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RamWorks® III
&
RamWorks basic

User's Manual

APPLIED ENGINEERING®

A DIVISION OF AE RESEARCH CORPORATION

v1.41

RamWorks® III
&
RamWorks basic

User's' Manual

Table of Contents

Preface **iii**
About This Manual... iii
Comments or Suggestions? iv

1

Introduction **1**
About RamWorks III and RamWorks basic 1
System Requirements 1
For More Information 2

2

RamWorks III Installation **3**
Before You Begin... 3
Installing RamWorks 4

3

Super Desktop Expander **5**
AppleWorks Enhancements 5
Before You Begin... 6
Enhancing AppleWorks 7
About the New Features 7

4

Using RamWorks **13**
RamWorks and Application Software 13
To Activate RamWorks with Pascal or CP/M 13
To Activate RamWorks
using Applesoft BASIC 13
the upper case restrict feature 14
The Escape Mode Features 15
Display Features with RamWorks 16
Controlling RamWorks Display
from Applesoft BASIC 17

5

RamWorks III RamDrive **19**
Introduction to RamDrive 19
DOS 3.3 RamDrive 20
RAMCOPY Instructions 27
SPEEDOS Documentation 27
RamDrive Technical Information 28
ProDrive for ProDOS 29
AppleWriter *//* Patch 38

6

RamWorks Memory Configuration **39**
Introduction 39
The Proper Memory Chips 39
Memory Chip Installation 39
Still Not Enough? 41
512K Rev. B Note 41
2 Meg / 2 Meg Plus Note 42
Memory Bank Configurations 42

7

RamWorks III Auxiliary Memory **45**
For Programmers Only... 45
Bank Switching 45
Programming Suggestions 46

A

Early "Revision A" Apple *//e* Computers **48**

B

RamWorks III Memory Test **49**

C

RGB Color Option for RamWorks III **50**

D

A Brief ProDOS Tutorial **51**

E

Getting Help **53**

About This Manual...

This manual is included with the Applied Engineering RamWorks Ill and RamWorks basic accessoiy cards for the Apple IIe. It tells you all about installing and using your RamWorks Ill or RamWorks basic card. Don't worry! You don't have to be a programmer to take advantage of RamWorks' extended memory, 80 column screen display, or other special features, like the Super AppleWorks Desktop Expansion. Everything is explained in this manual.

This manual should provide all of the information required to install and use RamWorks Ill and RamWorks basic. If you feel something has been left out or not adequately explained, please let us know.

Here's a summary of what is covered in this manual:

Chapter 1 is an introduction to the RamWorks III and RamWorks basic cards. It explains what they are and what you need to make them work for you.

Chapter 2 tells you how to install the RamWorks in your Apple //e

Chapter 3 explains how to use RamWorks and the Super Desktop Expander software provided to enhance the performance of AppleWorks 1.0 through 1.3.

Chapter 4 provides information about the use of RamWorks display features with application programs and system software.

Chapter *5* contains the instructions on how to use the RamDrive software to use the extended memory of RamWorks to emulate solid state disk storage.

Chapter 6 provides the necessary information for adding or rearranging memory on RamWorks as well as notes about RamWorks Memory Expander "piggy-back" cards.

Chapter 7 is intended for experienced assembly-language programmers only. It deals with the access and control of RamWorks bank-switched memory.

Appendix A details the special action required when using the RamWorks with the early Revision A Apple *//e* Computer.

Appendix B contains the instructions for the RamWorks Memory Test.

Appendix C provides an overview of the Applied Engineering Digital Prism RGB Option card for RamWorks.

Appendix D is a brief ProDOS tutorial for those unfamiliar with volume names and pathnames. Several ProDOS resources are also listed.

Appendix E tells you what to do when you don't know what to do.

Comments or Suggestions?

We have tried to make this manual as informative, understandable, and error-free as possible. Any comments or suggestions regarding this manual or any other Æ manual, will be greatly appreciated both by Æ and by others who use our products. Please address any comments or suggestions to:

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Attention:Manager, Technical Publications

1: *Introduction*

About RamWorks III and RamWorks basic

RamWorks® III and RamWorks basic are peripheral cards that expand the memory of the Apple® *lle*. The two cards are virtually the same, the main difference being in the amount of memory each card will support; RamWorks III can hold up to 1 Meg of memory on the main board and with the 2 Meg Plus (or 2 Meg) Expander, up to a total of 3 Meg. RamWorks basic recognizes up to 512K on the main board and up to *2.5* Meg total with the 2 Meg Plus (2 Meg) installed.

The other noteable difference is the bank configuration of each card. The different configurations are detailed in Chapter 7.

Applied Engineering's reason for offering the two different cards is to give those customers who want to increase their memory a little, the chance to do so without paying a lot while still offering RamWorks III to those memory-hungry people who can never have enough.

> Note: Unless otherwise specified, "RamWorks" refers to both RamWorks III and RamWorks basic.

RamWorks emulates all of the features of the Apple Extended 80 Column Text card. With the optional RGB Color Option installed, RamWorks also duplicates all features of the Apple Extended 80 Column Color card. (See Appendix C for details on the RGB option.)

RamWorks provides a full 80 column by 24 line video screen display and is 100% compatible with all software written for the Apple Extended 80 Column card. Even some programs written for other memory expansion cards are compatible with RamWorks. You can use the expanded memory to enhance application software like AppleWorks™, Magic Office System™, SensibleWriter™, Supercalc™, and many others. Programs from Applied Engineering, included in the RamWorks package, also allows you to use the additional memory to emulate one or more high speed "solid-state" disk drives, called "RamDrives."

System Requirements

Simple. All you need is an Apple IIe (domestic or European) and a video monitor capable of displaying 80 column text. (You can install RamWorks in the auxiliary slot of the Apple lie only; it cannot be installed in the Apple II, II Plus, //c or Apple IIGS.)

Most monochromatic computer monitors can display 80 column screens. Most TV sets, on the other hand, can't. Televisions are acceptable only for software which outputs a 40 column text display. The narrower 80 column characters tend to blur and are very difficult to read when displayed on a TV screen.

> Note: If your RamWorks has more than 1.5 Megabytes of RAM installed, Applied Engineering recommends that you protect your system from excessive heat build-up with a cooling fan, such as the Kensington Microware System Saver®, available through many computer dealers.

For More Information

In order to install and use RamWorks, you should at least be familiar with how to set up and operate your IIe computer and its peripheral devices. Be sure you've read the Apple *lie* Owner's Manual. Especially the section entitled "Meeting Your Apple IIe"*!* You can find more valuable information in the following manual:

Apple lie Reference Manual (Apple Computer, Inc.) Contains nuts and bolts information about the bits and bytes of the //e. A must for serious programmers.

Applesoft Tutorial (Addison-Wesley Publishing 1-800-238-3801) is a step by step guide for first-time Applesoft BASIC programmers.

Applesoft BASIC Reference Manual (Addison-Wesley Publishing 1 -800-238-3801) gives in depth details on the Applesoft BASIC programming language. It is intended for serious programmers.

AppleWorks Reference Manual (Apple Computer, Inc.) describes all the features of AppleWorks.

AppleWorks (Microsoft Press), by Charles Rubin, is an excellent presentation of AppleWorks.

Apple Works: The Program for the Rest of Us (Scott, Foresman, and Company), by Michael L. Sloan, explains not only the features of AppleWorks, but also how to increase the usefulness of AppleWorks.

ProDOS User's Manual (Apple Computer, Inc.) provides an overview of Apple's Professional Operating System (ProDOS) and explains how to use the ProDOS User's Disk.

Beneath Apple ProDOS (Quality Software), by Don Worth and Pieter Lechner, provides additional information about ProDOS for both the novice Apple user and the advanced programmer.

BASIC Programming with ProD OS (Addison-Wesley Publishing 1-800-238-3801) gives a more detailed explanation of ProDOS and its commands.

The DOS User's Manual (Apple Computer, Inc.) provides an overview of Apple's Disk Operating System (DOS 3.3) and explains how to use the DOS 3.3 System Master Disk.

The DOS Programmer's Manual (Apple Computer, Inc.) describes DOS 3.3 and its commands and file structure.

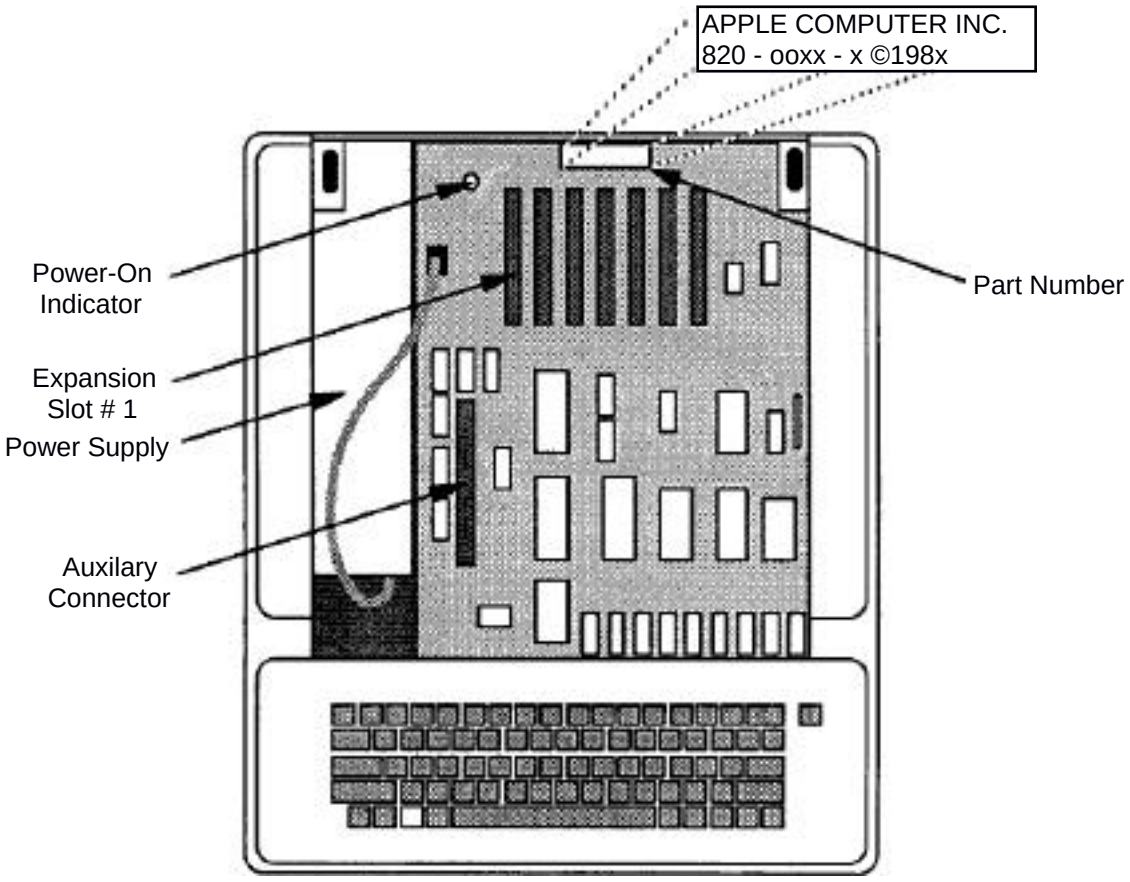
Beneath Apple DOS (Quality Software), by Don Worth and Pieter Lechner, is an in-depth presentation of DOS in an interesting and understandable format.

2: *Ram Works Installation*

Before You Begin...

You should have no trouble installing RamWorks. You don't even have to be an Electrical Engineer! If you follow the directions carefully, it should take you no more than a couple of minutes. If you are not familiar with the inside of your Apple //e, please read the chapter entitled "Meeting Your Apple //e" in your Apple //e Owner's Manual. illustration 2-1, below, points out the //e's components that are important in the installation of RamWorks.

Illustration 2-1 Inside Your Apple //e



READ THESE STEP BY STEP INSTRUCTIONS COMPLETELY before you install your RamWorks.

- ◊ Leave your computer plugged in, but switch the //e power switch to the OFF position.
- ◊ Remove the lid from the //e.
- ◊ Make sure the power-on indicator light inside the computer is OFF. (See Illustration 2-1)
- ◊ Check the upper left corner of the computer s main printed circuit board. If the He copyright year is not 1982—go on to the next step. If it says Apple IIe © 1982, check the part number of the computer's circuit board located between the *IIe* rear panel and expansion slots 3,4, and *5.* Look closely. If the number directly to the left of ©1982" is 820-0064-A please see Appendix A before installing your RamWorks.
- ◊ Discharge any static electricity that may be on your body or clothing by gently touching the power supply. ***This is important!!!*** Static electricity can ruin chips on your card and motherboard.
- ◊ Remove the RamWorks from its anti-static bag. Do not touch the gold edge connectors.
- ◊ Position the RamWorks card above the Auxiliary Slot, with the long end of the card toward the rear of the computer.
- ◊ Gently but firmly insert gold edge connector of the RamWorks into the Auxiliary Slot.
- ◊ Replace the computer's lid and the installation is complete!

