than three applications at any one time. Now, go ahead and begin running the first program, e.g. the Desktop.

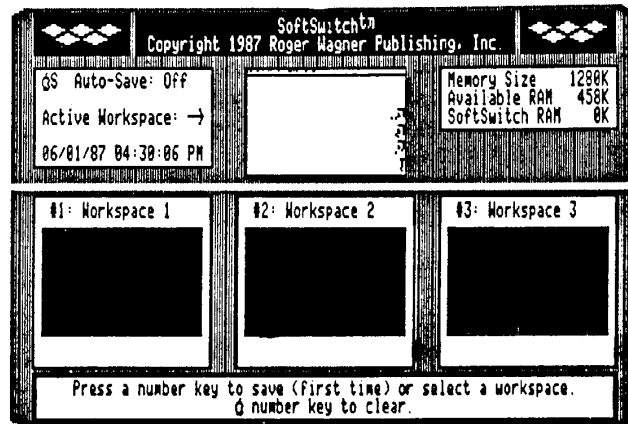
Fourth, at the first opportunity after you start the first program you wish to install onto SoftSwitch, press Open-Apple-Control-Esc simultaneously. The Desk Accessories Menu will appear. Along with the usual Control Panel and Display Mode options, the SoftSwitch option will appear. Simply choose the SoftSwitch option and press Return. You will see a Double Hi-Res graphics page menu like Figure 1.

The graphic menu is divided into two major parts. The bottom half of the menu provides a display of three mini-windows. It is here that you will install each of the applications. The top half of the graphic menu displays important information — the middle window shows a representation of the current or active work space, each side of the active work space has important information such as total memory size, the amount of RAM available to install an additional application, and the amount of RAM currently used by SoftSwitch.

You install each application by pressing its window number, (e.g., press 1 to install an application in window 1). The display of window 1 changes to be the same as that of the active window. This indicates that it has been stored. Additionally, the date and time of this installation is recorded immediately under the mini-window area.

You now exit SoftSwitch and return to the Desktop. Choose a second program to run. Go ahead and run it. At an appropriate display, call SoftSwitch in the usual manner — by pressing Open-Apple-Control-Esc simultaneously to get to the Desk Accessories Menu and choose SoftSwitch. When selected, the active mini-window will now display the second application. You can install it by pressing an inactive window number. To install it in the second window, you would simply press the number 2. The third window is installed in the same manner, i.e., you start the application, enter the Desk Accessory Menu, enter SoftSwitch, and install it in an inactive window. You can remove or replace an application in any window. You simply clear the current application (e.g., the Desktop) by pressing the Open-Apple key and the number of the window (e.g., 1). This will release the work area so that you can install a new application in the usual manner. When

FIGURE 1



finished, your SoftSwitch graphic menu may look like Figure 2.

#### How Well It Works

Once you have the correct applications installed, you can move quickly from one to the next. All you do is go through the Desk Accessory Menu and SoftSwitch, choose the number of the window with which you wish to work, press Return and Quit the Desk Accessories Menu. You will return to the present state of the application without having to wait for it to boot from disk! Now that's not too tough.... (While many of you have figured out already that you can save considerable time by loading all your important applications onto the RAM card, you still have to quit each application, reload your Loader or Desktop and then run the next application from scratch when you wish to switch to a different application. With SoftSwitch, you quickly switch directly to where you were when you interrupted the application — you do not have to spend your time quitting, loading, and starting each application. This can save a considerable amount of time and is an important improvement.)

Because you have complete control over the applications you wish to install with SoftSwitch, you have the flexibility to install several applications or the same application more than once. While this second choice may sound foolish since you can revert to the previous state of any application without multiple installations, think of the possibilities. You can

for example, install the same drawing program in two windows at the point you wish to experiment. You can then activate one of these windows, try several graphic experiments, return to SoftSwitch, select the original drawing, and make the changes that worked best. Now you can resume your experimental drawing knowing that the drawing is safely stored. Thus you did not need to save and load a copy of the drawing from disk each time you wished to experiment — it was already in RAM and could be found through the Desk Accessory Menu.

Alternately, you may wish to work with several different programs. SoftSwitch has an interesting option called Auto-Save. When this option is turned on, SoftSwitch automatically replaces the appropriate window with the most recent information. Thus you can easily switch between applications and be assured that at the time of the interruption, SoftSwitch will save the current state of the program.

So far, my typical configuration is to have ZBasic in Window 1, MouseTalk in Window 2, and AppleWorks in Window 3. Such a configuration enables me to get the power of a sophisticated language quickly and easily from Window 1, telecommunications from Window 2, and AppleWorks from Window 3. In addition, by setting the /RAM disk to 256K, I can use it to store part of the ZBasic program, MouseTalk macros, and as a clipboard to transfer files among the three applications. I find that I can transfer files quickly among these applications by writ-

ing to and reading from /RAM5. I can capture text files from a bulletin board in MouseTalk or create a program in ZBasic and transfer them easily to AppleWorks for comment and documentation. (By the way, I found that my SuperMacroWorks, modified AppleWorks, worked just as well as standard AppleWorks with SoftSwitch.)

### Options & Programs

I would be remiss if I did not mention two additional options and programs that come on the SoftSwitch diskette. With these options and programs you can capture a screen image and store/retrieve work space areas. First, let's examine capturing screen images. You can work with:

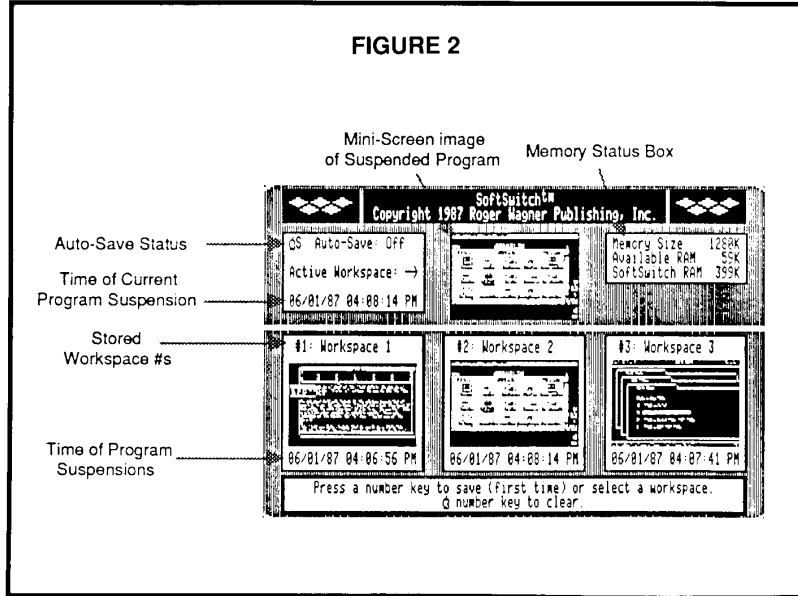
1. The 40 column text display, page 1.
2. 80 column text display, page 1.
3. Hi-Res graphics page 1 and 2.
4. Double Hi-Res page 1 and 2.

Once captured, you can then paste the image into one or more graphics programs. In addition, with the supplemental program, Screen Manager, provided on the SoftSwitch diskette, you can load, view, or save a picture to disk.

The second program, "Keepsake," enables you store and retrieve the current state of any window to disk — assuming that the Desktop is stored in one of the windows. This is a nice feature which enables you to quickly retrieve an application you suspended earlier. A nice addition would be an ability to access Keepsake directly from SoftSwitch as well as save/restore all work spaces simultaneously. (This may be difficult to implement since it requires saving the application and the machine state.)

### Documentation

The documentation is a seventy-eight page easy to read booklet. It takes you through the installation process step-by-step. It points out how to work with standard ProDOS software, protected programs, and DOS 3.3 software. In addition, it makes a number of helpful hints about the installation of applications. (E.g., install AppleWorks last and turn on Auto-Save, don't use ProDOS 1.1.1 and avoid those programs which deny access to the Desk Accessory Menu.) Finally, it should be noted that it actually has a good Index which will help when you wish to find a specific topic.



### Learning & Use

SoftSwitch is extremely easy to learn and use. In addition to the ease of installation of SoftSwitch and specific applications, SoftSwitch gives good error messages when you try to do things that are unreasonable. For example, you cannot erase a program while you have invoked automatic savings. Similarly, SoftSwitch gives appropriate prompts when you try to write over active work space areas.

### Error Handling

I had very few errors while working with SoftSwitch. I did run into one error, however, using Screen Manager. In trying to Quit to BASIC, I got an error message ?RETURN WITHOUT GOSUB ERROR IN 815. In any case, it exited to BASIC and I was able to proceed without having to press Control-Open-Apple-Reset which would have destroyed my installed SoftSwitch configuration.

### What's Missing

While the product is great for working with ProDOS and DOS 3.3, it does not now support ProDOS 16 applications like PaintWorks Plus or Music Studio. While I sympathize with the publishers intent to have three working programs within 512K RAM space, I disagree with the decision. Most people who purchase a GS will find the funds to buy at least an additional 512K of memory so that they will have at least 1 megabyte of memory. Indeed, with the development of inexpen-

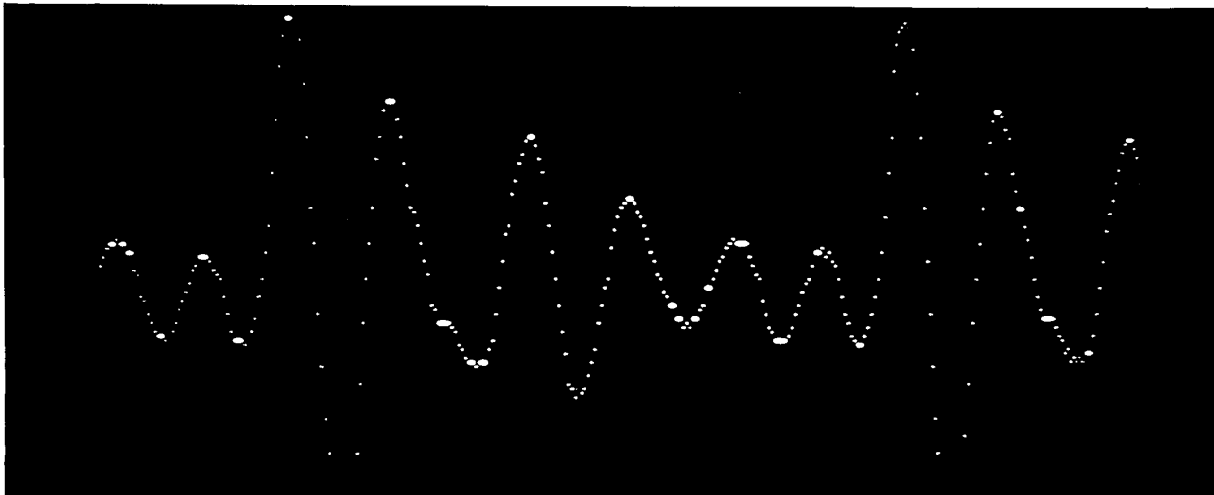
sive memory cards with more than 1 megabyte of memory, I am surprised at this choice and the rationale given in the manual. Second, I would like to see an option to install more than three applications onto SoftSwitch. Finally, it would be great if a way could be found to access Keepsake or another program, which will save one or more installed windows, disk space available, to an 800K diskette or hard disk drive from the SoftSwitch menu. This might allow for storing the entire SoftSwitch configuration and enable easy restarting at a later point in time.

### Value

For less than \$60, you get a powerful product. You get one 800K diskette with supplemental software, a manual, registration card, and comment card. When you complete the registration card, you will get a back-up disk. Most importantly, with this product you can improve your productivity considerably. You will no longer have to wait while programs load and quit from disk. Rather, you will be able to go quickly from one application to another through your Desk Accessories Menu. SoftSwitch is a product I intend to use!

Please rate this article on the Reader Service Card by circling:

- 101 Excellent      102 Good  
103 Fair      104 Poor



## Modular Assembly Language Programming, Oscilloscope Subroutines for the GS

### Bob Bishop

Back in 1979, when I was working in Apple's R & D group, I developed a little demo program which turned an Apple II into an oscilloscope. The program used a custom A/D converter (which one of the technicians built for me) to digitize sounds and then displayed those resulting wave forms on the Hi-Res graphics screen. (In June of that year, the oscilloscope program was shown at NCC in New York city as part of Apple's exhibit there.) This month, we will see how the built-in A/D converter in the Apple IIGS can be used to create a similar capability on that machine.

### Overview

The oscilloscope subroutines are shown in listings 1-6. Listing 7 is simply a short main program that invokes the oscilloscope subroutines. We will discuss each of these listings more thoroughly later on in this article. But first, let's discuss some hardware issues.

The Apple IIGS uses the Ensoniq 5503 digital oscillator chip (DOC), a programmable sound synthesizer chip. In addition to its thirty-two independent oscillators, the Ensoniq chip also has an A/D converter. An analog input signal can be sampled at pin 1 of the 7-pin molex connector (J25) located near the front-right corner of the Apple IIGS motherboard. However, the chip expects the input signal to range from 0 volts to 2.5 volts

(which does not match the output of most audio equipment). It would have been nice if Apple would have built in all of the necessary electronics to provide the proper conditioning of the input signal, and if they would have provided an input jack similar to the cassette ports on the back of the Apple IIe. However, it is possible to buy such hardware from outside sources. MDIdeas offers a "SuperSonic Digitizer" card for the Apple IIGS. (The price is about \$60.00.) The card provides you with a standard audio input jack, and provides all the necessary pre-conditioning of the input signal so that you can digitize it cleanly. The only problem is that the card does not plug directly into the Apple IIGS. It only plugs into the MDIdeas "SuperSonic stereo card" (another 60 bucks). However, we will soon see that it is possible to create an oscilloscope without using either of these two cards.

### Running With The MDIdeas Card

If you wish to use the MDIdeas card for digitizing the sounds, install the card in accordance with the instructions provided with that product. Next, load in the modules shown in Listings 1-7. (You will also need the UHGR module which I presented in the September issue of *Call-A.P.P.L.E.*) In addition, you will need to specify the slot number in which the MDIdeas card is located. This information is required by subroutine READA2D

(see Listing 2), and is passed via the calling parameter at READA2D-10. (The default is slot 2.) When you run the program, the oscilloscope will be displayed on the Super Hi-Res graphics screen. Pressing the Open-Apple key will freeze the display as long as the key is held down.