You don't have to test the RamWorks, but if you'd like to, Appendix B tells you how.

3: *Super Desktop Expander*

> **READ THIS FIRST**: this chapter tells you how to use the Super Desktop Expander disk to enhance AppleWorks versions 1.0 through 1.3. If you have AppleWorks version 2.0, 2.1 or 3.0, skip this chapter and refer to the *AW 3 Expander User's Manual.*

AppleWorks, the best selling program from Apple Computer, combines a word processor program, data base program, and a spreadsheet program into one "integrated software package". Evaluated separately, each of these programs would be an outstanding "stand-alone" program. When these programs are integrated into one program, AppleWorks becomes an extremely versatile and useful productivity tool. But with a RamWorks installed, AppleWorks can be extraordinary!

Here's how. AppleWorks uses a portion of the computer's extended memory to store active AppleWorks documents (files). This portion of memory is referred to as the AppleWorks Desktop and its size is expressed in Kilobytes or "K". (A Kilobyte is 1,024 bytes.) With the Apple Extended 80 Column Text card, the Desktop size is limited to only *55K.* But, depending on how much memory your RamWorks has, you could have a Desktop size as large as 2,277K! Since the AppleWorks program only expects to "see" a 64K extended memory card, the Super Desktop Expander Utility disk, included with your RamWorks, will enable you to easily modify AppleWorks disks to use the extra memory available with RamWorks.

AppleWorks Enhancements

Here is a list of the AppleWorks enhancements available with the Super Desktop Expander Utility:

- √ Expanded Desktop. ..allowing larger Desktop files
- √ 15,200 records in the Data Base (versus 1,350 records)
- √ 15,200 lines in the Word Processor (versus 2,250 lines)
- √ Clipboard expanded to 2,042 lines (versus 250)
- √ Greater Spreadsheet capacity
- √ Multiple disk file saving capability. ..to save larger Desktop files
- √ Auto-Load patch for improved AppleWorks speed
- √ Built-in printer buffer (option when used with standard printer interfaces)
- √ Time display and Data Base time-stamp capability (option for ProDOS clock cards)

Before You Begin...

This program will allow you to modify your AppleWorks STARTUP and PROGRAM disks to take advantage of RamWorks' capabilities. You have to modify it only once. Even if you add or reconfigure memory on your RamWorks you won't need to run this utility again. If you wish to use an Applied Engineering Timemaster H.O. or any ProDOS compatible clock card, this program will allow you to install the AppleWorks Time Utility.

This is what you will need to modify your AppleWorks disks:

◊ An Apple //e with at least one disk drive

◊ A RamWorks card, with at least 256K, installed in the Auxiliary Slot of the //e

◊ A BACKUP COPY of the Super Desktop Expander Utility disk.

◊ A BACKUP COPY of your ORIGINAL AppleWorks STARTUP and PROGRAM disks--any version of AppleWorks prior to but not including version 2.0

Æ recommends making backups with Apple ProDOS utilities only (Filer included on the AW 2 Expander disk or System Utilities), due to the fact that AppleWorks is stored on a non standard disk format. Some programs may not duplicate the disk correctly and, as a result, the "patched" AppleWorks disk may not work correctly. For directions on copying disks with the Filer program, refer to the appendices of the *AW 2 Expander User's Manual.*

+ *Note:* You must give the same name to the front and back side of the AppleWorks copy disk.

Use this utility only on unmodified copies of AppleWorks STARTUP and PROGRAM disks. You should make any patches to AppleWorks required by other programs, such as Pinpoint and MacroWorks, after the Super Desktop Expansion.

If you are using a non-Apple parallel-printer interface card and have AppleWorks version 1.0 or 1.1, you may require a special printer-interface "patch" to your STARTUP disk. (The version number is displayed on the AppleWorks STARTUP disk information screen.) If your version of AppleWorks requires this interface modification, you should install it before you use the Super Desktop Expander Utility. AppleWorks versions 1.2 and 1.3 do not require a printer-interface patch. See your authorized Apple dealer for an upgrade to the latest version of AppleWorks.

Enhancing AppleWorks

Follow these directions to use the Super Desktop Expander utility to modify the AppleWorks STARTUP and PROGRAM disks:

1. Boot the Super Desktop Expander Utility in your startup drive.

2. When the Main Menu appears, select the "Execute AppleWorks Desktop Enhancements" option. The Applied Engineering Super Desktop Expander copyright screen will then appear. To display the next screen, press the space bar.

3. The features and options available are described briefly on the display screens, and in greater detail in the next section of this chapter, About the New Features. Read each screen carefully.

4. When prompted for a yes or no input, enter a Y for yes or an N for No. The prompted options are:

   Install Auto Load Option.
   Install the Printer Buffer Option.
   Install the Applied Engineering Time Display Option.

5. After choosing the options you want to install, the program will prompt you to remove the Super Desktop Expander disk and insert a COPY of the AppleWorks STARTUP disk in drive one. Be sure you have removed the WRITE PROTECT tab from the disk. As prompted at the bottom of the display screen, press the space bar to continue or "Q" to quit and return to BASIC.

   The Super Desktop Expander program searches for the file APLWORKS.SYSTEM on the disk in the currently prefixed disk drive. (Usually the boot disk drive.) If, at this point, the program displays the following message:

   ```
   Cannot find correct file
   Please enter the prefix of the AppleWorks program
   7
   ```

   Enter the complete ProDOS pathname of your AppleWorks STARTUP disk. If you press the Return key before you specify a pathname, the program will automatically search the available ProDOS devices for the volume name /APPLE WORKS. If the AppleWorks program you want to modify is in a ProDOS subdirectory, enter the complete ProDOS pathname of the subdirectory that contains the AppleWorks files. Be sure to include the (/) slashes. An example ProDOS pathname of an AppleWorks subdirectory on a Profile hard disk (with a volume directory name of /PROFILE) might be:

   ```
   /PROFILE/APPLEWORKS
   ```

+ *Note:* If you don't understand volume names and pathnames, refer to, "A Brief ProDOS Tutorial" in the appendices of this manual.

While the enhancements are being made, the message, 'Working..." will appear at the bottom of the screen.

6. After the STARTUP disk has been successfully modified, the program will prompt you to remove it from the disk drive and insert a COPY (write enabled) of the AppleWorks PROGRAM disk. The Expander also expects the volume directory name of this disk to be /APPLE WORKS. If all of the AppleWorks startup and program files you are modifying are in a hard disk or Disk *3.5* directory, press the space bar when prompted to insert the PROGRAM disk.

7. When the Expander completes the modification to the AppleWorks PROGRAM disk, the program will beep the *lie* speaker and exit to Applesoft BASIC. You can now boot the modified AppleWorks disks in the normal manner. (Please read the section entitled, "About the New Features.")

8. You should make any modifications required by other AppleWorks accessory programs at this time. (You may wish to make an archive copy of the modified "Super Desktop" disk prior to any other modifications.)

9. If you will be using the modified AppleWorks from a hard disk drive, you can copy the modified AppleWorks files to the hard disk according to the instructions provided with your hard disk file management program.

About the New Features

The following paragraphs describe the new features of the Expanded AppleWorks and the instructions for using them. Please read this section very thoroughly.

Desktop Expansion

This feature expands the AppleWorks Desktop to accommodate larger files. It increases the maximum number of records in the data base and lines in the word processor from 1,350 and 2,250, respectively, to 15,200 for both! It also enlarges the Desktop size from the standard 55K up to 2,245K, depending on the amount of memory on the RamWorks card. The Desktop Expansion feature is invoked automatically when you boot the modified AppleWorks program.

In order to achieve the extraordinary increase in the number of lines and records, a small portion of the AppleWorks Desktop space was sacrificed. Compared to the additional memory available on RamWorks, this sacrificed Desktop space is negligible.

Clipboard Expansion

The standard AppleWorks clipboard is limited to only 250 lines of information. The Super Desktop clipboard expansion increases the clipboard for the Word Processor and Data Base functions to 2,042 lines. Only clipboard activities within and originating from the Spreadsheet function are limited to 250 lines. The clipboard expansion is one of the standard features of the Super Desktop Enhancements.

Multiple Floppy-Disk Files

Data storage problems arise when the size of a file on the Desktop exceeds the amount of storage space on the data disk. A standard floppy disk can store only 135K of AppleWorks data. The modified AppleWorks will segment, or “split,” Desktop files larger than the available disk space and save them in sections to two or more disks. The following paragraphs explain how to use this feature to save and load segmented Desktop files.

This seems to be a good time to remind you of Murphy’s Law:

Whatever can go wrong will go wrong.

Back up your Desktop files! A power failure during a disk save operation could conceivably wipe Out a file that had taken months to create! You should have backup copies of your working data disks, especially if you have large amounts of data stored on them.

Save Desktop Files to Disk

When you save a Desktop file which exceeds the data disk space available, AppleWorks will prompt you with the following message:

```
Segmented Desktop File...
Please insert NEXT disk with SAME VOLUME NAME
```

Remove the data disk from the current disk drive and replace it with the next data disk. You must save all segments of a given segmented Desktop file MUST on data disks having the same volume (disk) name as the primary (first) data disk.

If you discover that you don't have enough formatted blank disks with the same volume name, don't panic! Just use the AppleWorks Disk Formatter utility under the "Other Activities" menu. First, use the Esc key to stop saving the Desktop file and to return to the AppleWorks Main Menu. Do not turn the computer off. Doing so will erase the Desktop file from memory.

In order to enable the multiple disk save capability, one of AppleWorks' safety features had to be overridden. Ordinarily, AppleWorks would save a changed file to the disk before it deletes the original file. Now it will replace the original file by writing over it. Pressing the Escape key at any time during a save operation will cancel the save and DELETE the current disk file or file segment on disk. (The Desktop file does remain in memory until removed in the normal manner or power is turned off.) BE CAREFUL!

Add multiple-disk files to the Desktop

When you add multiple-disk, or segmented, files to the Desktop, you must load the file MUST from the data disks in the same sequence as it was saved. AppleWorks will prompt the user to insert the NEXT data disk(s) until the file is completely loaded.

If you list the files on disks that contain segmented files you will notice that the first segment has the filename that you gave it. The next segment (on the NEXT disk) will have a ".2" appended to the end of your filename. The next disk in the sequence will have a ".3" appended to the filename and so on. When it reaches the ninth disk (.9), the Super Desktop Expander goes back to .1, then .2 etc. This is the way AppleWorks keeps track of the segmented Desktop file sequence. You will need to label your data disks in such a way that you too can keep track of the proper sequence. If you do not keep track of the disks yourself, you may confuse the first disk with the tenth (both are appended with .1).

AppleWorks Auto-Load feature

AppleWorks was designed for use with only 64K of additional memory, so not all of the PROGRAM disk information is loaded into memory during program startup. Some special "functions", like displaying help screens, adding files, or using the clipboard, are left on the disk and retrieved only when they are needed. If you have a RamWorks with 256K memory or more you can load these special functions into memory, and minimize the time consuming disk accesses. This allows you to move between Desktop files and AppleWorks' special functions very quickly.

The Auto-Load feature loads all of the AppleWorks special functions into memory along with the rest of the AppleWorks PROGRAM disk. This extends the AppleWorks startup time by about a minute. The PROGRAM disk startup screen will display a counter indicating the number of functions it still needs to load. (During the countdown it may appear that the counter has skipped a function. This is because some of the relatively small

functions load faster than indicated by the counter.) Pressing the Escape key during this count-down will stop the loading of special functions and immediately display the AppleWorks Main Menu. AppleWorks will access the functions in memory that were loaded before you pressed the Escape key and access the PROGRAM disk for those functions that it had not loaded.

The AppleWorks special functions are loaded into RamWorks memory, but they don't decrease the size of the available Desktop. Magic? Nope! The functions are originally "hidden" in an unused portion of the Desktop memory and as the files on the Desktop grow larger, they "bump" the special functions from memory individually to make room. If AppleWorks can't find a special function in memory it will go back to the PROGRAM disk.

This brings up an interesting point about the convenience of using the Auto-Load feature to replace the AppleWorks PROGRAM disk in drive one of a single disk system. if you have all of the special functions Auto-Loaded in memory, you can first specify drive one as the standard location of your data disk and then replace your PROGRAM disk with your data disk. Keep your PROGRAM disk handy, though. AppleWorks may prompt you to insert your AppleWorks PROGRAM disk whenever you specify new information about your printer, change the standard location of your data disk, or change the date.

> **Note:** if you copy all AppleWorks files to a ProDrive and execute the program from the /RAM emulated disk volume, the AutoLoad feature is not required. This method of executing AppleWorks is tricky; those not familiar with AppleWorks and Apple ProDOS ™' (Professional Disk Operating System) should not attempt this. This method also requires an AppleWorks file (APLWORKS.SYSTEM) to be modified before being executed from a ProDrive. See the PARTiTION instructions in Chapter *5*.

Printer Buffer Option

if your RamWorks has *256K* or more of memory the Printer Buffer option will automatically enable you to continue to work with files on the AppleWorks Desktop even while your printer is printing. This option will support two printers printing at the same time, each printing multiple files.

> **Note:** This feature will not work with all printer interfaces. It was designed to work with all standard interfaces supporting the Pascal 1.1 protocol for status checking. if you cannot get this option to work, your interface does not support this official protocol. Contact the manufacturer of your printer card for details on upgrades.

Even as the Desktop file to be printed is being loaded to the buffer, the printer will begin printing, if the printer is printing an exceptionally large file and the computer seems to be locked, it is probably caused by insufficient buffer space. The AppleWorks Desktop will return as soon as the buffer can hold the remainder of the print file.

if you press the Esc key while the print buffer is filling, it will cause AppleWorks to stop sending the remainder of the print file to the buffer, if you send an (Control-C from the keyboard at any time while the printer is printing, it will reinitialize (clear) the AppleWorks internal print buffer. (An (Control-C is issued by simultaneously pressing the Open-Apple "Control" and "C" keys.) if your printer or printer interface has an internal

print buffer of its own, the printer may continue to print the remaining contents of its buffer even after the AppleWorks buffer has cleared.

AppleWorks Time Utilities Option

We designed this option to take advantage of the Applied Engineering Timemaster H.O. (High Output) clock card but it will support all ProDOS compatible clock cards. (The Timemaster H.O. has many features that leave the competition far behind!) It will replace the "Open-Apple-? for Help" message in the bottom line of the AppleWorks screen with a current date and time display. This option also allows the AppleWorks user to enter the current date and time into a Data Base category by typing the @ character as the only entry in that category.

> **Note:** The category name must contain either the word DATE or TIME, but should not contain both. For example, you should not use this feature in a category named "Date and Time".

4: Using Ram Works

RamWorks is an accessory card for the //e, and like most other accessory cards, you must activate (or deactivate) it somehow. This chapter provides the essential information for the various ways to activate, deactivate,, and control the 80 column text features of RamWorks. This chapter also explains some of the differences between the standard //e 40 column display features and those available with the RamWorks 80 column screen. Ch. 6 explains the use of the expanded auxiliary memory from a programmer's standpoint.

RamWorks and Application Software

Programs written for specific purposes, such as word processing or record keeping, are referred to as commercial or application software. If the application software that you wish to run expects an 80 column text card installed m the computer, then RamWorks automatically activates the 80 column mode (unless your particular software package gives you an option for 40 or 80 column screen). If your software was not designed to take advantage of the 80 column screen features, it will ignore the RamWorks card and display the screen in the standard 40 column mode.

To Activate RamWorks with Pascal or CP/M

Both Pascal and CP/M automatically activate the 80 column mode. Just boot your Pascal or CP/M disk in the normal manner.

To Activate RamWorks using Applesoft BASIC

You should be familiar with the Applesoft BASIC language and the applicable operating system, either DOS or ProDOS, as explained in the Apple //e Owner's Manual. Please refer to Ch. 1 for a list of additional recommended reference sources.

Follow the steps below to activate and deactivate the RamWorks 80 column firmware from the Apple *//e* keyboard.

1. Access Applesoft BASIC (with or without DOS or ProDOS). The cursor should be a flashing checkerboard pattern, indicating 40 column mode.

2. Make sure you have the Caps Lock key down.

3. Type PR#3 and press the RETURN key to activate 80 column mode. Notice the cursor becomes narrow, solid, and steady (does not flash).

4. To switch to 40 column mode while the 80 column feature is active, press and release the Escape key, then the 4 key. The display is 40 columns wide but the 80 column firmware is still activated. Notice, in this case, the cursor is now wide, solid, and steady. This indicates 40 column mode with 80 column firmware active.

5. To switch back to 80 column display, press Escape, then 8.

6. To deactivate the card completely press the Escape key followed by Control-Q (simultaneously press the Control and Q keys). Another way to deactivate RamWorks is with a Control-Reset. We do not recommended this, however, because it could "clobber" your program currently in memory.

A word of caution: Be careful in using PR#0 to deactivate RamWorks. You probably shouldn't access another slot, PR#1 for example, when the 80 column feature is active. The results can be unpredictable. You will want to use Escape Control-Q to turn off the card from the keyboard in most cases.

the upper case restrict feature

When programming in Applesoft BASIC on a "non-enhanced" Apple //e with the RamWorks firmware active, you can use only upper case for program statements. If you try to use lower case, you'll get a SYNTAX ERROR. The upper case restrict mode provides an easy way for owners of the non-enhanced IIe to use lower case letters in PRINT and INPUT statements.

To activate the upper case restrict mode, press the Esc key then the letter R. Release the Caps Lock key (up) and enter an Applesoft BASIC program just as you normally would. You will notice that when you type an opening quotation mark, as in the beginning of a string literal (letters enclosed in quotation marks), all the characters which follow are in lower case. To make one or more of these letters upper case, use the shift key as you normally would. Once you type the closing quotation mark, all letters which follow are in upper case. To cancel the upper case restrict mode, enter the Esc mode, then type the letter T. The upper case restrict mode remains active until cancelled or the 80 column firmware is deactivated.

Note: Owners of the Enhanced Apple //e will discover that this feature is already built in. So Esc-R is not supported by the Enhanced //e.

You can do all programming in lower case letters (except in DOS 3.3 which still expects its inputs in upper case). When you list the program, all Applesoft key words and variable names will appear in upper case; all literal strings, DATA statements, and REM statements will remain as originally typed.

The Escape Mode Features

Press the ESC key while in Applesoft BASIC to put the computer into an "altered state" called Escape Mode. While in the Escape Mode some keys take on special meanings. Some keys will execute a certain function then exit the Escape Mode; other keys will allow the Escape Mode to remain active until canceled by the user. The Escape Mode allows control of the Apple //e display and RamWorks from the keyboard, enables you to edit programs, and allows you to correct typing mistakes. For a more detailed description of the Escape Mode, please refer to the Applesoft BASIC Programmers Reference Manual. For your convenience, we have summarized the Escape Mode code sequences in Table 4-1, below.

Table 4-1 Escape Codes

Escape Sequence	Function	Notes
Esc @	Clears screen and homes cursor	*
Esc A	Moves cursor right one space	*
Esc B	Moves cursor left one space	*
Esc C	Moves the cursor down on line	*
Esc D	Moves the cursor up one line	*
Esc E	Clears from cursor to end of line	*
Esc F	Clears from cursor to bottom of screen	*
Esc I or Esc ≠	Moves the cursor up one line	**
Esc J or Esc"	Moves the cursor left one space	**
Esc K or Esc Æ	Moves the cursor right one space	**
Esc M or Esc Ø	Moves the cursor down one line	**
Esc R	Activates upper-case restrict mode	***
Esc T	Deactivates upper-case restrict mode	***
Esc 4	Switches from 80 to 40 column display	***
Esc 8	Switches from 40 to 80 column display	***
Esc Control-Q	Deactivates the 80 column firmware	***

***** These keys perform their function, then exit the Escape Mode.

****** These keys perform their functions and remain in the Escape Mode. To exit Escape mode, press the SPACE bar once. This is not the only way but it is the most straight forward.

******* These Escape sequences are available in the 80 column mode only.

Display Features with RamWorks

Some Applesoft BASIC commands affect the display screen differently when you have activated the 80 column firmware. The display features affected are HTAB, INVERSE, FLASH, and HOME. Using commas in PRINT statements to tab across the screen is also different when you have the 80 column firmware active. To further confuse things, some things are not different if you have the new Enhanced Apple *//e*. Read on.

If you're not sure what the commands listed below do or how to use them, please refer to the Applesoft Tutorial or Applesoft Programmer's Reference Manual.

IN VERSE When you have the 80 column firmware off, the computer will display only upper case characters in inverse. In the 80 column mode, it will display both upper and lower case inverse characters.

HOME When the screen shows a NORMAL display (black screen with light letters) with the RamWorks either active or inactive, the HOME command will clear the screen to black and move the cursor to the upper left corner of the screen. if you issue the HOME command when the RamWorks is active and the display mode is INVERSE, the screen will clear to a light display and show black characters. -if you turn the 80 column firmware off and issue the HOME command in INVERSE mode, it will clear the screen to black and remain in the INVERSE mode.

FLASH The flash command will not work in the 80 column mode. If you use the FLASH command when the 80 column firmware is active, strange things may happen. To recover from this, use the NORMAL or INVERSE commands.

HTAB This command was originally intended for use with a 4() column display only. You cannot HTAB beyond 40 columns on a non-enhanced //e. To position the cursor anywhere on the 80 column line, use the POKE 1403,n command. ("n" is the column number between 1 and 79.) This POKE command will only work when RamWorks is active. If you have an Enhanced //e, the HTAB command works in both the 40 and 80 column modes.

Comma Tabbing Using commas in a PRINT statement to align output into columns only works on a 40 column display. The 80 column firmware can be active, but you must have the display set to 40 columns (ESC-4). Unless, of course, you have an Enhanced //e, which supports comma tabbing to a full 80 columns.

Controlling RamWorks Display from Applesoft BASIC

When you program in Applesoft BASIC, you can access some RamWorks features by using control codes. These codes are actually invisible ASCII characters which have a special meaning to the computer and RamWorks. To enter the control codes from the keyboard, hold the Control key down and press another character key. Or you can issue their codes from Within a BASIC program with the PRINT CHR$(xx) statement. Please refer to the Applesoft BASIC Programmer's Reference Manual for more details. Table 4-2 presents a summary of control codes and their functions. Note that you can enter some—but not all—codes both from the keyboard and from within a program.

Table 4-2 Control Codes

Control Character	Decimal Code	Function Name	Function	Notes
Control - G	7	Bell	Speaker 1000 Hz tone for 100 mS	
Control - H	8	Backspace	Cursor moves one space left	
Control - J	10	Linefeed	Cursor down one line	
Control - K	11	Clear EOS	Clears from cursor to end of screen	1
Control - L	12	Clear	Homes cursor and clears screen	1
Control - M	13	Return	Same as pressing RETURN key	
Control - N	14	Normal	Sets the NORMAL display mode	1,3
Control - 0	15	Inverse	Sets the INVERSE display mode	1,3
Control - Q	17	40 Column	Sets the display to 40 columns	1,3
Control - R	18	80 Column	Sets the display to 80 columns	1,3
Control - S	19	Stop list	Stops listing until another key pressed	2
Control - U	21	Quit	80 Column mode off	1,3
Control - V	22	Scroll	Scrolls display down one line	1
Control - W	23	Scroll up	Scrolls display up one line	1
Control - Y	25	Home	Homes cursor (does not clear screen)	1
Control - Z	26	Clear line	Clears the line the cursor is on	1
Control - \	28	Forward	Cursor moves one space right	1
Control -]	29	Clear EOL	Clears from cursor to end of line	1
Control - ^	30	GOTOXY	Uses next two characters, minus 32	1
			as cursor coordinates (Pascal - not BASIC)	1

1. Features available only when 80 column mode is activated.
2. Codes will work only in the immediate mode (keyboard)
3. Codes will work only in the deferred mode (program)



RamWorks

5: RamWorks RamDrive™

Introduction to RamDrive™

RamDrive is nothing more than a program which allocates all or a specified portion of RamWorks extended memory (RAM) to be used as one or more "solid-state" disk drives. This program loads itself into a special reserved area of the //e's memory and uses a portion of the RamWorks memory to store desired programs and files in "disk format". This "tricks" the computer into thinking that it is accessing a disk drive when it is actually retrieving or storing data in memory.

Increased data access speed and potentially greater disk storage capacity make the RamDrive a convenient, low cost alternative to a hard-disk drive. Loading from and saving to a RamDrive can be as much as 20 times faster than a conventional disk drive because it eliminates the mechanical activity that a conventional drive has to perform. The RamDrive data storage capacity depends upon the amount of memory available on your RamWorks.

RamDrive is compatible with almost all DOS 3.3 applications available for the Apple //e. You can load any programs or data files which are not copy-protected into a RamDrive and run or access them just like from any other disk drive. A disk which cannot be duplicated with a standard copy program, like COPYA or FID, are probably copy protected. Although, some copy-protection schemes will allow you to copy the program files from the floppy disk to a hard disk or RamDrive, they do not allow you to copy them to another floppy disk. Due to the rising popularity of hard disk drives and RAM drive software, most software publishers are offering copyable upgrades to their previously copy-protected programs. Check with the software publisher or dealer from whom you purchased the software for details.

RamDrive is a volatile storage medium. Since information stored in a RamDrive is actually stored in RamWorks memory, when the computer is turned off, the information in the RamDrive disappears. This means you will have **to** save the data you want to keep to a regular disk drive before you turn the computer off.