### Running Without The MDIdeas Card

The code in listings 1-7 is designed to work either with the MDIdeas card or without it. If you don't want to spend the \$120.00 for the interface cards, you can still implement a "poor man's" oscilloscope. Simply go to Radio Shack and buy an Archer 200mW amplifier-speaker (catalog #277-1008). This device, which is shown in Figure 1, is the same amplifier that we used back in part VI of this series. (See "Fun With The Cassette Ports," *Call-A.P.P.L.E.*, June 1987, pages 42-46.) This little battery operated device has an input jack for a microphone and an output jack for an external speaker. Simply connect the output of the amplifier to pins 1 and 2 of the J25 molex connector. To make the connection, you will need a cable with a miniature phono jack on one end (to plug into the Archer amplifier) and either a molex connector or a pair of test clips on the other end (to connect to the Apple IIGS). Such a cable is shown in Figure 2. But now comes the tricky part: Instead of connecting the signal to pin 1 and the ground to pin 2, *you must hook it*

up backwards. Now run the code shown in Listings 1-7. The oscilloscope trace should appear at the bottom of the screen. When you talk into the microphone, you should see a clipped signal (i.e., the negative part of the waves will be off the bottom of the screen, as shown in Figure 3 ). Shout into the microphone and/or briefly turn up the volume control on the amplifier so that the waves also start to clip at the top of the screen. When you stop shouting, you will notice that the zero line of the trace has moved up a little. Keep repeating this process until the trace line reaches the middle of the screen. At this point, turn the amplifier volume control down to the normal setting so that you can comfortably see both the positive and negative portions of the signal. (If you accidentally over shoot the middle of the screen, you can return the trace back to the bottom of the screen by momentarily unplugging the cable from the amplifier and then plugging it back in.)

*Caution: do not try this with a line driven amplifier such as a stereo output or you may damage the Ensoniq chip.* But, because the Archer amplifier runs off of a battery, it doesn't seem to be doing any damage to the chip. However, if you're hesitant to try this for fear of possibly burning out your Ensoniq chip, you can always play it safe by buying the MDIdeas card.

**Oscilloscope Subroutines**

Now that we've discussed the hardware aspects, let's look at each of the oscilloscope subroutines modules and see what they are doing.

The module shown in Listing 1 contains the two entries SCOPE and PRESCOPE. Subroutine PRESCOPE is merely an initialization subroutine for setting up the Super Hi-Res screen. This routine must be invoked once at the beginning of your code. Then, each subsequent call to the SCOPE subroutine will display a new oscilloscope trace on the screen. (See the almost trivial main program in Listing 7.) Subroutine PRESCOPE has two calling parameters—PRESCOPE-4 and PRESCOPE-2, each contain 2-byte pointers to 512 bytes of scratch memory (which will be used to store the digitized sound samples). The default values for these two scratch regions are \$9000-91FF and \$9200-93FF.

Subroutine SCOPE calls subroutine READA2D shown in Listing 2. This subroutine samples the Ensoniq A/D and returns a digitized series of samples. The subroutine has 5 calling parameters:

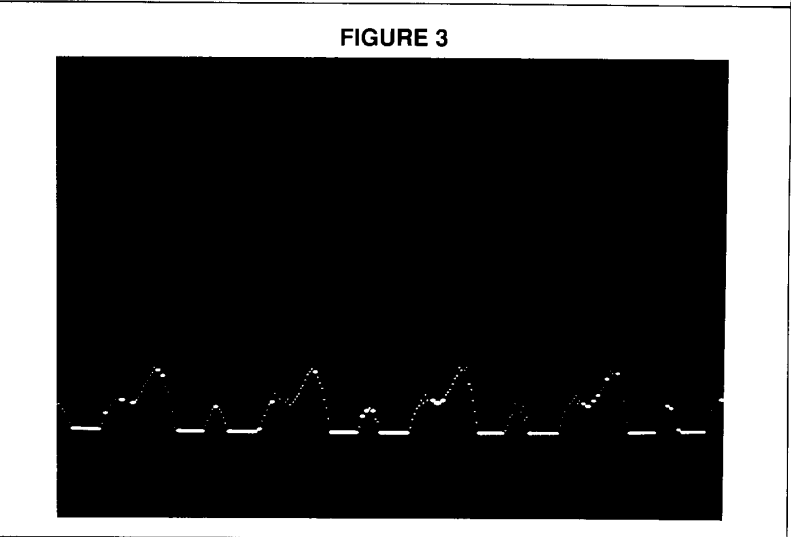
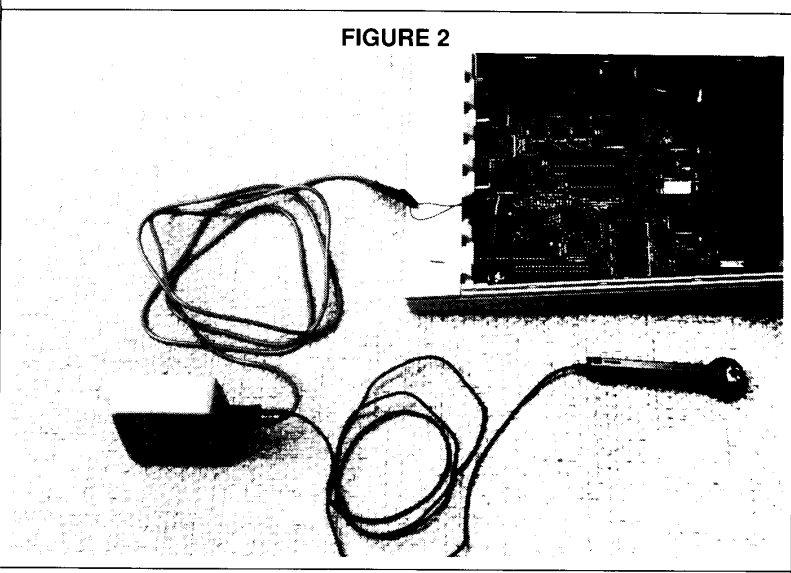
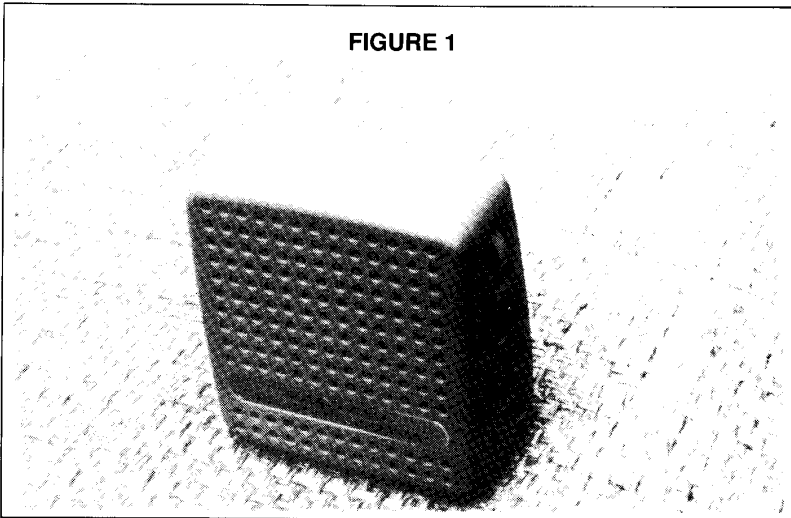
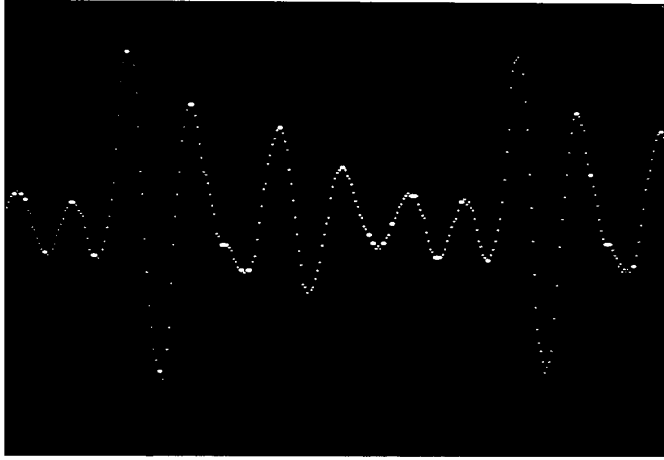


FIGURE 4



READA2D-6 specifies the number of samples that you want to take. READA2D-4 is a 2-byte pointer to the region of memory (data buffer) in which you want the samples to be returned. READA2D-2 specifies the bank in which the data is to be returned. READA2D-8 controls the frequency of the sampling. The larger the number, the longer the delay between samples. READA2D-10 specifies the slot containing the MDIdeas card. If you are not using an MDIdeas card, simply pass a 0 in this parameter.

Subroutine GETZERO (shown in Listing 3) computes the value of the zero level for a trace. If you're using the MDIdeas card, this subroutine is not really necessary. The MDIdeas card returns samples whose zero level is always close to \$80. But when running the "poor man's" oscilloscope (using the Archer amplifier) the zero level can be almost anywhere.

Subroutine SYNC (see Listing 4) scans the digitized data and looks for the first occurrence of a positive going pulse. This positive going pulse will then be the first data point to be displayed by subroutine TRACE (shown in Listing 5).

Subroutine TRACE invokes the general purpose subroutine UHPLOTX (shown in Listing 6) for exclusive ORing a pixel onto the Super Hi-Res graphics screen. (Subroutine UHPLOTX is very similar to subroutine UHPLOT that we saw back in September in this series.)

And finally, as we have already seen, Listing 7 is the trivial main program which calls (either directly or indirectly) all of the other modules. One might ask why I even bothered to incorporate such a trivial main program as in Listing 7.

Couldn't I have simply rewritten Listing 1 and made *it* the main program? While this may, at first, seem to be a relatively trite issue, it is actually the most important point in this month's article! Back in the December 1986 issue of *Call-A.P.P.L.E.* (see "Let's Start Publishing Useable Assembly Language Code") I presented a series of guidelines for publishing assembly language code.

The first of those guidelines (Rule 1) was: "Publish subroutines, not programs." There is very little you can do with a main program except run it. Had I presented Listing 1 as a main program, you would have merely had a stand-alone oscilloscope program. But, by presenting the code in the form of separate subroutines and an almost trivial main program, you have the option of using the oscilloscope as either a main program or as a subroutine in one of your own programs.

### Things To Do On Your Own

The oscilloscope modules presented here generate a "bare bones" oscilloscope. You might want to try to "fancy up" the display a bit by generating a grid, decorations, etc. (Since the oscilloscope trace is exclusive ORed onto the screen it will not erase your grid.) In addition, you might want to try changing the value of the calling parameter at TRACE-4. This parameter selects the color of the oscilloscope trace. (The default is white.) Another parameter you might like to adjust is the delay value at READA2D-8. As you recall, this parameter controls the delay between the A/D samples.

Subroutine SYNC attempts to stabil-

ize the successive traces by always starting each trace with a positive going signal. This technique works *ok* for simple wave forms like monotonic sound waves. But for more complicated wave patterns, the display often loses sync due to the different number of positive going pulses.

You might want to try writing your own version of subroutine SYNC to synchronize not to just any positive going signal, but to the positive going signal that attains the greatest amplitude. Such a synchronization subroutine would eliminate the break-up that occurs when viewing complicated wave forms, such as when you say: "aahhh" as shown in Figure 4.

### Where Can I Get EDASM And The Linking Loader?

EDASM was created back in the late 1970s, and for many years was the "official" assembler supplied by Apple Computer, Inc. It is also the "official" assembler that has been chosen for this monthly column. EDASM is currently available from several sources including: APDA™ (as part of the ProDOS Assembly Tools), Interactive Arts (as part of the Programmers Assembly-language Construction Kit), and even from Apple Computer, Inc. However, the EDASM Linking Loader is currently available only from Interactive Arts as part of the PACK (Programmer's Assembly-language Construction Kit).

Furthermore, Interactive Arts offers both EDASM and the Linking Loader not only in a ProDOS version, but also in a DOS 3.3 version (for those programmers, such as myself, who still prefer the older operating system).

In addition to EDASM and the Linking Loader, the PACK also contains libraries of more than 100 subroutine modules similar to the ones that appear in this monthly column. For more information about the PACK (including EDASM and the Linking Loader) contact:

Interactive Arts  
2715 Porter Street  
Soquel, California 95073  
(408) 475-7047  
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111 Excellent    112 Good  
113 Fair        114 Poor

**LISTING 1**

```

1000: 1000 1      ORG  $1000
1000:      2      REL
1000:      3      *
1000: 1012 4      ENTRY SCOPE
1000: 1004 5      ENTRY PRESCOPE
1000: 0000 6      EXTRN UHGR
1000: 0000 7      EXTRN READA2D
1000: 0000 8      EXTRN GETZERO
1000: 0000 9      EXTRN SYNC
1000: 0000 10     EXTRN TRACE
1000:      11     *
1000:      12     * INITIALIZATION SUBROUTINE
1000:      13     *
1000:      14     * ENTER WITH:
1000:      15     * PRESCOPE-4: POINTER TO 512
                        BYTES
                        OF SCRATCH
                        MEMORY
1000:      16     *
1000:      17     * PRESCOPE-2: POINTER TO 512
                        BYTES
                        OF SCRATCH
                        MEMORY
1000:      18     *
1000:      19     *
1000: 00 90 20     NEWPNTR  DW  $9000
1002: 00 92 21     OLDPNTR  DW  $9200
1004:      22     *
1004: 18      23     PRESCOPE  CLC
1005: FB      24     DFB  XCE
1006: 08      25     PHP
1007: C2 30 26     DFB  REP,$30
1009:      27     *
1009: 20 00 00 28     JSR  UHGR
100C: 20 40 10 29     JSR  PREP
100F: 4C 23 10 30     JMP  CONTINUE
1012:      31     *
1012:      32     * OSCILLOSCOPE SUBROUTINE
1012:      33     *
1012:      34     * RETURN WITH:
1012:      35     * NEWPNTR & OLDPNTR: SWAPPED
1012:      36     *
1012: 18      37     SCOPE      CLC
1013: FB      38     DFB  XCE
1014: 08      39     PHP
1015: C2 30 40     DFB  REP,$30
1017:      41     *
1017: 20 40 10 42     JSR  PREP
101A: AD 60 10 43     LDA  OLDSYNC
101D: 8D FE FF 44     STA  TRACE-2
1020: 20 00 00 45     JSR  TRACE
1023: AD FE FF 46     CONTINUE LDA  SYNC-2
1026: 8D 60 10 47     STA  OLDSYNC
1029: 8D FE FF 48     STA  TRACE-2
102C: 20 00 00 49     JSR  TRACE
102F: AD 00 00 50     LDA  NEWPNTR
1032: 48      51     PHA
1033: AD 02 10 52     LDA  OLDPNTR
1036: 8D 00 10 53     STA  NEWPNTR
1039: 68      54     PLA
103A: 8D 02 10 55     STA  OLDPNTR
103D:      56     *
103D: 28      57     PLP
103E: FB      58     DFB  XCE
103F: 60      59     RTS
1040:      60     *
1040: AD 00 10 61     PREP      LDA  NEWPNTR
1043: 8D FC FF 62     STA  READA2D-4
1046: 8D FE FF 63     STA  GETZERO-2
1049: 8D FC FF 64     STA  SYNC-4
104C: 20 00 00 65     JSR  READA2D
104F: 20 00 00 66     JSR  GETZERO
1052: AD FC FF 67     LDA  GETZERO4
    
```

```

1055: 18      68     CLC
1056: 6D FA FF 69     ADC  SYNC-6
1059: 6A      70     ROR  A
105A: 8D FA FF 71     STA  SYNC-6
105D: 4C 00 00 72     JMP  SYNC
1060:      73     *
1060:      0002 74     OLDSYNC  DS  2
1062:      75     *
1062:      76     * EQUATES FOR 65C816
1062:      77     *
1062:      00C2 78     REP      EQU  $C2
1062:      00FB 79     XCE      EQU  $FB
1062:      80     *
    
```