> **Proceed with Caution!** Be careful how you use RamDrives. Although the use of emulated disk drives can appreciably speed up those programs that require frequent disk access, RamDrives can be tricky to use and potentially hazardous to your data. Keep Murphy's Law in mind when you weigh the advantages and disadvantages of using RamDrive software.

The ProDOS version of RamDrive, ProDrive, and its utilities are on side one of the Super Desktop Expander disk. Side two of the Super Desktop Expander disk contains the DOS 3.3 version of RamDrive and its special utilities. This chapter explains the installation, configuration, and use of these programs and utilities.

DOS 3.3 RamDrive

You don't have to be an experienced programmer to use the RamDrive software but you do have to be familiar with the commands and operation of DOS 3.3. You must also know some of the Applesoft BASIC programming language. For additional information we suggest the following reference manuals:

The DOS User's Manual (Apple Computer, Inc.)
The DOS Programmer's Manual (Apple Computer, Inc.)
Beneath Apple DOS (Quality Software)
Applesoft Programmers Reference Manual (Addison-Wesley Publishing)
Apple lie Reference Manual (Apple Computer, Inc.)

This section explains what the DOS 3.3 version of RamDrive is and how to install and use the emulated disk drive(s). This section also provides instructions for the additional programs, SPEEDOS, RAMCOPY, and a specially modified version of Eli), included on the DOS 3.3 side of the Super Desktop Expander disk.

Description of RamDrive

Depending on the amount of memory (or memory you allocate) on your RamWorks, the RamDrive software will automatically configure up to one megabyte of RamWorks memory on the main board to emulate from one to six solid-state disk drives. The storage capacity of the individual RamDrives also depends upon the amount of RamWorks memory you allocate for RamDrive emulation. These disk drives support all DOS 3.3 commands (with the exception of INIT) so you can access them just like conventional DOS 3.3 disk drive(s) by addressing a phantom disk interface card installed in slot 3. For each additional 192K of RamWorks memory DOS 3.3 will recognize another emulated disk drive. For example, a 512K RamWorks can emulate one drive (Drive 1) with 744 free sectors, one (Drive 2) with 749, and another (Drive 3) with 239 free sectors. (An initialized DOS 3.3 floppy disk has 496 free sectors; one sector contains *256* bytes of data.) The number of DOS 3.3 files is still limited to *105* per volume (disk). Table *5-1* illustrates RamDrive storage available for various memory configurations.

Install RamDrive

Install RamDrive(s) in one of two ways:

Way 1: Boot side two of the Super Desktop Expander disk and select the "Install RamDrive" option from the main menu.

Way 2: Load DOS 3.3 into memory and run the RAMDRIVE binary program file. You can do this from within an Applesoft program by inserting the following program line:

```
PRINT CHR$(4); "BRUN RAMDRIVE,S6,D1"
```

This example assumes that the disk with the RAMDRIVE program is in drive one and the disk controller is in slot six, although you

may copy the RamDrive program to any DOS 3.3 disk used in your system.

Table 5-1 RamDrive Free Sector Chart

RamWorks Memory	Free Sectors Dl	D2	D3	D4	D5	D6
64K	234					
128K	489					
192K	744					
256K	744	239				
320K	744	494				
384K	744	749				
448K	744	749	239			
512K	744	749	494			
576K	744	749	749	239		
640K	744	749	749	494		
704K	744	749	749	749		
768K	744	749	749	749		
832K	744	749	749	749	239	
896K	744	749	749	749	494	
960K	744	749	749	749	749	
1024K	744	749	749	749	749	239

Note: You will need to "unlock" Bank 0 to get 6 drives with 1 Meg on board or one drive with 64K on board. Refer to the Bank Lockout section in this chapter.

Using RamDrive

If you have only one emulated disk drive (192K or less), then you may access the RamDrive through Slot 3, Drive 1 or 2. You still have only one emulated disk but you don't need to specify the drive number.

To see that RamDrive is enabled, type:

```
CATALOG, S3, Dl
```

in all capitals. The catalog header:

```
DISK VOLUME 001
```

will appear on your monitor.

Copying files to RamDrive

Three methods to transfer files to RamDrive are: load and save program files; use the Apple File Developer program (FID); and EXECute a text file in combination with the FID program.

- ◊ LOAD and SAVE method: Individually LOAD each program from disk and SAVE to RamDrive.

- ◊ FID method: BRUN the FID program found on the Apple DOS 3.3 System Master disk. The FIT) program is especially useful for transferring binary and text files. The Apple version of FID does not allow you to address drives 3 through 6. We have included a modified RID, which enables drives 1 through 6 to be specified, on side two of the Super Desktop Expander disk.

- ◊ FID and EXEC file method: This is a quick way to transfer a selected list of files to a RamDrive. See the DOS Users Manual for more information on EXECuting text files.

We have put an example EXEC file, COPY ALL FILES, on side two of the Super Desktop Expander disk. This sample file instructs the RD program to copy certain files on the disk to RamDrive. To use this sample EXEC (text) file, boot the disk and select the "Copy Files to RamDrive" option. This menu option will automatically run SPEEDOS, install RamDrive, and copy the specified files to RamDrive. Or you can execute this program by typing 'EXEC COPY ALL FILES,56,Dl' from the Applesoft BASIC prompt. (Remember to install RamDrive first!) RamDrive space permitting, this program will copy all specified files on the disk (in this example) to RamDrive in Slot 3, Drive 1.

Customize COPY ALL FILES

You must customize COPY ALL FILES for every desired combination of source and destination slots and drives. You can customize easily with any word processor program which saves files to disk in text file format (like the DOS 3.3 form of AppleWriter). To further understand how COPY ALL FILES works, use FID to manually transfer some files from S6,Dl to S3,D1. Carefully record each keystroke you make, then load the COPY ALL FILES into a word processor and compare it with your keystrokes.

> **Note:** When you create an EXECutable text file for FIT), be sure that none of your filenames contain any DOS 3.3 commands. (e.g. READING.1; CATALOG LIST)

After you customize your own COPY ALL FILES text file, you can easily create a turnkey startup disk with the following 'HELLO' program:

```
10 REX Turnkey HELLO program
20 PRINT CHR$(4);"BRUN RAMDRIVE"
30 PRINT CHR$(4);"EXEC COPY ALL FILES"
40 END
```

This program (HELLO) requires that the same disk contain FID, RAMDRIVE, and COPY ALL FILES. The disk must also contain the files you want copied to the RamDrive—unless you have a two-drive system and specify S6, D2 as the destination disk when you create the COPY ALL FILES text file.

Activate and Deactivate the RamDrives

The DOS 3.3 'INIT command does not initialize a RamDrive, *it* merely deactivates it. It does not install DOS 3.3 or specify a greeting program on the RamDrive. For example, 'INIT HELLO,S3,D1' will disable RamDrive 1, but will not erase any information stored on that RamDrive volume. To reactivate a RamDrive, run the RAMDRIVE program again. You can then once again access all files previously saved on that RamDrive. You can also deactivate RamDrives by a warm-boot (-Control-Reset or PR#6), and then reactivate them by running the RAMDRIVE program.

> **Note:** Some application software may use the first 64K (Bank 0 ot RamWorks memory.) This conflicts with the RamDrive software and can wipe-out data on the S3,D1 RamDrive. We have "locked out" Bank 0 for you to prevent this from happening. The Bank Lock Out procedure is discussed later in this section.

Erase RamDrives

To erase previous RamDrives and create empty ones, hold the 'Solid-Apple' ( ) key down during RAMDR1VE program execution. For example, type 'BRUN RAMDRIVE,S6,Dl', hold the Solid-Apple key down and press RETURN. Continue to hold the key down until the Drive 1 access LED goes out.

RamDrive Audio-Visual Access Indicators

Just as the red LED on the front of your disk drives indicate a disk access in progress, RamDrive provides a visual access indicator. Whenever DOS 3.3 accesses a RamDrive, an inverse 'R' or 'W' will appear in the lower right corner of the display. The 'R' indicates a disk read operation; the 'W' signifies a disk write operation.

In addition to the visual indicator, the program also gives you the option of an audio access indicator. The audio indicator is a high pitched click for a "read from disk" access and a lower pitched click for a "write to disk" operation. To activate the audio indicator option, hold the Open-Apple ( ) key down while you enable the RamDrive. For example, type 'BRUN RAMDRIVE,S6,D1', hold the key down, and press RETURN. Continue to hold the 0 key down until the Drive 1 access indicator goes out and you hear the //e speaker click once. Each audible click indicates a sector read or write operation. You may use this procedure to activate the audio indicator even if you have already enabled the RamDrive.

Change RamDrive Parameters

Several modifications can be made to RamDrive to suit the user's needs. To implement these modifications:

```
BLOAD RANDRIVE
```

into memory,

```
POKE
```

the new values into specific memory locations, and then:

```
CALL 24576
```

to run the RAMDRIVE program. Table *5-2* provides the memory locations, parameters, and initial values for the RamDrive options. Explanations of the options immediately follow the table.

> **Note:** If a RamDrive is currently active, you must re-install the RamDrve before any modifications will have any effect. Do this with the 'CALL 24576' statement.

Table 5-2 RamDrive Parameters

Location (Decimal)	Initial Value (Decimal)	Description
24576		Entiy point into RAMDRIVE program
24579	1	80 column option (1=enable; 0=disable)
24580	0	Double High-Res option (enable=1; disable =0)
24581	3	Emulated slot number (1 to 7)
24582	1	Emulated Volume number
24583	24	Duration of read audio indicator (0 to 255)
24584	18	Duration of write audio indicator (0 to *255)*
24585	6	Frequency of read audio indicator (0 to 255)
24586	18	Frequency of write audio indicator (0 to 255)
24587	18	Read visual indicator character (decimal ASCII value)
24588	23	Write visual indicator character (decimal ASCII value)
24589	0	Lowest emulated drive number (0 for default or 1 to 3)
24591	15	Directory entries ÷ 7 for emulated drive 1 (1 to 15)
24592	15	Directory entries ÷ 7 for emulated drive 2 (1 to 15)
24593	15	Directory entries ÷ 7 for emulated drive 3 (1 to 15)
24594	15	Directory entries ÷ 7 for emulated drive 4(1 to 15)
24595	15	Directory entries ÷ 7 for emulated drive 5 (1 to 15)
24596	15	Directory entries ÷ 7 for emulated drive 6 (1 to 15)
24597	0	Bank lock out bit map for banks 8 through 15
24598	1	Bank lock out bit map for banks 0 through 7

80 Column and Double High Resolution Graphics

The 80 column and double high resolution screen displays reside in Bank 0(64K) of the RamWorks card. Applied Engineering provides the RAMDRIVE program with bank 0 "locked out" from the RamDrive. This allows the 80 column and double High-Res display memory area to function without conflict, regardless of the parameter values in locations *24579* or 24580.

The default values for these parameters allow the use of the 80 column screen and disallow the use of the double high resolution screen feature. If bank 0 is available to the RamDrive (not locked out) and a disallowed display is used anyway, parts of the data on the first RamDrive will be "clobbered". If you will not require the 80 column display and want to gain an additional 4 sectors of RamDrive space, enable RamDrive with Applesoft statements like these:

] BLOAD RAMDRIVE, S6,D1	Loads RamDrive into memory
] POKE 24579,0	Disables 80 column display--unlocks bank 0
] CALL 24576	Reinstalls RamDrive with new setting

(The bracket that begins each line represents the Applesoft BASIC prompt. It is not part of the statement!)

To use the double high resolution graphics display, which displaces 8K (32 sectors) of RamDrive space, activate RamDrive with this statement:

I **POKE 24580,1**	Enables the double High-Res option
I **CALL 24576**	Reinstalls RamDrive with new setting

Emulated Slot

This option allows you to specify the slot in which you want to install the "phantom" RamDrive controller card. Slot 3 is the default value, as table 5-2 indicates, but you can select any slot between 1 and 7 (regardless of any other cards installed) by changing the value at location 24581. If the emulated slot is also the actual disk controller slot, slot 6, for example, then S6,D1 would be the only physical drive and drives 2,3,...6 would be the emulated drives. The program ignores the physical drive 2 in slot 6 in this case.

Lowest Drive Number

Use the value in location *24589* to set the lowest emulated drive number. With reference to the emulated slot 6 example above, if you change the lowest drive value to 3, the physical slot 6 drives would be drives 1 and 2. The emulated drives would then be drives 3, 4, *5,* & 6 (assuming sufficient RamWorks memory).

Emulated Volume Number

The contents of this memory location *(24582)* specifies the volume number of the first emulated drive. Subsequent emulated drives will have a volume number one greater than the preceding volume.

Read and Write Visual Access Indicators

Change the default indicators from 'R' and 'W' to any other characters by POKE-ing the appropriate decimal ASCII value into the corresponding memory location. You can effectively disable the visual indicators by changing the values at 24587 and 24588 to 160 (the high ASCII SPACE character).

Directory Entries

You may specify the maximum number of files (directory entries) allowed on each emulated RamDrive. Divide the number of desired directory entries by seven and enter the integer value in the memory location corresponding to the emulated drive number (see Table 5-2). The default value provides for 105 directory entries (105+7 = 15). The minimum allowed is 7 files; the maximum is 105. Obviously, fewer directory entries specified yields more emulated disk data storage space. You can gain up to 14 additional sectors.

Audio Access Indicators

Adjust he duration and frequency of the optional audible read and write access tones by varying the values in locations 24583 through 24586. The higher the number, the longer or higher the tone. For example:

```
POKE 24583, 255
```

sets the read audio indicator at maximum length.

Bank Lockout

RamWorks memory is organized into memory 'banks", each of which contain 64K bytes of data. Depending upon the amount of memory on RamWorks, you can use up to 16 banks can be used for RamDrive emulation. Upon execution, the RamDnve program determines how many RamWorks banks are available and automatically configures them for use as emulated disk storage. If you wish to allocate some banks for other purposes, maldng them unavailable for RamDrive use, RamDrive allows you to lock out specified banks. The RamDrive will not modify information stored in locked out banks.

As stated earlier, we have initially configured the RAMDRIVE program on the DOS 3.3 side of the Super Desktop Expander disk to lock out bank 0 on RamWorks. RamDrive cannot access that particular bank for use as part of an emulated disk drive. We used the bank 0 lock out default to allow you to run other application programs which use that bank without conflicting with the RamDrive(s). With RamDrive installed and bank 0 locked out, DOS 3.3 based programs can run, use bank 0 as they normally would (if at all), and also access the RamDrive(s).

> **Note:** The type of RAM chip (64K or 256K), the memory blocks used, and the amount of RAM installed determines the numbering scheme for RamWorks memory banks. See Ch. 6, RamWorks Memory Configuration, for more details.

To lock out an individual bank from bank 0 to bank 7, raise 2 to the power of the bank number you wish to lock out and POKE the result in location 24598. For example, to lock out bank 0:

2^ 0= 1; therefore enter:

```
POKE 24598,1
```

To lock out more than one bank in the bank O to 7 range,POKE the sum of the individual bank results. For example, to lock out banks 0 and 3:

(2A0+2A3)=(l +8)=9;there fore enter:

```
POKE 24598,9
```

To lock out a bank or series of banks in the bank 8 to 15 range, apply the same formula except divide the sum of the results by 256 and POKE the final result in location *24597*. For example, to lock out banks 8 and 9:

(2A8 + **2A9)** -i- *256* = (256 + 512) *+256=3;* therefore enter:

```
POKE 24597,3
```

RAMCOPY Instructions

RAMCOPY is a disk duplication utility for the Apple //e with a RamWorks card installed. It decreases the number of disk swaps required during disk duplication by using the extra memory available on RamWorks to store more of the source disk data in one pass. It operates much like Apple's COPYA which uses the //e's main memory only.

RAMCOPY is a binary *file* that you can be execute with the BRUN command or select from the main menu of the DOS 3.3 side of the Super Desktop Expander disk. Slot 3, or an emulated RamDrive, cannot be specified as either the original or duplicate slot. RAMCOPY will copy standard DOS 3.3, ProDOS, Apple Pascal 1.1, and CP/M disks.

WARNING! RAMCOPY uses the first two 64K banks it finds on RamWorks. It will wipe out any RamDrive information that is stored in these banks. To prevent this from happening, lock out these banks from RamDrive. RAMCOPY will also disable RamDrive, requiring you to reactivate the RamDrive.

Note: This program will not copy copy-protected software.

SPEEDOS Documentation

This DOS 3.3 speed-up utility, included on the DOS 3.3 side of the Super Desktop Expander disk can make DOS 3.3 run up to 40 times faster, using it in combination with a RamDrive! It is a public domain program written by Lee DeRaud and published in Call A.P.P.L.E.

Use FID to copy SPEEDOS onto your startup disks. Enable SPEEDOS by typing 'BRUN SPEEDOS' at the Applesoft prompt or from within a greeting program.

SPEEDOS modifies only the "image" of DOS 3.3 in memory; it does not modify DOS 3.3 on the disk. When you enable SPEEDOS, the NIT command is disabled. SPEEDOS will not allow RamDrive load or save files outside the memory range from $200 to $BFFF.

RamDrive Technical Information

We have included the following information for hard core programmers only. Don't blame us if your mind turns to mush after attempting to understand this section.

- ◊ After you enable the RamDrive, a PEEK(24590) statement will indicate the highest emulated drive number *(0-5)* available. A value of 0 in this location indicates the drive specification from the lOB to be ignored (1 drive). Together with the lowest emulated drive number found in location 24589, you can find out how many RamDrives you have available.

- ◊ A PEEK to location 24599 will return the number of 64K banks (0 to *15)* used by RamDrive. This number may be less than the amount of memory on the RamWorks card if some banks have been locked out.

- ◊ You can find a list of specific banks used by RamDrive in memory locations 24600 to 24615. A value of 255 signifies no bank.

- ◊ Some DOS 3.3 enhancement programs and utilities may not work with RamDrive installed. Utilities which relocate DOS 3.3 into high memory will not work with RamDrive.

- ◊ Track 1 and track 17 map to the same memory. Unused sectors on the directory, track 17, are used in track 1.

- ◊ The RamDrive program loads into an area of memory starting at $6000, which is freed after RamDrive is enabled. RamDrive uses memory from *$A581* to $A59D, from $AAB8 to $AACO, and overwrites the second through fifth bytes of the RWTS entry point routine at $B7B5. If the highest emulated drive number is greater than 2, DOS 3.3 is patched at $A9B5. When you use the INIT command, all patches to DOS 3.3 are removed, disabling the RamDrive.

- ◊ The RESET vector from page 3 points to a patch area above the RWTS in DOS 3.3. The purpose is to enable 64K bank 0, if it is not already, whenever you press the RESET key. Use care in changing the RESET vector after enabling RamDrive.

- ◊ After each disk access to RamDrive, the bank switched memory ($DOOO to $DFFF in main memory) will be left in the following conditions:
  RAM bank 2 will always be write enabled.

- ROM will be read enabled if Applesoft was in use prior to the disk access.
- RAM bank 2 will be read enabled if Applesoft was not in use.

These rules insure that Applesoft and Integer BASIC and other programs using bank switched memory will work properly.

◊ The RWTS routine may be called at $3D9 as described in the DOS Programmer's Manual noting the following exceptions:

- The lOB and buffer must reside in the memory range from $200 to $BFFF.
- Track numbers may range from 1 to 49 only. If an 1/0 error results, you may have too little memory for the requested track on that drive. All non-existent or reserved tracks and sectors are flagged in the VTOC.
- Sector numbers may range from 0 to 15

ProDrive™ for ProDOS

ProDrive is the ProDOS version of RamDrive. It is not difficult to use, but you should be familiar with the ProDOS commands and file structure, and the Applesoft BASIC programming language. Applied Engineering recommends the following documents for additional information:

The ProDOS User's Manual (Apple Computer, Inc.)
BASIC Programming With ProDOS (Addison-Wesley Publishing)
Beneath Apple ProDOS (Quality Software)
Applesoft Programmer's Reference Manual (Addison-Wesley Publishing)
The Apple lie Reference Manual (Apple Computer, Inc.)

This section describes the ProDrive emulated disk drive and explains how to install, configure, and use it. This section also includes the instructions for AUTOCOPY, a program which provides a convenient way to copy a group of files from a source disk to a ProDrive.

Description of ProDrive

When ProDOS is loaded into the Apple *IIe's* memory it automatically recognizes the 64K "bank 0" of the RamWorks extended memory as an emulated ProDOS volume (disk) with a volume name of VRAM'. The PRODRIVE program on side one of the Super Desktop Expander disk can enable all or a combination of additional RamWorks memory banks for use as a larger emulated ProDOS volume. The size of this emulated volume depends upon the amount of available RamWorks memory and the number of banks locked out. The ProDrive fully emulates a ProDOS volume (initially named '/RAM') in slot 3, drive 2.

Installing ProDrive

You can create the ProDrive in one of two ways:

Way 1: Boot side one of the Super Desktop Expander disk and select the "ProDrive options menu" option from the main menu; then select "Install ProDrive" (<4>) from the ProDrive menu.

Way 2: Load PRODOS and BASIC.SYSTEM into memory and run (BRUN) the PRODRIVE binary program file. To do this from within an Applesoft startup program, insert the following program line:

```
10 PRINT CHR$(4);"BRUN PRODRIVE"
```

or, by using the ProDOS DASH (-) command:

```
10 PRINT CHR$(4);"-PRODRIVE"
```

The ProDrive will remain active until you power-down the computer (or lose power in some other way, perish the thought), you warm-boot the computer (Control-Reset or PR#6), or until another operating system or program application overwrites its data or volume directory. Some programs may purge the ProDrive from ProDOS or disable any emulated disk interface in slot 3. AppleWorks modified by the Super Desktop Expander does deactivate the ProDrive. To overcome this, you can "patch" ProDrive and AppleWorks by using the PARTITION program included on the Super Desktop Expander disk. SLOTCHANGER, also provided on this disk, allows the user to change the ProDrive emulated disk interface slot and drive for compatibility with programs which disable slot 3 interfaces (e.g. PFS software). (See instructions for PARTITION and SLOTCHANGER later in this chapter.)

The first time you install a ProDrive after booting the system, the PRODRIVE program creates an initialized (cleared) /RAM volume directory. if you execute the PRODRIVE program while a ProDrive is still active, the program will not initialize the /RAM volume directory. if a ProDrive is active and you warm-boot the computer into an operating system or application program that does not corrupt the data contained in the ProDrive banks, you may be able to recreate the previous /RAM volume directory and recover that data. Hold the Closed-Apple () Key down as the PRODRIVE program is executed (about 5 seconds) to activate the ProDrive without clearing its previous volume directory. You can then access all information previously stored in that ProDrive, if not overwritten by another program.

Accessing ProDrive

The ProDrive emulated disk drive supports all ProDOS commands and protocol, except that you cannot be format it. You can rename, save to, load from, and delete files from the ProDrive just like a conventional ProDOS volume.

Copy ProDOS files to the ProDrive using a standard file copy program, such as Apple's FILER, Pinpoint's RAM Enhancement Kit, or Applied Engineering's AUTOCOPY program. (Apple's System Utilities program will not copy files to a ProDrive.) We have included the FILER and AUTOCOPY programs on the Super Desktop Expander disk. See the instructions for AUTOCOPY later in this chapter or on the text (ASCII) file on the disk (select "Autocopy Documentation" under "ProDOS Documentation"). Print this file using a ProDOS word processor (e.g. AppleWorks), or

display it on the screen by selecting the “AUTOCOPY documentation” option from the “ProDrive options menu” of the Super Desktop Expander disk. See the ProDOS User’s Manual for FILER instructions or use the FILER’s TUTOR menu options. When using the FILER, do not use the “COPY A VOLUME” option on a ProDrive.

Executing Programs from ProDrive

Once you have installed the ProDrive and copied the program files to /RAM, you must execute the program using software commands only. Do not perform a warm-boot (-Control-Reset or PR#6); it will wipe out the ProDrive program drivers. To start a program with software commands, you should first be familiar with the ProDOS startup routine and be able to determine the filename of the program’s boot or startup program.

When you boot a ProDOS floppy disk in the startup drive, it first loads the operating system file, PRODOS, into memory. Then ProDOS executes the first system file it finds in the currently prefixed directory with a filetype of SYS and filename suffix of .SYSTEM. If the first system file is BASIC.SYSTEM, like the Super Desktop Expander disk, the BASIC.SYSTEM program looks for and, if found, executes a BASIC program file (file type BAS) with the filename STARTUP. Other SYS type system files usually either contain the application program or load and execute other program files in the directory.

If you have installed ProDrive and copied your program files to /RAM, you should first set the prefix to /RAM before executing the program. Enter:

```
PREFIX /R&M<return>
```

at the BASIC prompt) Then type:

```
CAT<return>
```

Check the directory for the first SYS type file or a file named STARTUP. If list shows a STARTUP file, type:

```
—STARTUP<return>
```

if it shows a SYS file, use the dash command to execute the file. (e.g. —APLWORKS. SYSTEM<return> for AppleWorks.)

Although you can run most ProDOS based software from a ProDrive, not all programs will work as expected. Disk copy-protection may not allow you to execute programs from /RAM, although some copy-protection schemes will allow you to copy and execute the original program from a non-floppy disk (e.g. /RAM volume or a hard disk). Some programs, such as the ProDOS version of AppleWriter //, purposely disable the /RAM volume directory. (See “AppleWriter // Patch” at the end of this chapter.) Other programs may disable the imaginary ProDrive interface card assigned to slot 3. (See Using SLOTCHANGER in this chapter.) if your software does not run as expected you should contact the publisher of your software or seek the assistance of an experienced programmer to instruct you on the modification of your software or the execution of your particular program from a /RAM volume directory.