**LISTING 2**

```

1000: 1000 1      ORG  $1000
1000:      2      REL
1000:      3      *
1000: 100A 4      ENTRY  READA2D
1000:      5      *
1000:      6      * READ THE ENSONIQ A/D
1000:      7      *
1000:      8      * ENTER WITH:
1000:      9      * SLOT: 16 TIMES THE SLOT
                        NUMBER
                        OF THE MDIDEAS CARD
1000:      10     *
1000:      11     * DELAYVAL: DELAY BETWEEN
                        A/D SAMPLES
1000:      12     *
1000:      13     * NUMBER: NUMBER OF A/D
                        SAMPLES TO BE
                        TAKEN
1000:      14     *
1000:      15     * POINTER: 2-BYTE POINTER
                        TO
                        THE DATA BUFFER
1000:      16     *
1000:      17     * BANK: BANK IN WHICH THE
                        BUFFER IS LOCATED
1000:      18     *
1000:      19     *
1000: 20 00 20     SLOT      DW  $0020
1002: 05 00 21     DELAYVAL DW  5
1004: 00 02 22     NUMBER    DW  $0200
1006: 00 90 23     POINTER   DW  $9000
1008: 00 00 24     BANK      DW  $0000
100A:      25     *
100A: DA      26     READA2D  DFB  PHX
100B: 5A      27     DFB  PHY
100C: 18      28     CLC
100D: FB      29     DFB  XCE
100E: 08      30     PHP
100F: C2 10 31     DFB  REP,$10
1011: E2 20 32     DFB  SEP,$20
1013:      33     *
1013:      34     * SETUP THE DOC
1013:      35     *
1013: AD 3E C0 36     LDA  $C03E
1016: 48      37     PHA
1017: AD 3C C0 38     DOCBUSY LDA  $C03C
101A: 30 FB 1017 39     BMI  DOCBUSY
101C: 48      40     PHA
101D: A9 00 41     LDA  $00
101F: 8D 3C C0 42     STA  $C03C
1022: A9 E2 43     LDA  $E2
1024: 8D 3E C0 44     STA  $C03E
1027:      45     *
1027: AE 04 10 46     LDX  NUMBER
102A: 8E 82 10 47     STX  CLOCK
102D: AC 06 10 48     LDY  POINTER
1030: 8B      49     DFB  PHB
1031: AD 08 10 50     LDA  BANK
    
```



```

1034: 48      51          PHA
1035: AB      52          DFB  PLB
1036:         53 *
1036:         54 * WASTE THE FIRST TWO VALUES
1036:         55 *
1036: AE 00 10 56          LDX  SLOT
1039: BD 80 C0 57          LDA  $C080,X
103C: AD 3D C0 58          LDA  $C03D
103F: 20 75 10 59          JSR  DELAY2
1042: AE 00 10 60          LDX  SLOT
1045: BD 80 C0 61          LDA  $C080,X
1048: AD 3D C0 62          LDA  $C03D
104B: 20 75 10 63          JSR  DELAY2
104E:         64 *
104E:         65 * FILL THE BUFFER
104E:         66 *
104E: AE 00 10 67 LOOP      LDX  SLOT
1051: BD 80 C0 68          LDA  $C080,X
1054: AD 3D C0 69          LDA  $C03D
1057: 99 00 00 70          STA  $00,Y
105A: 20 7B 10 71          JSR  DELAY
105D: C8       72          INY
105E: AE 82 10 73          LDX  CLOCK
1061: CA       74          DEX
1062: 8E 82 10 75          STX  CLOCK
1065: D0 E7 104E 76          BNE  LOOP
1067:         77 *
1067:         78 * RESTORE THE CALLING ENVIRONMENT
1067:         79 *
1067: AB      80          DFB  PLB
1068: 68      81          PLA
1069: 8D 3C C0 82          STA  $C03C
106C: 68      83          PLA
106D: 8D 3E C0 84          STA  $C03E
1070: 28      85          PLP
1071: FB      86          DFB  XCE
1072: 7A      87          DFB  PLY
1073: FA      88          DFB  PLX
1074: 60      89          RTS
1075:         90 *
1075:         91 * DELAYS
1075:         92 *
1075: 20 81 10 93 DELAY2  JSR  RTS
1078: EB      94          DFB  XBA
1079: EB      95          DFB  XBA
107A: EA      96          NOP
107B: AD 02 10 97 DELAY  LDA  DELAYVAL
107E: 3A      98          SPIN DFB  DEA
107F: D0 FD 107E 99          BNE  SPIN
1081: 60      100         RTS
1082:         101 *
1082: 0002 102 CLOCK  DS  2
1084:         103 *
1084:         104 * EQUATES FOR 65C816
1084:         105 *
1084: 003A 106 DEA  EQU  $3A
1084: 008B 107 PHB  EQU  $8B
1084: 00DA 108 PHX  EQU  $DA
1084: 005A 109 PHY  EQU  $5A
1084: 00AB 110 PLB  EQU  $AB
1084: 00FA 111 PLX  EQU  $FA
1084: 007A 112 PLY  EQU  $7A
1084: 00C2 113 REP  EQU  $C2
1084: 00E2 114 SEP  EQU  $E2
1084: 00EB 115 XBA  EQU  $EB
1084: 00FB 116 XCE  EQU  $FB
1084:         117 *
    
```

LISTING 3

```

1000:         1000 1          ORG  $1000
1000:         2          REL
1000:         3 *
1000:         1004 4          ENTRY GETZERO
1000:         5 *
1000:         6 * COMPUTE THE ZERO LEVEL
1000:         7 * FOR 512 DATA SAMPLES
1000:         8 *
1000:         9 * ENTER WITH:
1000:         10 * BUFFPNTR: 2-BYTE POINTER
1000:         11 *
1000:         12 * START OF DATA BUFFER
1000:         13 * RETURN WITH:
1000:         14 * ZERO: THE ZERO LEVEL
1000:         15 ZERO      DW  $0000
1002:         0002 16 BUFFPNTR DS  2
1004:         17 *
1004: DA      18 GETZERO  DFB  PHX
1005: 5A      19          DFB  PHY
1006: 18      20          CLC
1007: FB      21          DFB  XCE
1008: 08      22          PHP
1009: C2 10 23          DFB  REP,$10
100B: E2 20 24          DFB  SEP,$20
100D:         25 *
100D:         26 * COMPUTE THE ZERO LEVEL
100D:         27 *
100D:         28          LDY  BUFFPNTR
1010: 20 25 10 29          JSR  ADDER
1013: 8D 00 10 30          STA  ZERO
1016: 20 25 10 31          JSR  ADDER
1019: 6D 00 10 32          ADC  ZERO
101C: 6A      33          ROR  A
101D: 8D 00 10 34          STA  ZERO
1020:         35 *
1020:         36 * RESTORE THE CALLING ENVIRONMENT
1020:         37 *
1020: 28      38          PLP
1021: FB      39          DFB  XCE
1022: 7A      40          DFB  PLY
1023: FA      41          DFB  PLX
1024: 60      42          RTS
1025:         43 *
1025:         44 * ADD 256 SAMPLES AND RETURN
1025:         45 * THEIR AVERAGE VALUE IN A-REG
1025:         46 *
1025: A2 00 47          ADDER  LDX  #$00
1027: 01      48          DFB  $01
1028: A9 00 49          LDA  #0
102A: 8D 47 10 50          STA  WORK+0
102D: 8D 48 10 51          STA  WORK+1
1030: 18      52          CLC
1031: AD 47 10 53 ADDLOOP  LDA  WORK+0
1034: 79 00 00 54          ADC  $00,Y
1037: 8D 47 10 55          STA  WORK+0
103A: AD 48 10 56          LDA  WORK+1
103D: 69 00 57          ADC  #0
103F: 8D 48 10 58          STA  WORK+1
1042: C8      59          INY
1043: CA      60          DEX
1044: D0 EB 1031 61          BNE  ADDLOOP
1046: 60      62          RTS
1047:         63 *
1047:         0002 64 WORK  DS  2
1049:         65 *
1049:         66 * EQUATES FOR 65C816
1049:         67 *
    
```

```

1049: 00DA 68 PHX EQU $DA
1049: 005A 69 PHY EQU $5A
1049: 00FA 70 PLX EQU $FA
1049: 007A 71 PLY EQU $7A
1049: 00C2 72 REP EQU $C2
1049: 00E2 73 SEP EQU $E2
1049: 00FB 74 XCE EQU $FB
1049: 75 *
    
```

```

1030: 7A 56 DFB PLY
1031: FA 57 DFB PLX
1032: 60 58 RTS
1033: 59 *
1033: 60 * EQUATES FOR 65C816
1033: 61 *
1033: 003A 62 DEA EQU $3A
1033: 00DA 63 PHX EQU $DA
1033: 005A 64 PHY EQU $5A
1033: 00FA 65 PLX EQU $FA
1033: 007A 66 PLY EQU $7A
1033: 00C2 67 REP EQU $C2
1033: 00E2 68 SEP EQU $E2
1033: 00FB 69 XCE EQU $FB
1033: 70 *
    
```

**LISTING 4**

```

1000: 1000 1 ORG $1000
1000: 2 REL
1000: 3 *
1000: 1006 4 ENTRY SYNC
1000: 5 *
1000: 6 * FIND FIRST UP-GOING ZERO
1000: 7 * CROSSING
1000: 8 * ENTER WITH:
1000: 9 * ZERO: THE ZERO LEVEL
1000: 10 * BUFFPNTR: 2-BYTE POINTER
1000: 11 * TO
1000: 12 * START OF DATA
1000: 13 * BUFFER
1000: 14 * RETURN WITH:
1000: 15 * SYNCNTR: 2-BYTE POINTER
1000: 16 * TO
1000: 17 * START OF UP-
1000: 18 * GOING
1000: 19 * DATA
1000: 20 *
1000: 80 00 21 ZERO DW $0080
1002: 0002 22 BUFFPNTR DS 2
1004: 0002 23 SYNCNTR DS 2
1006: 24 *
1006: DA 25 SYNC DFB PHX
1007: 5A 26 DFB PHY
1008: 18 27 CLC
1009: FB 28 DFB XCE
100A: 08 29 PHP
100B: C2 10 30 DFB REP,$10
100D: E2 20 31 DFB SEP,$20
100F: 32 *
100F: 33 * FIND THE FIRST NEGATIVE VALUE
100F: 34 *
100F: AE 02 10 35 LDX BUFFPNTR
1012: A0 C0 36 LDY #192
1014: 00 37 DFB 0
1015: AD 00 00 38 LDA ZERO
1018: 3A 39 DFB DEA
1019: D5 00 40 LOOP1 CMP $00,X
101B: B0 0A 41 1027 BCS GOTNEG
101D: E8 42 INX
101E: 88 43 DEY
101F: D0 F8 44 1019 BNE LOOP1
1021: F0 08 45 102B BEQ EXIT
1023: 46 *
1023: 47 * THEN, THE FIRST POSITIVE VALUE
1023: 48 *
1023: D5 00 49 1023 LOOP2 CMP $00,X
1025: 90 04 50 102B BCC EXIT
1027: E8 51 GOTNEG INX
1028: 88 52 DEY
1029: D0 F8 53 1023 BNE LOOP2
102B: 8E 04 10 54 EXIT STX SYNCNTR
102E: 55 *
102E: 56 * RESTORE THE CALLING
102E: 57 * ENVIRONMENT
102E: 58 *
102E: 59 *
102E: 28 60 PLP
102F: FB 61 DFB XCE
    
```

**LISTING 5**

```

1000: 1000 1 ORG $1000
1000: 2 REL
1000: 3 *
1000: 1004 4 ENTRY TRACE
1000: 0000 5 EXTRN UHPLTX
1000: 6 *
1000: 7 *EOR 320 POINTS ONTO THE
1000: 8 * SCREEN
1000: 9 * ENTER WITH:
1000: 10 * COLOR: (0-15)
1000: 11 * BUFFPNTR: POINTER TO
1000: 12 * START
1000: 13 * OF TRACE DATA
1000: 0F 00 14 COLOR DW $000F
1002: 0002 15 BUFFPNTR DS 2
1004: 16 *
1004: DA 17 TRACE DFB PHX
1005: 5A 18 DFB PHY
1006: 18 19 CLC
1007: FB 20 DFB XCE
1008: 08 21 PHP
1009: C2 10 22 DFB REP,$10
100B: E2 20 23 DFB SEP,$20
100D: 24 *
100D: AD 00 10 25 LDA COLOR
1010: 8D FA FF 26 STA UHPLTX-6
1013: AE 02 10 27 LDX BUFFPNTR
1016: A0 00 28 LDY #0
1018: 00 29 DFB 0
1019: 8C FC FF 30 STY UHPLTX-4
101C: B5 00 31 LOOP LDA $00,X
101E: 49 FF 32 EOR #$FF
1020: 4A 33 LSR A
1021: 69 24 34 ADC #36
1023: 8D FC FF 35 STA UHPLTX-4
1026: 8C FE FF 36 STY UHPLTX-2
1029: 20 00 00 37 JSR UHPLTX
102C: E8 38 INX
102D: C8 39 INY
102E: C0 40 40 CPY #$40
1030: 01 41 DFB $01
1031: 90 E9 101C 42 BCC LOOP
1033: 43 *
1033: 28 44 PLP
1034: FB 45 DFB XCE
1035: 7A 46 DFB PLY
1036: FA 47 DFB PLX
1037: 60 48 RTS
1038: 49 *
1038: 50 * EQUATES FOR 65C816
1038: 51 *
    
```

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```

1038: 00DA 52 PHX EQU $DA
1038: 005A 53 PHY EQU $5A
1038: 00FA 54 PLX EQU $FA
1038: 007A 55 PLY EQU $7A
1038: 00C2 56 REP EQU $C2
1038: 00E2 57 SEP EQU $E2
1038: 00FB 58 XCE EQU $FB
1038: 59 *
    
```

```

1030: 00FA 52 PLX EQU $FA
1030: 00C2 53 REP EQU $C2
1030: 00E2 54 SEP EQU $E2
1030: 009F 55 STALX EQU $9F
1030: 00FB 56 XCE EQU $FB
1030: 57 *
    