Bank Lock Out Feature

When you initially create the ProDrive with the PRODRIVE program, the program locks out the 64K in bank 0 of auxiliary memory. That is, the ProDrive cannot access that particular bank for use as part of the emulated disk drive. The bank 0 lock out default was used to allow other application programs which use that bank to run without conflicting with the ProDrive memory area. With ProDrive installed and bank 0 locked out, ProDOS based programs can run, use bank 0, and access the ProDrive.

> **Caution:** The bank lock Out procedure described in this section is more complicated than it sounds. Don't attempt it unless you are very familiar with Applesoft BASIC and ProDOS. Instead, you may wish to use the PARTITION program described later in this chapter.

If you wish to lock out additional banks of RamWorks memory or use all of the available banks, you must make one or two simple modifications to the PRODRIVE program. You'll need to calculate the values used to lock out the desired banks, load the PRODRiVE program into memory, insert those values into specific memory locations, and execute the modified PRODRIVE program.

> **Note:** The numbering scheme for RamWorks memory banks is determined by the type of RAM chip (64K or *256K),* which memory chip sockets are used, and the amount of RAM installed. See Chapter 6, "RamWorks Memory Configuration", for more details.

You can access two memory locations to modify the number of banks locked out. These are (decimal) 8195 for banks 0 through 7 and 8196 for banks 8 through 15. To lock out an individual bank from bank 0 to bank 7, raise 2 to the power of the bank number you want to lock out and POKE the result in location 8195. For example, to lock out bank 1:

2^1 = 2;therefore POKE 8195,2

To lock out more than one bank in the bank 0 to 7 range, POKE the sum of the individual bank results. For example, to lock out banks 0, 1, and 2:

(2^ 0 + 2^1 + 2"2) = (1 + 2 + 4) = 7; therefore POKE 8195,7

To lock out a bank or series of banks in the bank 8 to 15 range, apply the same formula except divide the sum of the results by 256 and POKE the final result in location 8196. For example, to lock out banks 8 and 9:

(2^8 + 2^9) + 256 = (256 + 512) + 256 = 3; therefore POKE 8196,3

To execute the now modified PRODRIVE program (in memory) issue a CALL to location 8192. These modifications do not affect the the PRODRIVE program on disk unless the PRODRIVE program in memory is saved back to disk using the BSAVE command.

Following is a summary of Applesoft BASIC statements to lock out banks 0, 1,2, 8, and 9 as in the examples above. (The bracket at the beginning of each line represents the Applesoft BASIC prompt. It is not part of the statement!)

```
]BLOAD PRODRIVE
]POKE  8195,(2^ 0 + 2^1 + 2^2)
]POKE 9196,((2^8 + 2^9)/256)
]CALL 8192
```

Or, as part of a BASIC startup program, this example could appear:

```
]10 PRINT CHR$ (4);"BLOAD PRODRIVE"
]20 POKE 8195,7
]30 POKE 8196,3
]40 CALL 8192
```

Using PARTITION

There is an easier way to lock out banks! The PARTITION program on side one of the Super Desktop Expander Disk is a menu-driven utility that will reconfigure the bank lock out parameters within the PRODRIVE program. PARTITION let you lock out the specified lower numbered 64K banks of available memory from use by the ProDrive. PARTITION will also modify a COPY of your AppleWorks STARTUP disk, which enables AppleWorks to recognize the /RAM volume as well as use the remaining locked out memory banks (free memory) to expand the AppleWorks Desktop.

PARTITION is not difficult to use. Just follow these step by step instructions.

1. Make BACKUP copies of your AppleWorks disks (modified or unmodified) and the A Super Desktop Expander disk. Do not write protect the copies. Put your originals in a safe place!

2. Execute the AW 2 Expander (or Super Desktop Expander) Enhancements before you use the PARTITION utility. (Refer to Ch. 3 for instructions) Any other modifications to AppleWorks required by Pinpoint or similar programs should be done after the PARTiTION modifications.

3. Boot side one of the copy of the Super Desktop Expander disk. Select the "Exit to BASIC" option.

4. At the Applesoft BASIC prompt (]), type:

   RUN PARTITION<return>

5. Read the brief paragraph on the screen.

   If you wish to modify a PRODRIVE program file only, select option 0.

   If you wish to modify a PRODRIVE program file and an AppleWorks STARTUP disk, select option A.

The bar graph that appears represents, from left to right, the amount of free memory available for program use, the amount of memory allocated for ProDrive use, and the amount of uninstalled memory, up to 3 megabytes.

6. Use the left and right arrow keys to adjust the desired free memory and ProDrive sizes. Press the return key when completed.

7. Insert the write-enabled Super Desktop Expander disk (backup copy!), that contains the PRODRIVE file to be modified, into the startup drive. At the ? prompt type:

```
/1W. EXP/PRODRIVE<return>
```

   Or, if you have changed the volume directory, filename, or pathname of either of the above, enter the appropriate ProDOS pathname.

Note: If you encounter an error that results in a PATH NOT FOUND, SYNTAX ERROR, OR WRITE PROTECTED message, type: RUN<return> at the BASIC prompt —or re-boot and begin again at step 5 of this procedure.

8. If option A was selected, PARTITION will prompt you to insert the AppleWorks STARTUP disk. Remove the Super Desktop Expander disk and insert the write-enabled copy of the AppleWorks STARTUP disk into the startup drive. At the ? prompt type:

```
/APPLEWORKS/APLWORKS .SYSTEM<return>
```

   Or, if you have changed the volume directory or pathname of either of the above, enter the appropriate ProDOS pathname.

   When you execute the modified PRODRIVE program, it will now install the /RAM volume in the banks above the ones used by the patched AppleWorks. The modified AppleWorks STARTUP disk is now patched to use only up to the amount of memory specified by the PARTITION program. Be sure you've read the sections in this chapter entitled "Installing ProDrive" and "Executing Programs from ProDrive."

Using SLOTCHANGER

When the PRODRIVE program initially creates the ProDrive it gives it the volume name tRAM which is assigned to a slot 3, drive 2 ProDOS disk driver (emulated disk interface card). Some application programs may disable the ProDrive by deactivating any ProDOS device drivers assigned to slot 3. ProDOS based PFS software and AppleWorks 1.3 (not modified by the Super Desktop Expander) are examples of application software which disable a ProDrive assigned to slot 3. The SLOTCHANGER program on the Super Desktop Expander disk will allow the user to reassign the emulated /RAM interface card from slot 3, drive 2 to another slot and drive. Drive 1 or 2 of any slot can be designated so long as the designated drive is not already a ProDOS device. (e.g. disk drive or already installed ProDrive.) In other words, the slot number chosen for the new emulated interface does not necessarily have to be physically empty.

SLOTCHANGER, an Applesoft BASIC program, can be executed directly from BASIC or from the “ProDrive options menu” of the Super Desktop Expander disk. Selecting the “Change ProDrive emulation slot,drive” option from the “ProDrive options menu” of the Super Desktop Expander disk will install a ProDrive (if not already installed) and run the SLOTCHANGER program. If you execute it from BASIC, SLOTCHANGER will not automatically install a ProDrive; SLOTCHANGER will display this prompt:

```
Change ProDrive to emulate what slot,drive? (l-7),(l-2) S_
```

Enter the new slot number,l through 7 (Do not enter the comma or press the return key!) and then enter the number of the new drive, either 1 or 2. If you make a mistake which results in an error, just reboot and start again.

Using AUTOCOPY

We have included AUTOCOPY, an Applesoft BASIC utility program, on the Super Desktop Expander disk. This program will allow you to copy all of the files on one or more floppy disks to a ProDrive. The authors of AUTOCOPY tried to make the program as simple to use as possible, but it does require some elementary knowledge of ProDOS pathname structure. The ProDOS User’s Manual (Apple Computer, mc) will explain the basics of pathnames, directories, subdirectories, and filenames.

Select the “Autocopy all files to ProDrive” option from the Super Desktop Expander to automatically install a ProDrive (if not already installed) and run the AUTOCOPY program. AUTOCOPY first prompts you with the following line:

Enter name of volume directory to copy (<RETURN> to quit) /

Carefully type the volume name of the floppy disk containing the files you wish to copy. The leading ProDOS slash (/) delimiter is provided; just enter the volume name character string. You don’t need to type the ending delimiter. To correct an entry, use the left arrow key to backspace over the error, then enter the correct character(s) before you press the return key. Next, the program prompts you to enter the destination subdirectory:

Enter name of destination subdirectory /RAM/

The program provides the ProDrive volume directory name, /RAM/; type the desired subdirectory name. If you want to copy the source files directly under the /RAM directory, just press the RETURN key. To change the destination volume directory name, use the left-arrow key to backspace over “RAM” and enter the desired volume name or pathname.

Use the equal sign (=) as a wildcard to substitute for the trailing characters of a source filename character string. For example:

Enter name of volume directory to copy
(<RETURN> to quit)/PFS.FLLE/FRED=

In this example, AUTOCOPY will copy to the ProDrive only the files with filenames that begin with “FRED” on the /PFS.FILE volume.

If you specify a destination subdirectory which does not already exist, AUTOCOPY will automatically create it. The program copies the contents of any subdirectories encountered under the source pathname to subdirectories created by AUTOCOPY under the

destination pathname. AUTOCOPY does not copy ProDOS to the ProDrive because the ProDrive is not a bootable device. Besides, ProDOS is already in memory and would serve no purpose in /RAM.

You can also execute AUTOCOPY from Applesoft BASIC either from the immediate (BASIC prompt) or from the deferred (within a BASIC program) mode. If you want to execute AUTOCOPY from BASIC, remember to install a ProDrive first.

> **IMPORTANT:** If you want to copy AUTOCOPY to another disk and execute it from that disk, you will need to also copy the GET.LEN file to that disk. GET.LEN must be under the same directory as AUTOCOPY.

Customizing AUTOCOPY

Users familiar with the BASIC programming language can alter certain AUTOCOPY program statements (lines), allowing the program to function as an automatic (STARTUP) program, capable of copying multiple volumes or pathnames to a ProDrive. Users not familiar with Applesoft BASIC should refer to the Apple manuals, Applesoft BASIC Programmer's Reference Manual and BASIC Programming with ProDOS.

AUTOCOPY program lines 40 through 44 conveniently contain the user options. The statements beginning with line *45* are string array elements that contain the multiple source and destination pathnames. The initial default option settings, shown in Example 1, are explained in the following paragraphs.

Example 1:

```
40  PROMPT  = YES
41  ASKFILE = NO
42  EXITFILE$ = "/?"
44  MULTIVOL  = NO
45  MV$(0) = "/?":MU$(0) = "/?"
46  MV$(1) = "/?":MU$(1) = "/?"
47  Mv$(2) = "/?":MU$(2) = "/?"
```

Line 40 PROMPT =

In the default state (YES) AUTOCOPY will prompt you to insert the source disk and press return. If changed to PROMPT = NO, the program will scan the system for the source pathname and begin the copy process.

Line 41 ASKFILE =

The default setting (NO) will cause AUTOCOPY to automatically copy all files encountered under the source pathname. If you change this option to YES, you'll be asked to confirm each file before it's copied. This allows selective copying of files when desired.

Line 42 EXITFILE$ =

This option allows you to name a file for the program to execute after it completes the copy process. The default (EXITFILE$ = *"/?")* will cause the program to display "COPY COMPLETE" when it has finished copying all files, set the current prefix to the boot drive, and exit to the BASIC prompt The EXITFILE must be an executable program file and you should specify it by its complete pathname. The EXITFILE routine will automatically insert the ProDOS DASH (-) command.

Line 44 MULTIVOL =

If MULTIVOL = NO the program uses only the option parameters specified in program lines 40 through 42, inclusive. It ignores the multiple source and destination pathnames described listed in the next paragraph.

If MULTIVOL = YES the program will use the pathname string arrays it finds beginning with line 45. Up to ten additional source (MU$) and destination (MU$) string array elements may be created as required. When the program encounters a source or destination array element which contains "/?" it will prompt the operator for keyboard input for that element.

You can use the equal-sign (=) as a wildcard to substitute for the trailing characters of a source character string, as shown in this example program line:

```
45   MV$(0) = "/PFS.PLAN/PLAN=":MU$(0) = "/RAM/PFS"
```

The program will only copy to the /RAM/PFS subdirectory the files with filenames that begin with "PLAN" on the /PFS.PLAN volume.

The program lines shown in Example 2 will load the contents of the AppleWorks startup and program disks to the /RAM/APPLEWORKS/ subdirectory. Since line 40 is set to YES, AIJTOCOPY prompts the operator to insert the volume /APPLEWORKS two times (the AppleWorks STARTUP and PROGRAM volumes.) After AUTOCOPY has copied all files to the ProDrive, it executes the EX1TFILE$ string in line 42.