```

**LISTING 6**

```

1000: 1000 1 ORG $1000
1000: 2 REL
1000: 3 *
1000: 1006 4 ENTRY UHPLTX
1000: 5 *
1000: 6 * EOR A PIXEL ON THE SUPER HI-RES SCREEN
1000: 7 *
1000: 8 * ENTER WITH:
1000: 9 * UHPLTX-2: 2-BYTE X-COORDINATE
1000: 10 * UHPLTX-4: 2-BYTE Y-COORDINATE
1000: 11 * UHPLTX-6: 2-BYTE COLOR (0-15)
1000: 12 * (MS-BYTE MUST BE $00!)
1000: 13 *
1000: 0001 14 ZZ DS 1
1001: 00 15 DFB $00
1002: 0002 16 YY DS 2
1004: 0002 17 XX DS 2
1006: 18 *
1006: DA 19 UHPLTX DFB PHX
1007: 18 20 CLC
1008: FB 21 DFB XCE
1009: 08 22 PHP
100A: C2 30 23 DFB REP,$30
100C: 24 *
100C: AD 01 10 25 LDA YY-1
100F: 4A 26 LSR A
1010: 4A 27 LSR A
1011: 6D 01 10 28 ADC YY-1
1014: 6D 04 10 29 ADC XX
1017: 4A 30 LSR A
1018: AA 31 TAX
1019: 32 *
1019: E2 02 33 DFB SEP,$20
101B: AD 00 10 34 LDA ZZ
101E: B0 04 1024 35 BCS GOT-COLOR
1020: 0A 36 ASL A
1021: 0A 37 ASL A
1022: 0A 38 ASL A
1023: 0A 39 ASL A
1024: 5F 00 20 E1 40 GOTCOLOR DFB EORLX, $00,$20,$E1
1028: 9F 00 20 E1 41 DFB STALX, $00,$20,$E1
102C: 42 *
102C: 28 43 PLP
102D: FB 44 DFB XCE
102E: FA 45 DFB PLX
102F: 60 46 RTS
1030: 47 *
1030: 48 * EQUATES FOR 65C816
1030: 49 *
1030: 005F 50 EORLX EQU $5F
1030: 00DA 51 PHX EQU $DA
    
```

**LISTING 7**

```

1000: 1000 1 ORG $1000
1000: 2 REL
1000: 3 *
1000: 0000 4 EXTRN SCOPE
1000: 0000 5 EXTRN PRESCOPE
1000: 6 *
1000: 20 00 00 7 JSR PRESCOPE
1003: 20 00 00 8 LOOP JSR SCOPE
1006: AD 61 C0 9 FREEZE LDA $C061
100B: 30 FB 1006 10 BMI FREEZE
100B: 10 F6 1003 11 BPL LOOP
100D: 12 *
    
```

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# Setting the Standards

## A Report on a Panel

## Discussion Sponsored by APDA<sup>TM</sup>

Charles Stillman, Ph.D

The following is a report on a gathering of programmers sponsored by APDA (Apple Programmers' and Developers' Association) at the San Francisco AppleFest in September. Sean Nolan inspired the event with his wish to share with others a standard way to install drivers under ProDOS 8 (see his SETUP.SYSTEM article in this issue). The purpose of the panel discussion at AppleFest was to explore new ideas for standards in the Apple II family: hardware, firmware, operating system and software. As expected, participants emphasized the IIGS. Unexpected was the willingness of Apple's engineers to discuss openly some of their plans for future enhancements to the operating system. Even more welcome was the strong statement that Apple would heed well-organized proposals from the developer community for specific new features (no guarantees of course).

The panel was moderated by Michael Fischer (author, developer, and A2PRO SYSOP on GEnie). Panelists included four key engineers from Apple Computer: David Eyes (language tools development), Steve Glass (GS Toolbox, windowing and more), Rich Williams (responsible for GS Memory Manager, and much firmware since 1979), and Jim Merritt (head, Apple II Developer Tech Support). Others were Roger Wagner (longtime Apple II writer and developer, Roger Wagner Publishing), Gary Little (A+ Technical Editor, author of *Modem Magician*, and many Apple II books), Tom Weishaar (editor of *Open-A.P.P.L.E.*, author of *ProntoDOS*), and Kevin Harvey (author of *MultiScribe*, president of Styleware). A full transcript of the session can be purchased by APDA members, availability to be announced in the next APDAlog.

### Why Standards?

The history of the Apple II has been one more of anarchy than planfulness, with *Call-A.P.P.L.E.*, often leading the way to exploit a few more illegal entry points into the monitor or to trick Apple-soft into doing one more impossible feat. Such practices caused Apple engineers many sleepless nights while developing the revised monitor firmware for the IIc, IIc and IIGS to assure compatibility with existing software. Why did we break the rules? Sometimes just for the fun of doing a clever hack, but more often, we needed more speed and more functions out of the paltry 64K of code space. We didn't have a choice. We wanted to squeeze every bit of performance out of our computers.

It has all changed now on the IIGS. The ROM has grown from 16K to 128K (not all used yet), and both the ROM and ProDOS 16 are undergoing periodic revisions. Woe be to the programmer who expects that he can jump into the middle of the IIGS ROM code or ProDOS and expect the code to be in the same place in the next revision. Okay, that's a reason not to break the rules, but why are standards so valuable? With a twinkle in his eye, Rich Williams put it well — "Standards, I think are very, very good for you. Apple tries to take it with a spirit that standards are something that you try to promote because people are benefitting from it, not like trying to make people eat vegetables where we are telling them it is good for them and they will do it." What are some of the benefits of standards? Standards make it possible to develop the system in an orderly fashion always leaving room for future enhancements. The Macintosh has shown us the power of user interface standards, a consistent environment for the user so each new program

isn't like learning computers all over again. Best of all, standards can be a great master several feet of documentation before writing significant software on the GS. And more than ever, there's the problem of performance and the load of system overhead. As one wag on the panel put it, the IIGS needs all the "underhead it can get." By the time a proper call has fought its way through several layers of operating system, toolbox, etc., a simple action can become slow as a slug. A faster processor, greater vertical resolution and QuickDraw in hardware, may be necessary to make productivity software on the GS really practical in graphics mode. (I can wish can't I?) In the meantime, Jim Merritt, among others, points out that the GS in the hands of a skilled programmer has a lot more power than most give it credit for.

It is tempting to program direct to the hardware, skipping the system altogether. But as Roger Wagner said, "There's always a way of going in there and looking at the exact machine, the exact program you're working on and finding an optimal solution for that. The reason for standards is to try to come up with something, preferably at an operating system level, and Apple is always the logical choice for who is supposed to decide all this stuff, so that the programmer (a) doesn't have to worry about it, and (b) all the programs have a common assumption about what's going on." Such common assumptions are what make possible desk accessories, program switchers like Wagner's Softswitch, and rational and effective use of memory. Yes, standards are often difficult to follow, but if followed well, everyone benefits.

### A Peek at The Future

Apple's engineers have been busy

working on the "real" ProDOS 16 which will gratify some of the wishes voiced at the conference. It will load files about twice as fast as the current version. It will also make good use of any extra memory you just happened to have around. If that memory isn't required for anything else, then it can be used to retain information that ProDOS already loaded once before, at least until that memory is needed for something else. The next time the information is needed, ProDOS can check, and if it's still there, load the information super fast direct from memory. This concept of disk caching can come in several forms. If caching is designed into the operating system from the start, it can be very smart, memory efficient, and device independent (Bill Basham's Diversi-Cache with no help from the operating system, is limited to track caching and only on the Apple 3.5" drive.) The new ProDOS 16 will probably combine at least three different caching methods, each with different Memory Manager purge levels. The big advantage of caching at the operating system level is that the system knows something about what it is caching. Thus it can give highest priority to retaining things that will be accessed often such as disk directories, path tables, the like where you want speed. It can also selectively cache certain programs such as the Finder, or tracks, load segments, resources, as needed. Obviously, this can get quite involved, but it should be designed to optimize performance where it is needed most, efficient memory use (never unlimited), and allow device independence (come on Apple... we know you have CD ROM players in the works.. I want one now!) Roger Wagner expressed interest in support of Switcher programs at the operating system level. Caching can be a problem for program switchers since the programs which are inactive may not know that a disk has been swapped while another program was active. This question was not resolved at AppleFest but will be discussed further.

The GS operating system and tools have much in common with the Macintosh system, but a Resource structure was not included in the original design of the ProDOS16 program file structure. One reason was to maintain compatibility with the existing ProDOS file structure. Apple is right now looking at ways to implement Resources on the GS. What are Resources? First the Resource portion of a file is a place to put the actual text contents of things like menus, windows, and dialog boxes. The advantages of collecting this information in one place are that the pro-

gram code isn't as cluttered, and compilation time isn't wasted parsing the same old menu strings over and over during development. In the Mac, ResEdit allows menus and the like held as Resources to be modified directly. The panel discussed the advisability of letting users mess around with menus, but the general consensus was that such tools are a good thing to make available. The Resource portion is also a place to put toolbox data structures, important for high level languages. The panelists agreed that resources should be implemented on the GS, and that Apple is open to suggestions. For now, it appears that Resources will most likely be implemented as a ProDOS16 load segment.

The development team will continue to work on the speed of the GS tools and operating system. The closely related Memory Manager and System Loader are due for some revisions. A project is underway to speed the Memory Manager's scanning of data structures. Other miscellaneous issues: Developers have requested a means of finding the actual amount of purgeable memory available without actually performing a purge. Another requested guideline for how developers can use memory and the Memory Manager more efficiently (Scott Knaster's Mac programming book was recommended.) Another developer requested the capability to have the system point to a routine of his choice when a memory request has failed. Other enhancements are anticipated elsewhere. Look for scrolling menus first (badly needed by us font junkies!), and also possibly tearoff menus and hierarchical menus.

### A Poke at Apple

The new Finder 3.1 is out and the preliminary Icon Editor is available through APDA. Yes, you can design your own icons. (A friend who turned his trash can into a toilet on the Mac lit up at the prospect of color icons on the GS!) Filetypes take on new importance now. Depending on the icon definition, double clicking an icon of a data file will automatically launch a corresponding application. There are 255 main file types available for use in ProDOS. Each filetype can have up to 65536 subfile types. The number of unassigned main filetypes is very small right now and some developers may be grabbing filetypes without going through the Developer Tech Support registry. Main filetypes are assigned only if they will have some general utility

and if Apple is supplied with detailed specifications. Apple is the final arbiter. If you need a filetype, don't just take it, go through Apple. Some developers have not been aware of the filetype registry, a point which underscores the need for good documentation and better communication. The filetypes should be disseminated widely online and updated at least biweekly.

Apple has been working hard to get preliminary documentation out through APDA (join if you program!), finished docs through Addison-Wesley, and technotes through GENie, Compuserve, AppleLink and user group channels. (Hey guys, how about Apple II format for technotes, not just Mac when on disk?)

There are acknowledged weaknesses in Apple's documentation: GS specific AppleTalk documentation is weak, and a decent user manual for the Finder is only now coming out. Partly because of documentation in need of improvement, many developers are programming desk accessories as non-purgeable. The example DA was done that way. If you program DAs, be sure that the bulk of your code can be purged when the DA is inactive. It isn't right to expect all users to have 4 megabytes of memory. Apple will continue to work on their manuals and everyone needs to help get the word out better as information becomes available.

### A Call For Discussion

Apple Developer Tech Support is looking into the possibility of an ongoing standards forum online, an idea we heartily support. Public discussion of new standards and directions is definitely worthwhile. Gary Little's Binary II file transfer protocol benefited from conferences on Compuserve during development, and the new PICT file format and Sound file formats for the GS were both improved by an open discussion with developers. Other standard formats are still needed, particularly for passing text files complete with formatting between GS applications and Mac and GS. Look for another standards conference at the May AppleFest. We may have some great opportunities to help design the GS of tomorrow.

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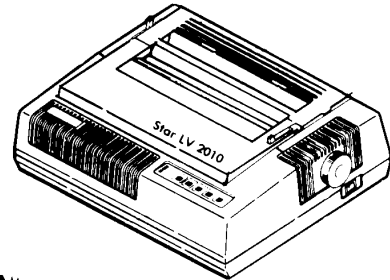
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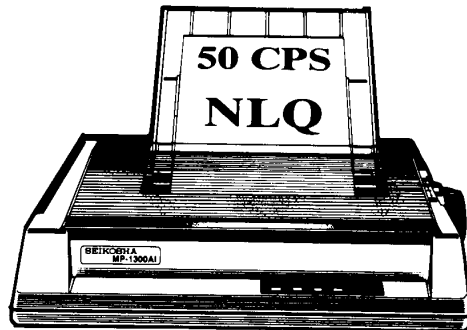
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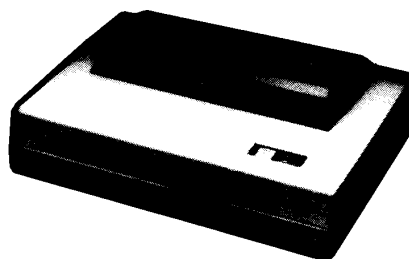
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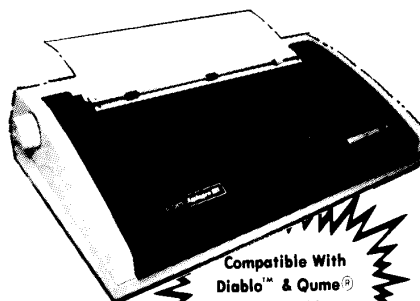
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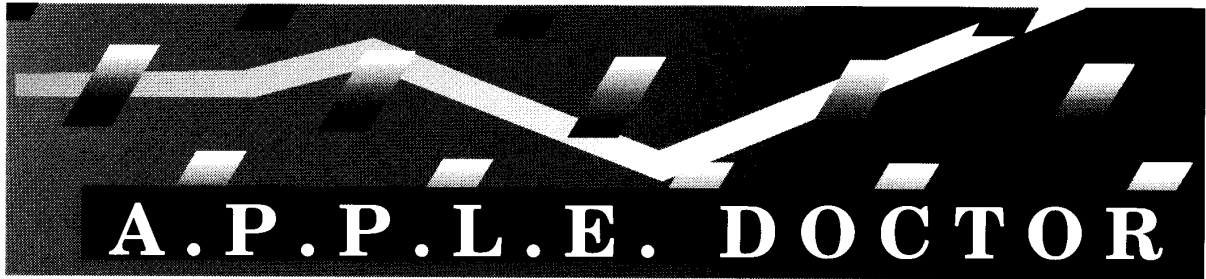
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**Robert C. Platt & Bruce F. Field**

**The GS Finder**

**Q.** *What is the latest IIGS System Master Disk?*

**A.** System Disk 3.1 features: ProDOS 8 ver. 1.4; BASIC.SYSTEM ver. 1.1; Loader ver. 1.3; ProDOS 16 ver. 1.4 and Launcher ver 2.1. The most notable improvement over System Disk 2.1 is the arrival of the long-awaited IIGS Finder program (version 1.0).

**Q.** *What are the differences between the IIGS Finder and the Desktop program?*

**A.** Unlike the Apple II Desktop program which runs under ProDOS 8, Finder runs under ProDOS 16. The Finder gives you more control using the Preferences dialog accessed through the Special menu. You can specify whether icon information will be saved or not on each disk (and folder) using a "FINDER.DATA" file.

If your data disks are tight on space, you can select the No Save option (which is not available on the Mac). You can also specify whether the "FINDER.DATA" files are visible or invisible. Another important time-saving option is "Do a smart block copy when copying disks of the same size."

In general, using the IIGS Finder takes longer to boot than the Desktop, but saves time when copying disks on a single drive machine. (The Finder copies disks with fewer disk swaps.) Although there are a few differences from the Mac's finder, Mac users will feel much more at home on the Finder than on Apple II Desktop.

**Do You Need an Upgrade?**

**Q.** *Is there a ROM upgrade available for the IIGS?*

**A.** Yes. The upgrade will replace your Read Only Memory (ROM) chip and your video control chip. This upgrade will remove a number of bugs from the old ROM as well as solve the infamous "pink

fringe" problem. The upgrade is available free from Apple dealers.

However, upgrade kits are in short supply so it's best to phone ahead for an appointment. Once you upgrade, do not use System Disks prior to the 2.0 version. No one has reported any commercial software to Apple which works under the old ROMs but not the new ones. Apple dealers will require you to upgrade your ROMs if you want the new video control chip.

**Q.** *How can I tell whether my IIGS has the old or the new ROM's?*

**A.** Watch the start-up screen which is displayed when you first turn on your IIGS. If your machine has the old ROMs, it will display "Apple IIGS" across the top of the screen and the rest of the screen will be blank. With the new ROMs, the bottom of the screen shows a copyright notice and a line saying, "ROM Version 01." If you do not have this message, be sure to get the free upgrade.

**Q.** *How can I test my IIC for the ROM update?*

**A.** Use the following procedure:

1. Switch on the IIC and press Control-Reset to stop the drive from spinning.
2. Type CALL -151 <return> to enter the Monitor. (You should have an asterisk (\*) prompt.)
3. Type Shift-1 (the "!" key) and press <return>.

You have the new ROMs, if it remains an \*. The old IIC ROM won't work with 3.5" disks or Apple's memory expansion card.

**Exchange Motherboards**

**Q.** *When I visited my Apple Dealer to install an Applied Engineering board in my IIC, he told me that my "MMU is soldered to my IIC's motherboard." I also want to use a 3.5" drive, which I borrowed from a friend and my ROM is apparently an older version, which does not support 3.5" drives. Can I get a free upgrade?*

**A.** Regarding the ROM upgrade, most Apple Dealers seem to require that you purchase a UniDisk in order to qualify for the free upgrade. Borrowed equipment does not seem to count.

Apple soldered in the MMU chip to increase the reliability of the IIC Logic Board. For owners who wish to purchase third-party peripherals, Apple has an inventory of motherboards with socketed MMU chips. The bad news is that if your IIC is out of warranty (including Apple-Care), then you will have to pay for the motherboard exchange.

**AppleWorks Tips**

**Q.** *When I start an Apple IIC with the AppleWorks Startup Disk, it asks for the program disk. After I insert the program disk and press return, the computer locks up, any clues?*

**A.** First, check that your AppleWorks Program Disk is not write-protected. Second, make sure that your copy of the AppleWorks program disk has the SAME name as the original: /APPLEWORKS. Also, be sure that your data diskware is not also named /APPLEWORKS.

**Q.** *I am trying to print labels with AppleWorks, but it is not recognizing my form size.*

**A.** Follow these steps:

1. From the main menu, select number 5, "Other Activities".
2. Select number 7, "Specify information about your printer(s)". You should now see a "Printer Information" menu.
3. Under the heading "Change printer specifications" select the name of the printer you want to use.
4. Change item number 2 "Accepts top-of-page commands" to no.

This trick will not print two or three labels across. Instead, try MacroWorks from Beagle Brothers. MacroWorks also adds Macro capability to AppleWorks. You can contact Beagle Brothers at (619) 296-6400.

**Q.** How can I transfer a word processor file created in AppleWorks, to AppleWriter, ProDOS version?

**A.** AppleWorks files cannot be read by AppleWriter directly. To transfer the file to AppleWriter you must print the file to disk. Use the following instructions:

1. With your AppleWorks word processor file in the window, press <Open-Apple-P>.
2. Choose "from the beginning", then select "A text (ASCII) file on disk." (This option "prints" your formatted file to disk rather than to a real printer.)
3. AppleWorks will ask for the pathname. Specify a disk and file name separated by slashes: /DISKNAME/FILENAME, where /DISKNAME is the name of your disk and /FILENAME is the name that you wish to save the file under.
4. You can now [L]oad the file into AppleWriter using the same pathname that you used to save the file in step 3.

**Q.** How can I reverse the process and read AppleWriter text files into AppleWorks?

**A.** From the AppleWorks main menu, select Add file to Desktop and create a new file for the Word Processor, indicate "From a text (ASCII) file" and provide the proper pathname when prompted.

**Q.** How do I delete formatting codes such as headers, footers, and page breaks from AppleWorks?

**A.** Press <Open-Apple-Z> to display all formatting codes. Highlight the codes using the cursor keys, and then press <Open-Apple-D> to delete them.

**Q.** My Applesoft program displays a status message on line 3. When a short message overwrites a longer one, I need to erase the rest of the line. How can I call the monitor ROM to do this?

**A.** Call -868 to erase to the end of the line. For example, your program might say: 10 VTAB 3:PRINT "short message":CALL -868.

**Q.** Is there confusion which may result in code, which causes SCSI hard disks to reformat themselves, thereby erasing their entire contents?

**A.** Yes. Apple II supersleuth Tom Vier reports that the Smartport operation code

for ejecting a 3.5" disk is 4, the same opcode assigned for reformatting SCSI hard disks. If a programmer assumes that a 3.5" disk is in a particular slot and drive and sends this command without checking the device type, hard disks could accidentally be erased. The moral of the story is to never assume that a particular device is attached to a given slot and drive.

Unfortunately, this makes program routines to eject disks much more complex to write. With Tom's help, I have rigged up the following Applesoft BASIC program which will scan all seven slots for a smartport and then identify each of the devices attached to each smartport. This should work on both the IIGS and IIe's with UniDisk or SCSI control cards. Lines 100-165 find the smartports.

The variable CSLOT has the value \$Cs00, where s is the slot number. Lines 700-750 poke in the parameters necessary to call the smartport ROMs. Lines 760-870 poke a machine language routine to JSR to the ROM. Lines 170-200 call the smartport to determine the number of units attached. Finally, lines 210-500 test the type of each unit. Of course, if you were trying to eject a 3.5 disk where you already know the slot and unit number, you would not need the loops and PRINT statements.

You could merely set SUB=3, call the smartport and then test IFTYPE=1 before you eject. Note that this program incorporates Apple's latest set of type codes. (See Smartport Tech Note # 4 for a list. The Open-Apple newsletter has been featuring a number of stories on accessing the smartport from BASIC, see Listing 1.)

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133 Fair        134 Poor

**LISTING 1**

```

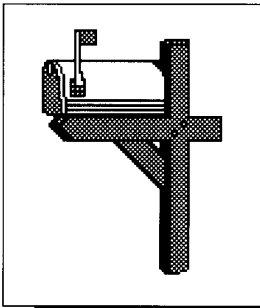
10 FOR SLOT = 1 TO 7
20 GOSUB 100
30 NEXT SLOT
40 END
100 REM Test slot for Smartport code
    bytes.
120 CSLOT = (192 + SLOT) * 256
130 IF PEEK (CSLOT + 1) < > 32
    THEN RETURN
140 IF PEEK (CSLOT + 3) < > 0

```

```

    THEN RETURN
150 IF PEEK (CSLOT + 5) < > 3
    THEN RETURN
160 IF PEEK (CSLOT + 7) < > 0
    THEN RETURN
165 PRINT SLOT;" is a Smartport"
170 UNIT = 0
180 CMD = 0
190 SUB = 0: REM Find # of units on
    Smartport
200 GOSUB 700
210 IF ERR THEN PRINT "ERROR":
    RETURN
220 NDEV = PEEK (784)
230 PRINT "Slot ";SLOT;" has
    ";NDEV;" devices."
240 CMD = 0:SUB = 3: REM
    Test Status
250 FOR UNIT = 1 TO NDEV
260 GOSUB 700
270 IF ERR THEN PRINT "ERROR":
    GOTO 500
280 TYPE = PEEK (805)
290 PRINT "Unit ";UNIT;" is a ";
300 ON TYPE + 1 GOTO
    320,330,340,350,360,370,380,
    390, 400,410,420
310 PRINT "ERROR": GOTO 500
320 PRINT "RAMdisk": GOTO 500
330 PRINT "3.5 Disk": GOTO 500
340 PRINT "ProFile Hard Disk":
    GOTO 500
350 PRINT "Generic SCSI Device":
    GOTO 500
360 PRINT "ROM Disk": GOTO 500
370 PRINT "SCSI CD-ROM": GOTO
    500
380 PRINT "SCSI Tape": GOTO 500
390 PRINT "SCSI Hard Disk": GOTO
    500
400 PRINT "SCSI Sequential": GOTO
    500
410 PRINT "SCSI Printer": GOTO 500
420 PRINT "5.25 Disk": GOTO 500
500 NEXT UNIT
510 RETURN
700 REM SET UP PARAMETERS
710 POKE 779,3
720 POKE 780,UNIT
730 POKE 781,16
740 POKE 782,3
750 POKE 783,SUB
760 REM CALL SMARTPORT
770 POKE 768,32
773 ADR = CSLOT + PEEK (CSLOT +
    255) + 3
775 POKE 769,ADR - INT
    (ADR / 256) * 256
780 POKE 770,ADR / 256
790 POKE 771,CMD
800 POKE 772,11: REM PARMS AT
    LOCATION 779
810 POKE 773,3
820 POKE 774,141
830 POKE 775,10
840 POKE 776,3
850 POKE 777,96
860 CALL 768: REM DO IT!
870 ERR = PEEK (778)
880 RETURN

```



# Write- A.P.P.L.E.

Readers' Forum

## AppleWorks IIgs

I have experienced a problem with the IIgs while using AppleWorks Ver. 2.0 (clean copy, no modifications). I will sometimes press Open-Apple P to print, and instead of going to the print menus, the disk drives on the IIgs will all start running — simultaneously! I have not been able to get out of this situation without either using Control Reset, or shutting down the system. Using either method, I have to re-boot AppleWorks, and data is lost! This has happened to me twice on consecutive work days, but I am unable to predict when it will happen. Even though the disk drives all started running these two instances, no data was lost from the disks that were in the drives at the time. (I was a little concerned when it first happened though!) The IIgs had printed with AppleWorks probably six times just prior to this mysterious occurrence. After re-booting, and loading up the same files again, the Open-Apple print option worked fine!

At the time this occurred, I had a 23K database, and two 2K word processing documents on the desktop. All of the IIgs control panel settings were at their default values. I was running AppleWorks off the 3.5" drive (slot 5, drive 1) and had my data disk in the 5.25" drive that came with the IIgs (slot 6, drive 1). In addition to those two drives being attached to the IIgs, I had an older 5.25" drive (slot 6, drive 2) daisy-chained to the first 5.25" drive with no disk in it. The IIgs had been running about 7 hours straight both times that the problem, occurred.

Today, I am back to just one 5.25" and one 3.5" drive on the IIgs, and I am curious as to whether or not the same

problem will occur. It is not likely that I will be duplicating all of the other circumstances that were in effect at the time of the other two occurrences. Can anyone provide a possible explanation for this occurrence? Has anyone else had the same experience?

I sent this inquiry to Apple's technical help people for an explanation, but they did not have one. The technician that responded thought the IIgs was looking for AppleWorks on disk at the time this problem occurred. This could be true if the GS was looking for the "print spec's," but AppleWorks was pre-loaded onto the RAM disk, so I think it should have looked at the RAM disk for the spec's. The technician suggested that I move the disk drives farther away from the monitor. The drives were 4-5" away from the GS and monitor on the left side. They are now 6" away. The problem has not re-occurred, but neither have the circumstances.

Larry Niebur

*Your first problem dealt with using the RAMdisk and two 3.5" disk drives. You found out that you needed ProDOS version 1.2 to be able to use the second 3.5" drive if the RAMdisk was being used. When you went to some of your newer ProDOS software packages, you found they contained ProDOS 1.1.1 to include AppleWorks 2.0 which contains upgrades to work with the IIgs. You logically assumed your IIgs system disk should have it so you copied the ProDOS file from it to your application disk.*

*When you booted the system, you obtained "UNABLE TO READ DIRECTORY," or something like that. You did*

*not know that ProDOS 1.6 would not work, yet ProDOS 8 was also on the System Disk under the name P8! The P8 file comes up as ProDOS Version 1.3. You have not tried it yet with the RAMdisk and two 3.5" drives combination, however, you are assuming it will work.*

*I was not aware of the problems you mention using Version 1.2 and a RAM disk. My system has two 3.5" drives and an Applied Engineering memory card. Several people have a similar configuration and have the second 3.5" drive in Slot 5, Drive 2. One would logically think the second 3.5" drive is Slot 5, Drive 2. This is not true, the RAM disk is called /RAM5 and occupies Slot 5, Drive 2. To set at the second 3.5" drive, one must specify Slot 2, Drive 1.*

*The problem with finding the proper version of ProDOS on some disk is unfortunate. I find it hard to believe Apple's documentation is so poor when it comes to helping the average user customize a system. I have had a lot of phone calls on this subject.*

*You and many others found that the ProDOS file in the root of SYSTEM.DISK has no resemblance to the ProDOS file on a version 1.1.1 disk. The documentation fails to tell you the ProDOS file you want is under the directory called SYSTEM and has the name P8. Like many others, you found out the hard way that P8 must be copied to your application disk and then renamed to ProDOS. After this, you can install the proper "xxx.SYSTEM" and you are on the air.*

*Regarding your second problem in which the IIgs will not print a hard copy from AppleWriter II ProDOS versions 2.0 or 2.1, I am glad you were able to install a patch from Don Lancaster to remedy the problem. According to your letter, Don says his patched version will not work with the IIe and will not support the use of a modem.*

*I would not have been able to help you on the second problem. When ProDOS came out, I purchased AppleWorks not AppleWriter, therefore, any knowledge I would have dates back to the DOS 3.3 version of AppleWriter. Making a wide variety of printers work with a wide variety of software has created many headaches for the industry.*

*If you or other readers have any other problems, don't hesitate to call. I really enjoy talking about the Apple systems.*

Cecil Fretwell

(Cecil is listed on the consultant's page - Ed.)

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**RAMWORKS 1**— With 512K including Applied Engineering Desktop Expander & Ramdisk software. \$125 w/trade-in of extended 80-column card. No RGB expansion available. (408) 253-9238. Ninth Wave, 21907 Almaden Avenue, Cupertino, CA 95014.

**LITTLEJACK** headphone jack and volume control allows private listening on Apple II, II+, and IIe! Works with all software. Installs in minutes—no tools needed. \$29.95 + \$2 s&h (includes headphones). 90 Day Warranty. FL residents add 5% Tax. Sevens Hills Software, 2310 Oxford Road, Tallahassee, FL 32304, (904) 576-9415, 9am-5pm EST. Visa/MC/COD Orders only, (800) 531-3122, 8am-4:30 pm PST.

**CARD PARTNER EUCHRE**— Hi-Res card game for Apple II+, IIe, IIc, IIgs. Lots of features and great fun, game after game! \$17.95 + \$2 s&h, 90 day warranty. FL residents add 5% Tax. Sevens Hills Software, 2310 Oxford Road, Tallahassee, FL 32304, (904) 576-9415, 9am-5pm EST. Visa/MC/COD orders only (800) 531-3122, 8am-4:30 PM PST.

**HARD DISK OWNERS**— Recover from the dreaded ProDOS "Please restart system — Error 0C" message! Recovers files, and entire ProDOS volumes!! Displays or prints file and block usage!! Comes complete with online help, and even works with a mouse, all for \$9.95!! To order, send check or money order to MOUSE CHKDKS, 3119 Mason Road, Houston, TX 77449.

**A HACKER'S CHALLENGE**— Awaits those who enjoy "Breaking" Protection schemes for fun. Knowledgeable with DOS 3.3 and associated utilities? If so, this game is for you. Includes Graphics routines from The Graphics Magician by Polarware. Protected by layers of graphical puzzles and DOS-Tricks Hides A Secret. Being among the 1st ten to discover this Game-Secret wins you a computer-game prize! What are these prizes? I'm not saying, yet all the clues you need to win along with this Prize List are concealed in the Game. Find the clues by Playing the game. Find clues by using your favorite utilities. To answer this challenge, send \$9.95 to Mark Whitehurst, PO Box 485, Franklin Park, IL 60131. Requires IIe/c.

**INTERFACE CARDS FOR WHOLESALE PRICE**— 16K RAM Card \$29.20, Z-80 Card \$26.90, 128K RAM Card \$60.90, 6522 Card \$26.30, 80 Column Card \$38.80, Drive Card \$27.00, Color Graphic Card \$57.80, Monochrome Graphic Card \$66.90, Mouse \$36.00, Telefax Card \$132.00, And 120 more different kinds of cards for special price. Hunter Electronic Co., LTD, P.O. Box 53-130, Taipei Taiwan, Rep. of China.

**RENT APPLE II SOFTWARE**— \$5 monthly. No membership fee. Send large \$39 SASE for list. PS, 4229 Baker Ave, NW, Seattle WA 98107.

**75 CENT APPLE PUBLIC DOMAIN LIBRARY**— Our 190 disk library contains thousands of programs for the Apple II, II+, IIe, IIc and IIgs: business, educational, games, EAMON adventures, music, graphics, utilities, hobbies, more. Our

copy-shipping fee is 75 cents/disk postpaid. We can copy onto disk(s) you mail to us for this fee or provide blank disks — \$1.10 each extra. We can copy single-sided or double-sided. Our 42 page public domain catalog is \$2. No additional charges or membership fees. ASPEN SOFTWARE, 729 1/4 E. Portland St., Phoenix, AZ 85006, (602) 253-0651.

**BEYOND PINBALL**—The first Pinball Adventure Game — is not another computer simulation of pinball but stretches the concept as only a computer can. Contains not one but 16 games. Contains not one, but 48 screens to play on. Does not have two stationary button-controlled flippers, but instead, a joystick-controlled bumper and 360-degree-swinging bat movable all over the screens. Some of the types of obstacles you'll encounter: Black Holes, Forbidden Zones, Transport Tubes, Moving Objects and Switchable Objects. Includes extensive manual and game maps. All Apple II series. Total price = \$21.95 (\$35.00 for Pinball and Hi-Res Golf 3). Send check, M.O. or Visa-Mastercard number to Prime-Ware Creations, Box 1058, Philomath, OR 97370. Need more info? Send SASE. (503) 929-6221.

**HI-RES COMPUTER GOLF 3**— Eight Pro-Courses version. Now in its sixth year, this version contains the same quality features of prior versions and includes a beginners course and EIGHT professional tour golf courses. Contains true-to-scale fairways and greens (longer holes require multi-screens), green contours, sand traps, roughs, trees, water traps and variable wind conditions. Eight clubs in your golf bag. You physically swing the clubs or use the auto-swing feature. Bad swings may cause tops, undercuts, hooks, slices, etc. Up to a foursome can play. The package contains two diskettes, extensive manual and command card. All Apple II series. Total price = \$21.95 (\$35.00 for Golf and Beyond Pinball). Send check, M.O. or Visa/Mastercard number to Prime-Ware Creations, Box 1058, Philomath, OR 97370, (503) 929-6221.

**US \$8.00 including disk!** Thousands of famous Business, Education, games, and programs for Apple II, IIe, IIc and IBM/PC. Details US \$1.00 Reliant, PO Box 33610 Sheungwan, Hongkong.

**BURIED UNDER MOUNTAINS OF CORRESPONDENCE?** Let INSTA-LETTER help. This new and unusual piece of software is not a word processor. It contains over 35 actual skeleton letters including thank you, sympathy, complaint, collections, request, praise, and more! You personalize each letter with your own words. Use for home and business. Runs on any Apple II series computer with 80 column card and printer. Rush \$49.95 to WordWeavers, P.O. Box 617, Dept. 102, Kent, WA 98032. (WA residents add 8.1% sales tax). Satisfaction guaranteed.

**KERMIT**— Why spend hundreds for communications software when the best is FREE! Just send me \$8 for the disk, documentation, shipping and handling and I'll send you Columbia University's APPLE-II KERMIT, FREE! Jim Fox, 14756 Castle Shannon, Pittsburgh, PA, 15234.

**APPLE COMPATIBLES LOW PRICES!**— IIe 1 Meg/80 column

board, w/256K & Software \$99. IIGS 1Meg RAM board w/ 256K \$89. GS Super Cooling Fan \$25. II+/IIe Cooling Fan with Surge Protect \$29. Super Serial Board \$49. II+ 80 Column Board \$49. Graphic Parallel Bd w/6 Ft Cable \$45. New A/B Switchbox Centronics or RS-232 \$29. IIe Keypad \$35. More Products +e/c/GS. Call/Write for our complete list. One year warranty. Add \$3.00 Shipping. COD + \$2. Visa/MC okay. School P.O.'s Welcome. NEXO DISTRIBUTION, 918 E. 8th Street, Suite 109, National City, CA 92050, (619) 474-3328.