Example 2:

```
40 PROMPT = YES
41 ASKFILE = NO
42 EXITFILE$ = "/RAM/APPLEWORKS/APLWORKS.SYSTEM"
44 MULTIVOL = YES
45 Mv$(0)  = "/APPLEWORKS":MU$(0) = "/RAM/APPLEWORKS"
46 MV$(1)  = "/APPLEWORKS":MU$(1) = "/R&M/APPLEWORKS"
```

The options specified in Example 3 tell the AIJTOCOPY program to automatically copy all files beginning with "FILE" on the /PFS.FILE volume to the /RAM/PFS subdirectory and prompt the operator for the next source and destination pathnames. After AUTOCOPY has copied all files, the program will then execute the EXITFILE$. (FILE.SYSTEM is the PFS:File startup program.)

Example 3:

```
40 PROMPT = YES
41 ASKFILE = NO
42 EXITFILE$ = "/RAM/PFS/FILE.SYSTEM"
44 MULTIVOL = YES
45 MV$(0) = "/PFS.FILE/FILE":MU$(0) = "/R&M/PFS"
46 MV$(1) = "/?":MU$(1) = "/?"
```

Note: PFS software is copy-protected. You can copy program files to a ProDrive and execute them, but they are "keyed" to the PFS program master disk which must be in the startup disk drive. See your PFS program user's manual for more information about how to execute programs from a hard disk or ProDrive.

AppleWriter // Patch

When you run the ProDOS-based AppleWriter I/program, it disconnects any /RAM volume it finds, whether created by ProDOS or PRODRIVE. The following Applesoft BASIC commands will permanently modify one of the AppleWriter program files which will prevent AppleWriter from disconnecting the ProDrive /RAM volume. Do not apply this modification to the original AppleWriter disk! Use a BACKUP copy!

Boot side one (ProDOS side) of the Super Desktop Expander and select the "Exit to BASIC" option. Remove the Super Desktop Expander disk from the internal drive and replace it with the AppleWriter BACKUP disk. You must name the BACKUP disk's volume, "AW2MASTER". Enter the appropriate command sequence below. (The AppleWriter copyright screen displays the AppleWriter version number.)

The bracket at the beginning of each line represents the Applesoft BASIC prompt. It is not part of the statement!

AppleWriter //version 2.0 (See your Apple dealer for details on update to 2.1.)

```
] PREFIX  /AW2 MASTER
] UNLOCK  AWD.SYS
] BLOAD  AND. SYS, TSYS,A$2000
] POKE  8484,243
] POKE  8486, 179
] BSAVE  AND. SYS,TSYS,A$2000
] LOCK  AND . SYS
```

AppleWriter //version 2.1

```
] PREFIX   /AW2MASTER
] UNLOCK AWD.SYS
] BLOAD AND. SYS, T$OC,A$2000
] POKE 8484,243
] POKE 8486, 179
] BSAVE AND. SYS, T$OC,A$2000
] LOCK AND . SYS
```

Now you can copy AppleWriter to and run from a ProDrive. You can also run AppleWriter from a conventional disk and use the ProDrive /RAM volume for temporary data storage.

Remember, if you boot another application program after installing a ProDrive, it will clear the ProDrive's directory. To avoid this,you must execute the AppleWriter startup program, AW.SYSTEM, with software commands. First, install the ProDrive. Then, set the ProDOS prefix to the directory containing the AppleWriter program files. Use the ProDOS dash command to execute the AppleWriter startup program. For example:

```
]PREFIX /AW2MASTER
]-AN. SYSTEM
```

Note: These patches do not expand the 46,845-character limit of AppleWriter.

6: RamWorks Memory Configuration

Introduction

This chapter provides the information required to add and configure memory on your RamWorks main board. It contains the specifications for the RAM (Random Access Memory) chips, tells where you can get them, and then, how to install them. Instructions for installing the 512K Expander or the 2 Meg Plus "piggy-back" boards are included with the Memory Expander cards.

The Proper Memory Chips

Selecting the proper RAM chips for RamWorks can be tricky. There are several chip manufacturers and many different types and specifications of chips available. RamWorks and the RamWorks Memory Expander card can use either 64K or 256K RAM Dual In-Line Package (DIP) chips. You must use DYNAMIC RAM chips which have a speed specification of 200 nS (nanoseconds) or faster. Applied Engineering recommends a rating of 150 nS.

You can get the 64K and 256K memory chips with the correct specifications at some computer or electronics parts stores. Or you can get them through Applied Engineering; possibly at lower cost. Because Applied Engineering gets bulk-quantity discounts on its purchases of memory chips, they can often offer them at lower prices. We use high-quality memory chips and warrant them for *5* years. (Most electronics parts vendors sell their chips "as is".) When you get Applied Engineering memory chips, we assure you that they are the correct chips.

Memory Chip Installation

Note: You may return your RamWorks and/or RamWorks Memory Expander card to Applied Engineering for a memory upgrade with no additional charge for the installation or testing. Call Applied Engineering Sales for the latest memory chip prices and get a Return Material Authorization (RMA) number. The Sales telephone number is (214) 241-6060.

If, however, you would rather install them yourself--read on.

> Warning! Don't ZAP your chips! The IIe, the RamWorks board and the Memory Expander cards have many static sensitive components. Be very careful to discharge any static electricity on your body by touching the //e power supply case before you touch any of the components!

The main RamWorks card can have from 64K to 1024K of memory installed using 64K chips, 256K chips, or a combination of both. (If your RamWorks replaces an Apple Extended 80 Column Text card, you may be able to install the Extended 80 Column card's 64K chips on your RamWorks.)

The memory on RamWorks is organized into 4 “blocks”, designated block A, B, C, and D. RamWorks basic memory is divided into 2 “blocks”, block A and B. Illustration 6-1 and 6-2 show which memory chip sockets go with which block. Each block must be either completely empty or completely populated with 8 chips of the same memory size.

Important: NEVER mix 64K chips and 256K chips in the same block!

Note: When you install or rearrange RamWorks memory chips, we suggest that you install the larger (256K) chips in block A, filling up the lower banks of memory first. Use the 64K chips in the blocks immediately after the blocks with 256K chips. Programs which use extended memory may “look” for memory only in the lower banks.

Illustration 6-1 and 6-2 show the correct orientation of the RAM chips on the RamWorks card. Note the position of the notch (or dot on some chips). Make sure that you insert the memory chips properly. Each RAM chip should have all legs fully seated in the socket and in the correct position.

OOPS! Applying power to a chip that is plugged in backwards will ruin the chip immediately. But don’t worry, RamWorks is tough; it will survive.

Illustration 6-1 RamWorks III Memory Blocks

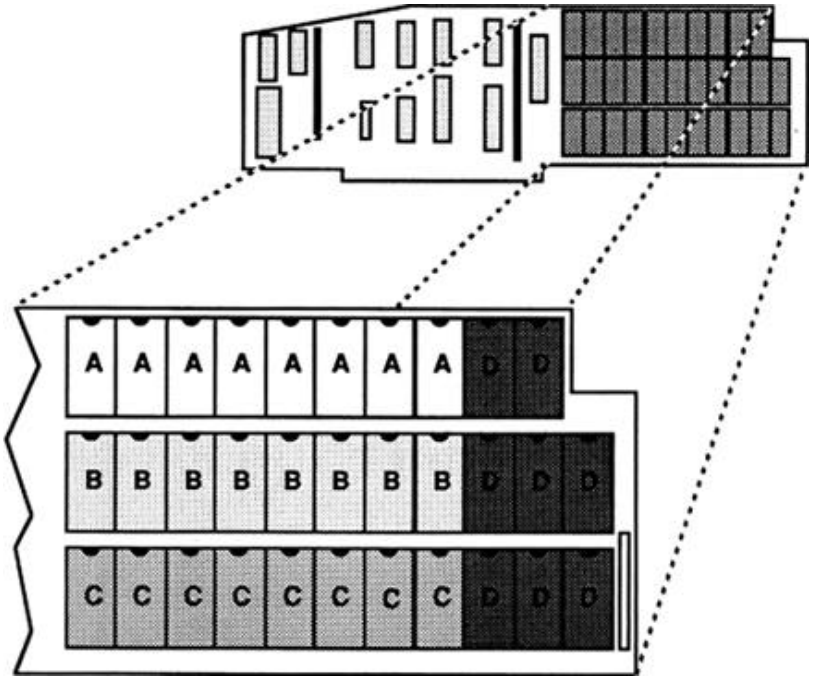
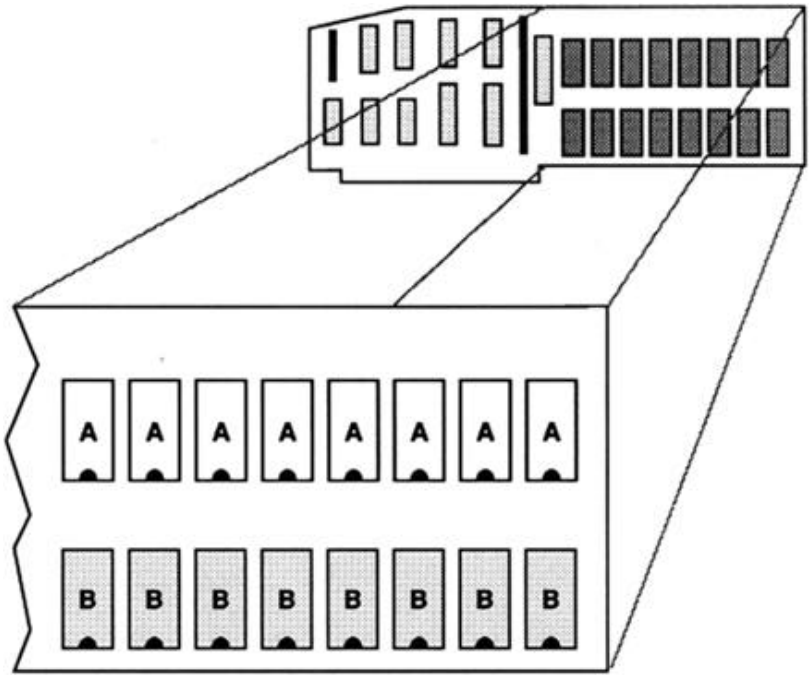


Illustration 6-2 RamWorks basic Memory Blocks



Still Not Enough?

Applied Engineering also sells two “piggy-back" expanders compatible with RamWorks III, RamWorks II, and RamWorks basic cards. The RamWorks 512K Memory Expander piggy-back card can have from 64K to 512K installed using the 64K chips, 256K chips, or both.

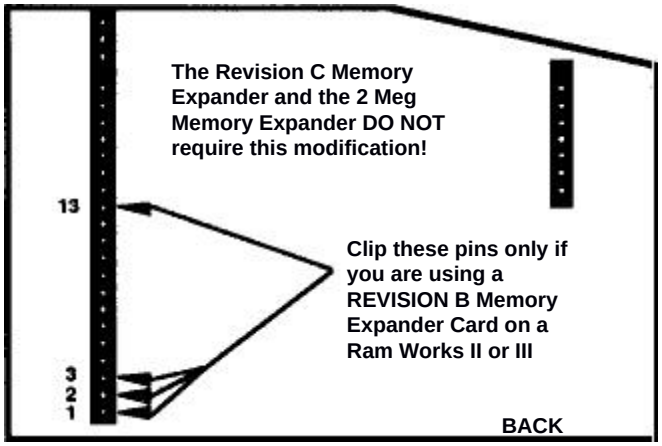
512K Rev. B Note

If you install a 512K RamWorks Memory Expander, you must first determine the revision level of the Expander card. The revision letter is located on the upper, keyboard end of the component side (the side with the chips) of the Expander.

if you have a revision B 512K Expander you will need to perform some minor surgery before you install it on your RamWorks. You need only a small wire cutter to make the altercation. Locate pins 1,2, 3, and 13 on the larger row of pins and clip them flush with the black sleeve. (See illustration 6-3.) Pins 1, 2, and 3 are easy, but count carefully when you clip 13! The pins take a long time to grow back.

The Revision C 512K Expander card and the 2 Meg Expander cards do not require this modification!

Illustration 6-3 Revision B 512K Expander Modification



Back (solder) Side of the Revision B 512K Memory Expander

2 Meg / 2 Meg Plus Note

The original 2 Meg Expander (now discontinued) used *256K X* 8 SIP RAM chips which are very expensive and not very common. The new 2 Meg Plus Expander uses more efficient and more common 1 Meg DRAM chips. You can now get as much memory (up to 2 Meg) for a much lower price.

We have included, on the following tables, the Bank addresses of the original 2 Meg Expander for the benefit of those who may still have one or who have acquired one second-hand.

Memory Bank Configurations

Many RamWorks users will never want or need to know the bank configuration of their RamWorks, but for those who want to know; Table 6-1 on the next page shows the relationships between memory blocks, banks, and memory chip size for RamWorks III, RamWorks 512K Memory Expander, 2 Meg Expander, and 2 Meg Plus Expander. Table 6-2 shows the configuration for RamWorks basic and for the expanders when used with RamWorks basic. Note that the memory configuration for the expanders are different when used with RamWorks Ill and with RamWorks basic.