**FREE LISTING**— of our Apple II software. Just write: Lamsoft Development, PO Box 42801, Philadelphia, PA 19101.

**EDUCATIONAL SOFTWARE**— For the Apple II series computer. Dozens of programs which are fun, challenging, and motivating for students. Programs include: Math Race, Math Master Series (6 programs, generates millions of math worksheets), Math Dot-to-Dot Puzzles (6 programs, generates millions of math puzzles), Math Bingo Series (6 programs, excellent classroom activity), Word Master Series (3 programs, spelling & vocabulary), Study Master Series (4 programs, students learn facts & generates tests), Electronic Gradebook, Computer Dating (fund raiser), plus more. All programs are not copy protected. Write for free catalog or send \$6 for sample math disk (refundable with any purchase). MACWARE, Box 27, Chillicothe, OH 45601, (614) 773-3223

**KEYBOARD**— IBM Style detached Case, Full ASCII updates II+; 1 Key commands Like CATALOG, PROGRAMMABLE Keys Enhance IIe, \$50 up, SASE, MARTEK, PO Box 24, Novi, MI 48050.

**THE RUINS OF KELEDOOR**— You tromp through creature infested ruins for fortune and glory to recover some special treasures. WHAT WILL YA SEE? A fully graphical 3-dimensional hi-res game with sound effects. Dungeon surroundings are fully colored and detailed, even down to the cracks in the walls! Monsters you attack look their fiercest in full detailed color. HOW HARD IS THIS GAME? Unlike other adventures taking Months or years to win, this one can be solved in a long weekend of play. You can actually play this game to conclusion! WHAT DO YA GET? An adventure booklet and UNPROTECTED two-sided game disk for \$12.95. Demonstration disk is \$3.00. Send check to Mark Whitehurst, Box 485, Franklin Park, IL 60131.

**WPL DATA BASES AND SPREADSHEETS**— Make your own customized data bases and spreadsheets using ProDOS AppleWriter with Don Thompson's WPL Expansion Kit. The Kit offers more strings (up to 255 characters long), more numerics (up to 4 billion + adds, subtracts), multiplication, division, compare numerics (<, =, >), Get Key, Peek & Poke, and clock support. Also Nine new WPL in-file options for DB and SS use. Determine cursor position (in a line, in a file, which line) for use in setting up records and fields. Pick up a word from a file (W) and put into a string variable, tab over or tab under within WPL, and more. Machine language sorts (soon). Call or write for more information. Sixth edition KIT price: \$54.50 + \$2 s&h (Visa/MC). Upgrades available. Order now: Thompson & Thompson, 23072, Lake Center, #210, El Toro, CA 92630, (714) 855-3838.

**FOR SALE**— Apple II+, 64K, lower case adaptor, Super-Mod modulator, \$275. Fourth Dimension disk drive, \$95. Mockingboard A, \$45. Parallel card, \$35. PIE Writer 2.2, \$35. Music Construction Set, \$18. Okidata 82A parallel/serial printer, \$175. Mannesman-Tally MT 160L near letter quality printer, parallel/serial, \$195. All in excellent condition with original documentation. (717) 396-9752, 5p.m. to 10 p.m. eastern time.

# THE MARKETPLACE

The following items are selected by our editorial staff from the large number of product announcements and news releases sent to us daily. They are presented solely to keep you informed about the current market for Apple related hardware and software. As we have not tested many of these products, appearance here does not necessarily represent endorsement or recommendation by A.P.P.L.E. Co-op. Further information about items appearing in The Marketplace can be obtained through the Reader Service Card. If you contact any manufacturer directly, please mention that you learned about them in *Call-A.P.P.L.E.*

## GAMES FOR THE HOLIDAYS

### FIVE NEW GAMES

PBI Software announces five new entertainment programs for the Apple IIGS. They are the Tower of Myraglen, Strategic Conquest II, Cavern Cobra, Sea Strike, and Monte Carlo.

The Tower of Myraglen combines spectacular IIGS graphics and digitized stereo sound (when used with MDIdeas SuperSonic Stereo Card) in an exciting arcade adventure fantasy game. The player is the last remaining Knight of Justice, his task is to retrieve the Medallion and save the Kingdom. He must enter the mysterious Tower and survive the myriad of intricate traps, mazes, secret passages and dangerous creatures. Price: \$54.95.

Strategic Conquest II is a war strategy and tactics game in which players must explore and conquer a vast unknown world. The player is Commander-in-chief of an army, navy, and air force, the computer is his enemy. Similar to Risk, SC II brings the concept to a more sophisticated level. SC II is also available for the Apple II and IIC. Price: \$49.95.

Cavern Cobra and Sea Strike are arcade style action games with great graphics and digitized stereo sounds. Cavern Cobra puts the player at the helm of a Cobra attack helicopter. He must rescue hostages held by terrorists deep within layers of secret underground caverns. Pilots must respond to different threats with a variety of weaponry. Sea Strike puts the player at the helm of a helicopter which must defend a convoy of oil tankers from enemy attack. Fast reflexes and gut instincts are required. Cavern Cobra: \$49.95. Sea Strike: \$39.95.

Monte Carlo turns the IIGS into a full time casino royal, complete with blackjack, baccarat, craps, roulette, poker, keno, and of course slot machines. Monte Carlo features full super hi-res color graphics and digitized stereo sounds. Price: \$39.95.

PBI Software, Inc., 1163 Triton Drive, Foster City, CA 94404, (415) 349-8765.

CIRCLE 14 ON READER SERVICE CARD

### THE SPY'S ADVENTURES IN SOUTH AMERICA

The Spy's Adventures in South America is the newest release in Polarware's The Spy's Adventures Around The World series. The adventure takes you on a continental search for the fiendish Dr. X, who may be hiding anywhere from Belize to the Antarctic. Travel South America and beyond in search of informants, who may give you clues to Dr. X's secret location. Learn the geography of the continent as you play or just play for fun! The adventure may be played by a single player, or with up to 6 people in a Spy against Spy network, or in a cooperative Spy network. Never play the same game twice!

Price: \$17.95, Polarware, 521 Hamilton St., P.O. Box 311, Geneva, IL 60134, (312) 232-1984.

CIRCLE 15 ON READER SERVICE CARD

### TRAIN AND TRANSIT DESIGN SOFTWARE

With a little creativity and an Apple II computer, model railroad enthusiasts can now design a complete layout in a fraction of the time it takes to experiment with real layout building. And people who never had an interest in trains before may suddenly become interested once they've had a chance to have fun with this train and transit system construction set.

We tried for the most realistic train operations possible, as well as the easiest user interface. The program uses pull-down menus, icons, allows text input, and includes libraries of hundreds of layout shapes for scenery. It also has painting and color fill capabilities.

Design your own Train consists of 99 layout speeds, 4 independently controlled trains, up to 26 operating switches per layout, operating train stations, and independent speed and direction controls. Custom locomotives can also be built with the special Scratch-Building feature. Price: \$49.95.

Abracadata, Ltd., PO Box 2440, Eugene, OR 97402, (503) 342-3030 or (503) 669-1406.

CIRCLE 16 ON READER SERVICE CARD

### FLIGHTSTICK

CH Products, the U.S. leading manufacturer of precision analog joysticks for industry and home, is proud to introduce the FlightStick for the entire Apple II family of personal computers. The FlightStick can be used with any software designed to use a joystick and would be an excellent choice for computer aided design software because of the added precision, user comfort and small footprint.

CH Products' FlightStick has a contour pistol grip that fits the hand like a glove with strategically placed trigger and fire buttons that provide both an audio and tactile feedback that adds to the reality of flight simulation. Features:

- Dual axis trim controls.
- High quality linear potentiometers rated at four million life cycles.
- Return to center accuracy of  $\pm 5\%$ .
- Five foot cable with finger screws for easy installation.
- Heavy duty construction and a complete ninety-day warranty.

Price of the Apple FlightStick (P/N 200-501) is \$74.95. The Apple model is plug compatible with the Apple IIe, IIC, IIGS and compatibles.

CH Products, 1225 Stone Drive, San Marcos, CA 92069, (619) 744-8546.

CIRCLE 17 ON READER SERVICE CARD

### HIGH SEAS GAME

Gardé Games of Distinction announces the "High Seas" for the Apple II family, an action simulation that puts players in command of the most powerful ships that ever moved under sail. Included are 5 1/4 inch Game Master Disk and Scenario Disk, featuring scenarios that range from one-on-one skirmishes to engagements between entire fleets. Players can also design their own scenarios. A detailed, but easy-to-follow rule book describes the many game features, including the ability to load and save ships to disk, a built-in ship editor, and a flag ship control option. An introductory tutorial is also provided.

Whether challenging the computer or a human opponent, players control the action as they sail their ships into battle, each vying for the wind advantage and a clear broadside. On the High Seas, mastery of sailing is the difference between victory and defeat. The drop down menu system provides easy access to all the game's commands and options.

Instrument readouts indicate the wind heading and velocity as well as the ship's speed, attitude to the wind and target ranges. Reports are received on ship and crew status, orders, damage, guns, and targets. Graphics include a panoramic three-dimensional battle view, a map screen for maneuvering and a chart view for a global look at the situation.

Players can assume various roles as they search for adventure

and plunder. As Privateers, they prey on enemy merchant ships. As Captains, they command one ship of the fleet or stand alone against the enemy. As Admirals, an entire fleet is theirs to command. Price: \$49.95.

*Gardé Games of Distinction, 8 Bishop Lane, Madison, CT, 06443, (800) 367-1435 or (203) 245-9089.*

CIRCLE 18 ON READER SERVICE CARD

## BEYOND ZORK

Infocom announces a new era with Beyond Zork. Set in the legendary Zorkian universe, Beyond Zork is not a sequel to The Zork Trilogy: it is a new chapter in the rich and growing lore of this fantastic universe. The riveting action and elaborate puzzles will excite both novice and experienced Zork adventurers.

Drawing on the most popular aspect of role-playing games, Beyond Zork lets you create your own characters. There are six attributes: strength, endurance, compassion, luck, intelligence, and dexterity. You choose how much of these attributes to give yourself. But remember, there is a trade-off — if you choose to be extremely intelligent, you are left with less potential in the other areas. Or, if you think your destiny is ruled by fate, you can let the computer define your character, either by randomly selecting your attributes or by choosing a predefined character. As you venture onward, your character will evolve, with the level of your attributes increasing as you gain experience and battle foes.

Innovations in Beyond Zork extend even to the look of the screen. Windows display your attributes, your location, or your inventory throughout the course of the game. An on-screen map makes it easy to chart every move. With Beyond Zork, you choose the screen option — either with the map and window display or with a standard Infocom test-only screen.

Other enhancements:

- Programmable function keys.
- Increase the game's vocabulary.
- Undo command.

Price is \$49.95. For more information contact:

*Infocom, Inc., 125 CambridgePark Drive, Cambridge, MA 02140 (617) 492-6000.*

CIRCLE 19 ON READER SERVICE CARD

## MEMORYSAVER

Checkmate Technology announces MemorySaver. MemorySaver's unique hardware/software system transforms standard Apple II GS memory cards into fast-booting, instant-access ROM disks.

Features:

- MemorySaver allows the user to create a fast, permanent ROM disk that can be many times larger than the 512K maximum size.
- MemorySaver supports competitors' II GS memory cards, as well as a new 2 megabyte II GS card.
- MemorySaver can actually accommodate two separate RAM cards, thus providing maximum flexibility in upgrading the system.

Suggested retail price is \$149.95. Call or write to:

*Checkmate Technology, Inc. 509 South Rockford Dr., Tempe, AZ 85281-3021, (800) 325-7347.*

CIRCLE 20 ON READER SERVICE CARD

## SCHOOL NETWORK

Corvus System, Inc., has introduced a new generation of its Constellation networking software for Apple II computers. Designed with the input of educational experts, the new product, designated Constellation III, is structured specifically for classroom situations and is designed to be an effective education management tool that can be easily administered by busy educators and other non-computer experts.

Constellation III enables the entire family of Apple II personal computers, from 48K Apple II's to the high-end Apple II GS, to be used on a Corvus Onminet local area network. Students share

programs, hard disk space and printers over the network, thereby reducing expenditures for the schools and minimizing floppy disk handling for the teachers. Data files and programs can be shared among users or protected from unauthorized access with passwords.

Constellation III includes many new features that streamline network management tasks, such as a batch processing mode that lets the network manager set up an entire class in minutes and prepare planning worksheets that give teachers guidance in network organization. The software supports the three most popular Apple II operating systems — ProDOS, DOS 3.3 and UCSD Pascal —and runs the largest number of educational software programs of any network available.

Constellation III also allows simultaneous use of CP/M, MS-DOS and Macintosh programs on the network and manages accounts and volumes that run under those operating systems. Users can transfer files between any computers on the network. Many of Constellation III's new features simplify the job of managing a school's network and enable educators with no programming experience to efficiently organize and administer the system:

- A batch processing mode sets up network accounts and volumes for a class in a matter of minutes.
- 8 simplified menus appear in pop-up windows that are easier to use and more accessible than layers of nested menus.
- Prompts and help screens use familiar terms and anticipate typical classroom situations.
- The documentation includes worksheets for planning an efficient network structure and provides step-by-step instructions for setting up volumes and user accounts.
- The network software provides ProDOS, DOS 3.3, and Pascal utilities, including routines for listing and copying files, mounting and unmounting volumes, selecting printing options, backing up the hard disk and diagnosing hardware problems.
- A new optional companion program, MenuMaker, allows teachers to create custom menus without programming.

Constellation III requires one 128K Apple IIe for network management, but a minimum of only 48K in each other Apple II on the network. It supports up to 63 workstations simultaneously and up to ten network hard disk drives with an aggregate storage capacity of one gigabyte. The new software is fully compatible with Constellation II. A Constellation II network can be upgraded to Constellation III in about fifteen minutes. Price: \$495.00.

*Corvus Systems, Inc., 160 Great Oaks Boulevard, San Jose, CA 95119-1347, (408) 281-4100.*

CIRCLE 21 ON READER SERVICE CARD

## DATA BASE MANAGERS

Stone Edge Technologies, Inc., announces DB Master Version Five, and DB Master Version Five Professional. The two programs are designed to meet the need for more data base management power than is available in AppleWorks, the leading productivity program for the Apple II.

DB Master Version Five is based on the design of earlier versions of DB Master, which has been available since 1980. However, the program has been completely re-written in assembly language to work with the ProDOS operating system and to take advantage of the greater power of the newer Apple II's. Both of the new programs can convert data base files created with AppleWorks or with earlier versions of DB Master into DB Master Version Five files.

Version Five Professional also includes high-power features such as multi-file relational capabilities, keystroke macros, field validation rules, a global editor, and password security. Special educational and multi-user versions of the programs are also available.

Price:

*Stone Edge Technologies, PO Box 200, Maple Glen, PA 19002, (215) 641-1825.*

CIRCLE 22 ON READER SERVICE CARD

## MEGA RAM & MEGA ROM

Parallax, Inc., introduces its first two products for the Apple II GS. Both are memory products exclusively for the II GS.

MegaRAM, a 1 Megabyte RAM expansion board. MegaRAM features two expansion ports, allowing further additions to MegaRAM itself, such as additional RAM or ROM. Because of a highly efficient design and single memory size, Parallax is able to offer MegaRAM for an inexpensive \$189.95.

MegaROM, is an 896 Kilobyte ROM expansion board. MegaROM piggybacks to MegaRAM, expanding the IIGS's ROM to the maximum possible. Like MegaRAM, MegaROM has two expansion ports for further additions. MegaROM's main function is for storage of archival or frequently-used data; however, Parallax is currently working with several major software publishers to offer popular software on ROM. MegaROM is available unpopulated for \$89.95. Software on ROM will be announced as soon as it is available.

Parallax, Inc., 5249 Locust Avenue, Carmichael, CA 95608, (916) 721-5451.

CIRCLE 23 ON READER SERVICE CARD

**SMOOTH TALKER**

A Software-only, text-to-speech synthesis product, SmoothTalker accepts plain English text from either the keyboard or from a text file and automatically synthesizes the text into a clear and smooth-sounding adult male or female voice. This program requires no additional hardware to operate.

Applications for this speech technology include: Teaching Languages, Accounting Systems, Scientific Applications, Education, Data Entry Proofreading, Critical Output Analysis, Product Tutorials and Information Broadcaster.

SmoothTalker for the IIGS comes with a comprehensive user manual. Also a tutorial on the disk, which can be printed out, provides users with verbal instructions on its uses. Price: \$49.95

Electronic Arts, PO Box 7530, San Mateo, CA 94403, (800) 245-4525 or (800) 562-1112.

CIRCLE 24 ON READER SERVICE CARD

**TIMEOUT SERIES**

Beagle Brothers introduces seven new AppleWorks enhancements that are more advanced, more powerful, faster and easier to use than anything you've ever seen. All 7 programs work inside AppleWorks:

- TimeOut Graph — Turn spreadsheets into great looking graphs. Nine graph types, auto or manual scaling, titles, legends, labeling, grid lines, axes, symbols and line formatting, and print in several sizes. Price: \$89.95.
- TimeOut Superfonts — Proportionally spaced characters, mix fonts and sizes from 6 point to 127 point, high quality print mode, 50% reduction, styles, and mix graphics with text. Price: \$79.95.
- TimeOut QuickSpell — Checks even large documents in seconds, make corrections in context or from a list of misspelled words, suggested spellings, finds and corrects "double words" and custom dictionaries. Price: \$69.95.
- TimeOut Ultramacros — Memorizes thousands of keystrokes, built-in commands and macros, over 50 programming commands and special key-lock for handicapped. Price: \$59.95.
- TimeOut Sidespread — No limit on spreadsheet size, print all or part of the file with 50% reduction. Price \$49.95.
- TimeOut Filemaster — Copy, compare rename, delete, lock and unlock files, erase and format disks, create and copy subdirectories and displays 100 files at once. Price: \$49.95.
- TimeOut Desktools — Calendar with appointment scheduler and task list, calculator, notepad, dialer, envelope addresser, clock, clipboard converter, page preview and puzzles. Price: \$9.95.

Beagle Bros, Inc., 3990 Old Town Avenue, Suite 102C, San Diego, CA 92110, (619) 296-6400.

CIRCLE 25 ON READER SERVICE CARD

# JOIN A.P.P.L.E. Co-op

The World's Largest Computer Co-op  
Get more from your personal  
computer investment!

**Benefits of Co-op membership:**

- **Become an Owner** — Co-op's are owned by their members, who receive annual dividends that correspond to their annual purchases, times the percent of the Co-op's annual profit.
- **12 issues of:**  
**Call -A.P.P.L.E. magazine** (Apple II/GS)  
and/or  
**MacA.P.P.L.E. magazine** (Macintosh)
- **Hotline/Technical Support:**  
You can get information and help with almost any Apple-related problem from our staff experts. Our staff is backed up by a group of consultants which are specialists in a variety of areas.
- **Telecommunications** — The wave of the future that you can be a part of. With your Apple and a modem you can send and receive information, messages and programs from the A.P.P.L.E. Crate Bulletin Board Service.
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## AE APPLIED ENGINEERING™

**RamWorks III™** If you have a IIe this card is perfect and if you use AppleWorks, it's an absolute must! Applied Engineering was the first company to expand AppleWorks and they're always 6-12 months ahead of the competition. And you can stay current with our FREE SOFTWARE UP-GRADES. Why settle for a partial compatible when you can have a real RamWorks at a discount price.

RamWorks III 256K ..... **\$159**  
 RamWorks III 512K ..... **\$199**  
 RamWorks III 1 MEG ..... **\$259**  
 RamWorks III 1.5 MEG ..... **\$389**

**65C816 16 Bit Card** Requires RamWorks II or III and Apple IIe. **\$149**

**RamWorks RGB Option** Even if you bought a RamWorks just to use the RGB option, it would be worth it. Runs both Apple and IBM RGB monitors, and is compatible with Apple's standard for RGB, includes cables. **\$99**

(See our new RGB monitor ar right.)

**TransWarp™** We tested all the accelerators and TransWarp was 20-300% faster than the others. Runs cool too! **\$219**

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**Timemaster H.O.™** Timemaster H.O. has the most features and is the easiest to use. It comes with more software than any other clock card. It even adds 15 new commands to BASIC! **\$79**

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**RamFactor™** If you have a II+ or would rather use slots 1-7 in your IIe or IIgs, RamFactor is for you. It is fully compatible with Apple's memory card, runs AppleWorks on a IIe, II+ or IIgs and has a battery back-up option.

RamFactor 256K ..... **\$189**  
 RamFactor 512K ..... **\$224**  
 RamFactor 1 MEG ..... **\$299**  
 Battery Back-up ..... **\$149**

**Extended 80 Column Card with 64K** For IIe, with documentation. **\$69**

**gsRAM & gsRAM Plus** These cards offer much greater performance and expansion capabilities than Apple's memory card and unlike most others, gsRAM and gsRAM Plus use standard RAM's so further expansion is easy and economical. Only gsRAM and gsRAM Plus can expand AppleWorks 2.0 internal limits and include a built-in printer buffer.

gsRAM 256K ..... **\$139**  
 gsRAM 512K ..... **\$179**  
 gsRAM 1 MEG ..... **\$249**  
 gsRAM 1.5 MEG ..... **\$319**  
 gsRAM Plus 1 MEG ..... **\$379**  
 gsRAM Plus 2 MEG ..... **\$619**

**IIc Clock™** Clock/Calendar for IIc **\$39**

**Z-RAM Ultra** For all IIc's  
 Ultra 1: 256K ..... **\$169**  
 Memory Only 512K ..... **\$209**  
 Ultra 2: 256K ..... **\$209**  
 Memory & Clock 512K ..... **\$249**  
 1 MEG ..... **\$319**  
 Ultra 3: 256K ..... **\$259**  
 Memory, Clock & 512K ..... **\$299**  
 CP/M 1 MEG ..... **\$369**

**Internal 1200 Baud Modem** DataLink for Apple IIe, II+, and IIgs. Compact design, fits any slot (except 3 of IIe and IIgs) including 1 and 2 of the IIgs even with fan. Hayes AT compatible. Auto-dial, auto-answer and built-in speaker. Powerful communications software in ROM and on disk. Totally complete with phone cable and manual. **\$169**

### More Quality Products

**Ultra Hi-Res RGB Monitor/TV** This Sony RGB monitor uses a 13" ultra hi-res CRT for super sharp 80 column text and great graphics. Works with the IIe and IIgs. But in addition to being the best RGB monitor available this unit is also a 180 channel cable-ready television set with remote control. Try it. You WILL like it. Only **\$489**

**IIe RGB Cable \$19 w/Sony** (\$29 Sep.)  
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**5-1/4" Disk Drive** Super quiet direct drive compatible with all Apple software and Apple controller card. A top quality unit with 1 year warranty. Add \$20.00 for IIc/IIgs Cable. Only **\$119**

**5-1/4" Disk Controller \$49**  
**16K RAM Card** For Apple II and II+ **\$69**

**Heavy Duty Apple Power Supply** Over twice the output current of Apple's original power supply for IIe and II+. **\$59**

**Kensington System Saver** Fan with 2 power outlets and surge protector. **\$69**

**Pinpoint's AppleWorks Accessories** The best available and they are written to fully utilize Applied Engineering's RAM cards. (Includes RAM enhancement software.) Together a \$118 value. Only **\$59**

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**MacroWorks and Super MacroWorks**

"... the best single AppleWorks add-on available today." A+ Magazine. Add new word processing power, create your own Macros and save lots of keystrokes. Use mouse with AppleWorks. No more path-names! Just select from a menu. Buy MacroWorks for AppleWorks versions 1.0 - 1.3. Buy Super MacroWorks for AppleWorks version 2.0.

MacroWorks (List 34.95) ..... **\$29.00**  
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**256K RAMS** 150ns. 5 year warranty. Set of 8 **\$39**

**VIP Professional** Lotus 1-2-3 Work-alike. For IIe & IIc (List \$249) **\$169**  
 For IIgs (List \$299) **\$199**

**RamWorks™** That's right, RamWorks not RamWorks II. RamWorks is the memory card that started the revolution. RamWorks can expand to 512K on the main board and up to 1 meg with an optional 512K piggy-back and can accept Applied Engineering's new RGB option. A 512K RamWorks gives AppleWorks a 360K desktop. Comes with Applied Engineering's newest software. With 512K **\$139**

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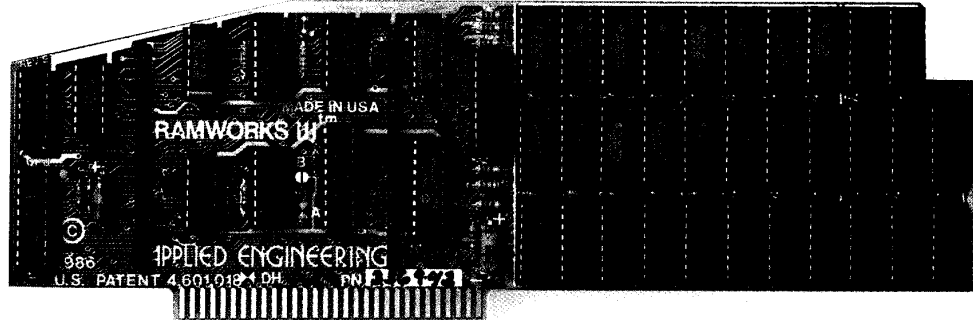
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CIRCLE 8 ON READER SERVICE CARD



# RamWorks® III

*Patented Performance from the Recognized Leader*



*With battery backed RAM port, RGB port, increased memory capacity, full software compatibility and more compact design, RamWorks III is a generation ahead.*

RamWorks III is the newest 3rd generation RAM card for the Apple IIe. It incorporates all of the technology and improvements that years of experience and over a hundred thousand sales have given us. By selling more memory cards than anyone else and listening to our customers, we were able to design a memory card that has the ultimate in performance, quality, compatibility and ease of use. A design so advanced it's patented. We call it RamWorks III, you'll call it awesome!

### The AppleWorks Amplifier.

While RamWorks III is recognized by all memory intensive programs, NO other expansion card comes close to offering the multitude of enhancements to AppleWorks that RamWorks III does. Naturally, you'd expect RamWorks III to expand the available desktop, after all Applied Engineering was a year ahead of everyone else *including Apple* in offering more than 55K, and we still provide the largest AppleWorks desktops available. But a larger desktop is just part of the story. Look at all the AppleWorks enhancements that even Apple's own card does not provide and *only* RamWorks III does. With a 256K or larger RamWorks III, *all* of AppleWorks (including printer routines) will automatically load itself into RAM dramatically increasing speed by eliminating the time required to access the program disk drive. Switch from word processing to spreadsheet to database at the speed of light with no wear on disk drives.

*Only* RamWorks eliminates AppleWorks' internal memory limits, increasing the maximum number of records available from 1,350 to over 25,000. *Only* RamWorks increases the number of lines permitted in the word processing mode from 2,250 to over 15,000. And *only* RamWorks offers a built-in printer buffer, so you won't have to wait for your printer to stop before returning to AppleWorks. RamWorks even expands the clipboard. And auto segments large files so they can be saved on two or more disks. You can even have Pinpoint or MacroWorks and your favorite spelling checker in RAM for instant response.

RamWorks, *nothing* comes close to enhancing AppleWorks so much.

### The Most Friendly, Most Compatible Card Available.

Using RamWorks III couldn't be easier because it's compatible with more off-the-shelf software than any other RAM card. Popular programs like AppleWorks, Pinpoint, Catalyst, MouseDesk, HowardSoft, FlashCalc, Pro-File, Managing Your Money, SuperCalc 3a, and MagiCalc to name a few (and *all* hardware add on's like ProFile and Sider hard disks). RamWorks is even compatible with software written for Apple cards. But unlike other cards, RamWorks plugs into the IIe auxiliary slot providing our super sharp 80 column text (U.S. Patent #4601081) in a completely integrated system while leaving expansion slots 1 through 7 available for other peripheral cards.

RamWorks III is compatible with all

Apple IIe's, enhanced, unenhanced, American or European versions.

### Highest Memory Expansion.

Applied Engineering has always offered the largest memory for the IIe and RamWorks III continues that tradition by expanding to 1 full MEG on the main card using standard RAMs, more than most will ever need (1 meg is about 500 pages of text)...but if you do ever need more than 1 MEG, RamWorks III has the widest selection of expander cards available. Additional 512K, 2 MEG, or 16 MEG cards just snap directly onto RamWorks III by plugging into the industry's only low profile (no slot 1 interference) fully decoded memory expansion connector. You can also choose non-volatile, power independent expanders allowing permanent storage for up to 20 years.

### It Even Corrects Mistakes.

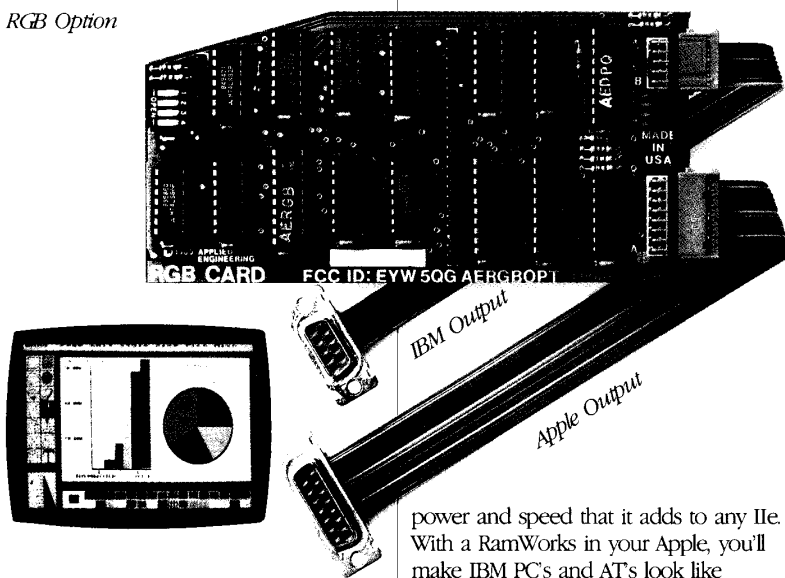
If you've got some other RAM card that's not being recognized by your programs, and you want RamWorks III, you're in luck. Because all you have to do is plug the memory chips from your current card into the expansion sockets on RamWorks! to recapture most of your investment!

### The Ultimate in RGB Color.

RGB color is an option on RamWorks and with good reason. Some others combine RGB color output with their memory cards, but that's unfair for those who don't need RGB *and* for those that do. Because if you don't need RGB

Applied Engineering doesn't make you buy it, but if you want RGB output you're in for a nice surprise because the RamWorks RGB option offers better color graphics plus a more readable 80 column text (that blows away any composite color monitor). For only \$129 it can be added to RamWorks giving you a razor sharp, vivid brilliance that most claim is the best they have ever seen. You'll also appreciate the multiple text colors (others only have green) that come standard. But the RamWorks RGB option is more than just the ultimate in color output because unlike others, it's fully compatible with all the Apple standards for RGB output control, making it more compatible with off-the-shelf software. With its FCC certified design, you can use almost any RGB monitor because only the new RamWorks RGB option provides both Apple standard and IBM standard RGB outputs (cables included). The RGB option plugs into the back of RamWorks with no slot 1 inter-

*RGB Option*



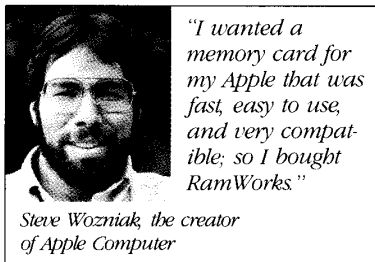
ference and remember you can order the RGB option with your RamWorks or add it on at a later date.

**True 65C816 16 Bit Power.**

RamWorks III has a built-in 65C816 CPU port for direct connection to our optional 65C816 card. The only one capable of linearly addressing more than 1 meg of memory for power applications like running the Lotus 1-2-3™ compatible program, VIP Professional. Our 65C816 card does not use another slot but replaces the 65C02 yet maintains full 8 bit compatibility.

**Endorsed by the Experts.**

A+ magazine said "Applied Engineering's RamWorks is a boon to those who must use large files with AppleWorks...I like the product so much that I am buying one for my own system." inCider magazine said "RamWorks is the most



powerful auxiliary slot memory card available for your Iie, and I rate it four stars..For my money, Applied Engineering's RamWorks is king of the hill"

Apple experts everywhere are impressed by RamWorks's expandability, versatility, ease of use, and the sheer

- Built-in super sharp 80 column display, (U.S. Patent #4601081)
- Expandable to 1 MEG on main card
- Expandable to 16 meg with expander cards, with NO slot 1 interference
- Can use 64K or 256K RAMs
- Powerful linear addressing 16 bit coprocessor port
- Automatic AppleWorks expansion up to 3017K desktop
- Accelerates AppleWorks
- Built-in AppleWorks printer buffer
- The only large RAM card that's 100% compatible with all Iie software
- RamDrive™ the ultimate disk emulation software included free
- Memory is easily partitioned allowing many programs in memory at once
- Compatible, RGB option featuring ultra high resolution color graphics and multiple text colors, with cables for both Apple and IBM type monitors
- Built-in self diagnostics software
- Lowest power consumption (U.S. Patent #4601081)
- Takes only one slot (auxiliary) even when fully expanded
- Socketed and user upgradeable
- Software industry standard
- Advanced Computer Aided Design
- Used by Apple Computer, Steve Wozniak and virtually all software companies
- Displays date and time on the AppleWorks screen with any PRO-DOS compatible clock
- Much, much more!

<b>RamWorks III with 64K</b>	<b>\$179</b>
<b>RamWorks III with 256K</b>	<b>\$199</b>
<b>RamWorks III with 512K</b>	<b>\$239</b>
<b>RamWorks III with 1 MEG</b>	<b>\$319</b>
<b>RamWorks III with 1.5 MEG</b>	<b>\$489</b>
<b>RamWorks III with 2 to 16 MEG</b>	<b>CALL</b>
<b>65C816 16 Bit Card</b>	<b>\$159</b>
<b>RGB Option</b>	<b>\$129</b>
<b>Optional Software:</b>	
<b>Pinpoint with RAM</b>	
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power and speed that it adds to any Iie. With a RamWorks in your Apple, you'll make IBM PC's and AT's look like slowpokes.

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RamWorks III is from Applied Engineering, the largest, most well supported manufacturer of Apple peripherals and the inventor of large RAM cards for the Apple. With our 5 year no hassle warranty and outstanding technical support, you're assured of the most trouble free product you can buy.

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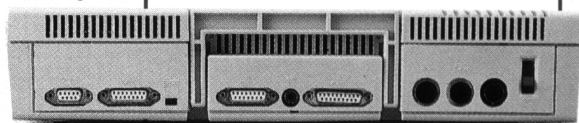


**Speed through the largest software library in the world.**

The Laser 128EX runs Apple IIe and //c software at speeds never before achieved. Its built-in 192K RAM (128K — User and 64K — Video) memory and triple speed processor lets you run programs at a world class pace. The Laser 128EX is a machine designed for leading performance.

**The 128EX has everything built-in, including a disk drive and interfaces to all your peripherals,** including

serial and parallel printers, a modem and mouse, joysticks, external 3½" and 5¼" drives, and even a color RGB or monochrome monitor. Only the Laser 128EX has these performance features built-in.



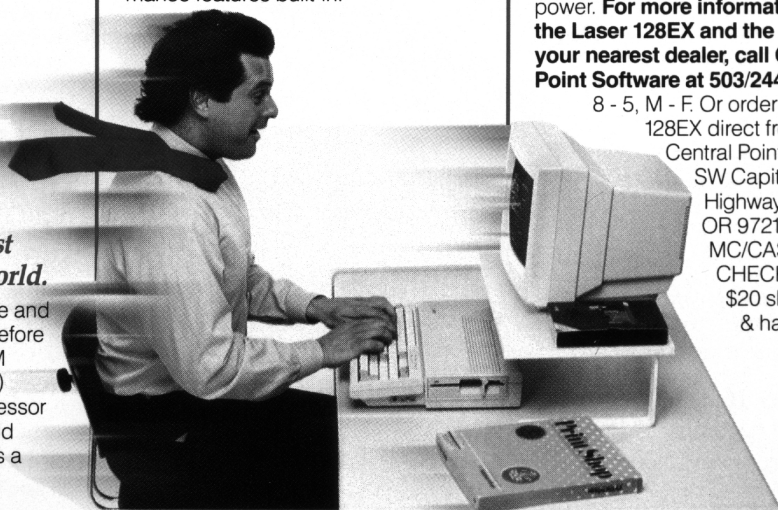
**The Laser 128EX is expandable!**

Boost the internal memory of the 128EX over 1Mb with its fully socketed AppleWorks-compatible RAM board. And, it has an expansion slot to let the computer grow with your increasing demands.

**The Laser 128EX performs like a top-of-the-line Apple, but is priced like a Commodore.** The 128EX is

about half the price of an Apple //c with three times the performing power. **For more information on the Laser 128EX and the name of your nearest dealer, call Central Point Software at 503/244-5782,**

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**THE AFFORDABLE COMPUTER-\$499**

CIRCLE 4 ON READER SERVICE CARD