Use these tables to determine the addressable 64K banks for any possible configuration of memory chips. The bank designations are in hexidecimal notation.

Table 6-1 RamWorks III Bank Configuration Chart

RamWorks III Main Board:	Block	Size	Bank Numbers (hex notation)			
	A	64K	$00	-	-	-
		256K	$00	$01	$02	$03
	B	64K	$04	-	-	-
		256K	$04	$05	$06	$07
	C	64K	$08	-	-	-
		256K	$08	$09	$0A	$0B
	D	64K	$0C	-	-	-
		256K	$0C	$0D	$0E	$0F
512K Memory Expander:	**Block**	**Size**	**Bank Numbers**			
	E	64K	$10	-	-	-
		256K	$10	$11	$12	$13
	F	64K	$14	-	-	-
		256K	$14	$15	$16	$17
2 Meg. Memory Expander: (discontinued)	**Block**	**Size**	**Bank Numbers**			
	E	256Kx8	$10	$11	$12	$13
	F	256Kx8	$14	$15	$16	$17
	G	256Kx8	$30	$31	$32	$33
	H	256Kx8	$34	$35	$36	$37
	I	256Kx8	$50	$51	$52	$53
	J	256Kx8	$54	$55	$56	$57
	K	256Kx8	$70	$71	$72	$73
	L	256K x 8	$74	$75	$76	$77
2 Meg Plus Memory Expander:	**Block**	**Size**	**Bank Numbers**			
	A	1 Meg	$10	$11	$12	$13
			$14	$15	$16	$17
			$30	$31	$32	$33
			$34	$35	$36	$37
	B	1 Meg	$50	$51	$52	$53
			$54	$55	$56	$57
			$70	$71	$72	$73
			$74	$75	$76	$77

Table 6-2 RamWorks basic Bank Configuration Chart

RamWorks basic Main Board:	Block	Size	Bank Numbers (hex notation)			
	A	64K	$00	-	-	-
		256K	$00	$04	$08	$0C
	B	64K	$03	-	-	-
		256K	$03	$07	$0B	$0F
512K Memory Expander:	**Block**	**Size**	**Bank Numbers**			
	E	64K	$01	-	-	-
		256K	$01	$05	$09	$0D
	F	64K	$02	-	-	-
		256K	$02	$06	$0A	$0E
2 Meg. Memory Expander: (discontinued)	**Block**	**Size**	**Bank Numbers**			
	E	256Kx8	$01	$02	$05	$06
	F	256Kx8	$09	$0A	$0D	$0E
	G	256Kx8	$21	$22	$25	$26
	H	256Kx8	$29	$2A	$2D	$2E
	I	256Kx8	$41	$42	$45	$46
	J	256Kx8	$49	$4A	$4D	$4E
	K	256Kx8	$61	$62	$65	$66
	L	256Kx8	$69	$6A	$6D	$6E
2 Meg Plus Memory Expander:	**Block**	Size	Bank Numbers			
	A	1 Meg	$01	$02	$05	$06
			$09	$0A	$0D	$0E
			$21	$22	$25	$06
				$29	$2A	$2D
	$2E					
	B	1Meg	$41	$42	$45	$46
			$49	$4A	$4D	$4E
			$61	$62	$65	$66
			$69	$6A	$6D	*$6E*

7: Ram Works Auxiliary Memory

For Programmers Only...

Because RamWorks is completely compatible with the Apple Extended 80 Column card, the purpose of this chapter is to describe only the feature which is unique to RamWorks, extended auxiliary memory. This material is definitely intended for assembly language programmers. Information concerning the access and control of the 80 column firmware, screen features, and auxiliary memory can be found in the Apple //e Reference Manual.

> **Warning:** Don't attempt to use the auxiliary memory directly from an interpreter such as BASIC or Pascal. These interpreters use certain portions of main memory that, when switched to auxiliary memory can cause your program and the interpreter to "bomb".

Bank Switching

The 6502 microprocessor has the address capability of only 64 kilobytes. In order to address more memory, use "bank switching," a feature built in to the Apple //e's firmware. Soft switches control whether the 6502 addresses the 64K bank of main memory or the single 64K bank of auxiliary memory available with the Extended 80 Column card. In order to use more than just 64K of auxiliary memory, RamWorks combines this bank switching technique with its own firmware feature called, "the bank select register." The bank select register determines which of 48 possible 64K banks of auxiliary memory the 6502 addresses.

The bank select register is mapped into the He's memory space at location $C073 (49267). The programmer can select one of 48 valid banks by writing the bank number into this location. (Chapter 6 provides the bank numbers for various memory configurations.) Once you make the bank selection, soft switches built into the //e firmware function as they normally would. This allows data transfer from main memory to auxiliary memory and vice versa.

Data transfers between banks of auxiliary memory must be done in two stages. The data transfers to main memory first and then from main memory to the desired bank(s). You can also transfer, one byte at a time, using the Accumulator.

Bank 0 in RamWorks always contains the text information for the 80 column display and the graphics information for the double high resolution display. This bank must be active whenever the program updates the display screen. Only Bank 0 contains the video information. This feature, unique to RamWorks, eliminates a screen flicker problem inherent with some other brands of memory cards when they access other banks.

The bank select register is initialized to zero on a power-up, but not after a reset. Please refer to the programming suggestion in "Reset Vector".

The location of the bank select register is also shared with the system. Writing to the bank select register will also trigger the paddle strobe, used to read the paddle inputs. To

insure the paddles are read correctly, wait at least 3 milliseconds after changing banks before starting the paddle read routine.

You cannot read the contents of the bank select register. The program must keep track of the current bank number in a reserved location within each bank.

Programming Suggestions

Interrupts

Programmers should note that RamWorks has multiple interrupt vectors. Since the interrupt vector is located at $FFFE, each auxiliary bank of memory contains an interrupt vector. Auxiliary memory may be switched in when an interrupt occurs; therefore, you should prepare routines that use auxiliary memory to disable or process interrupts. You should disable interrupts in programs which do not use them. Please refer to the Apple //e Reference Manual for details on how to handle interrupts.

Reset Vector

All programs should start by initializing the bank register to 0 (video bank). Since RamWorks cannot detect a hardware reset, the software should be able to handle a reset by storing a 0 in the bank register. The following assembly language subroutine intercepts the reset soft vector at $3F2-$3F3 and changes it to point to the new reset routine.

```
*Store off old reset soft vector
            LDA     $3F2
            STA     $300    ;IN $300.30 1
            LDA     $3F3
            STA     $301
*Set reset vector to point to $302
            LDA     #$02
            STA     $3F2    ;($3F2 -> $302)
            LDA     #$03
            STA     $3F3
            EOR     #$A5    ;Inits new validity check byte
            STA     $3F4
*Reset routine
            LDA     #$A9    ;LDA #0
            STA     $302
            LDA     #$0
            STA     $303
            LDA     #$8D    ;STA $C073
            STA     $304
            LDA     #$73
            STA     $305
            LDA     #$c0
            STA     $306
            LDA     #$6C    ;JMP ($300)
            STA     $307
            LDA     #$00
            STA     $308
            LDA     #$03
            STA     $309
```

Available Banks

The following subroutine will find all valid banks, determine the size of RamWorks memory, and save the results into BankTbl. BankTbl will have the number of 64K banks found, followed by the table of valid bank numbers. Keep in mind that the bank numbers are not necessarily linear. For example: 'BankTbl:08 0001 020304050607' indicates a 512K RamWorks containing banks 0 through 7.

```
BankSel     EQU     $C073
MaxMem      EQU     3*16 Maximum desired, 3 megabytes in this example

*Write bank number to each bank
        STA     $C009       ;Store in alternate zero page
        LDY                 #$7F        ;Valid banks range $00 to $7F
FindBanks   STY     BankSel     ;Go through each bank
        STY     $00         ;Store the bank number
        TYA
        EOR     #$FF
        STA     $01         ;Second self-check
        DEY
        BPL     FindBanks
*Read them back to find valid banks and save in table
        LDA     #$00
        TAY
        TAX
FindThem    STY     BankSel     ;Search through all banks
        STA     BankSel+3
        CPY      $00
        BNE     NotOne              ;Check bank number
        TYA
        EOR     #$FF
        CMP     $01
        BNE     NotOne      ;Check second double-check
        INX
        TYA     ;Found valid bank-save in table
        STA     BankTbl,X
        CPX     #MaxMem             ;Found all banks to be used
        BCS     Done
 NotOne     INY         ;Go through all valid bank ranges
        BPL     FindThem
*Ending routine
Done        LDA     #$00        ;Reset to video bank
        STA     BankSel
        STA     $C008
        STX     BankTbl     ;Size of Ram card
        IDA     #$FF STA BankTbl+l,X     ;Mark end of table
        JMP     Continue

BankTbl     DS      MaxMem+2
Continue    EQU  *
```

A: Early "Revision A" Apple //e *Computers*

There are currently three revision levels of domestic (U.S.) Apple //e main logic boards (motherboards). The first, the "early Revision A board", was sold for a very short period during early 1983. This board had a part number of 820 - 0064 - A and it did not support double high resolution graphics. Shortly thereafter, Apple introduced part number 820 - 0064 - B (revision B) which did fully support double High-Res graphics. The Enhanced //e, introduced in early 1985, has a redesigned main logic board with a new part number, 820 - 0087 - A, and, of course, does support double High-Res. Illustration 2-1 on page 3 indicates the location of the part number.

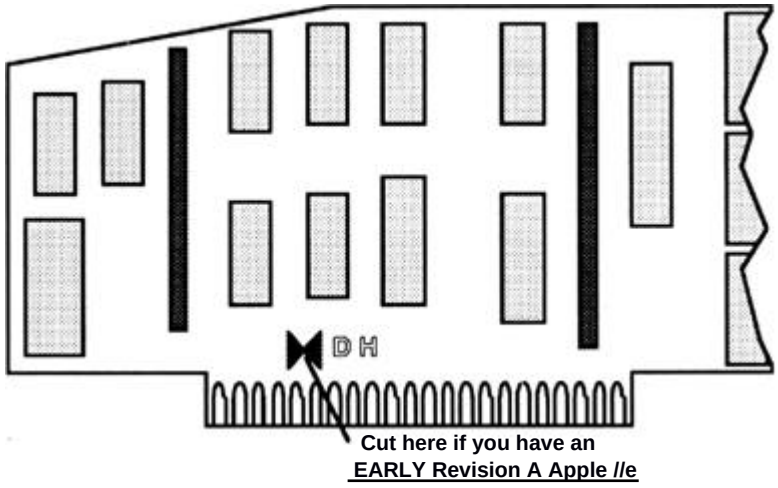
Important Note: If you have an early "revision A" computer, contact your authorized Apple dealer about an upgrade to a later revision. He can provide you with information on Apple Computer's update policy for Rev. A owners who want double high resolution graphics.

If you do have the early "revision A" Apple //e, you can still use RamWorks, but the RamWorks card must be modified. However, your computer will still not support double high resolution graphics. In fact, the 820-0064-A motherboard will not work at all with an unmodified RamWorks.

The modification is simple; just cut the "solder switch" marked "DH" on the RamWorks printed circuit card. This switch, located slightly above the gold edge connector on the component side of the board, looks like a tiny bowtie. (See illustration A-1.) Use an Exacto knife or sharp penknife to just break the connection where the two points join. Be careful to cut only this connection, not the adjacent printed circuit traces! This switch can be reconnected with a small blob of solder.

Warning! Cutting any other traces will void the warranty!

Illustration A-1 Double High Resolution Graphics Switch



B: *The Ram Works Memory Test*

Use the RamWorks Memory Test to verify the basic operation and hardware reliability of the RamWorks card. If you encounter problems when running a program that you feel relate to RamWorks memory, this test is a good first step in diagnosing the problem.

DO NOT attempt to repair your RamWorks card!

To run this test program, turn the computer off, insert the Super Desktop Expander disk or the AW 2 Expander disk in your startup drive, and turn the computer on. When the main menu appears, select the "RamWorks Memory Test" option. Select the appropriate option from the memory-test options menu. If you hold the Open-Apple key (O) down momentarily while you select the memory test, it will execute a longer more thorough memory test.

A graphic representation of the product being tested will appear on the screen. The test indicates any defective RAM chips or empty RAM sockets with a "XX" in the corresponding chip location on the graphic display. After eight successful passes, the program displays the message "Card Passed," indicating that the circuitry on the card has passed. In the lower left corner of the screen, a "pass indicator" will show how many times the program has run the memory test. The program will repeat the memory test indefinitely. Press any key to terminate the RAM test and enter the 80 column and high-resolution display portion of the RamWorks test.

If the test passes and you still experience problems with your program, the next step will be to eliminate the software as a possible source of the problem. Try to run different software packages or another copy of the program you are having problems with. Our experience shows that a large majority of "program crashes" are not necessarily caused by hardware failures but by software problems. Many software publishers offer technical support for software related problems.

If the RamWorks Memory Test fails, turn the system off, insure that all of the socketed memory chips and connectors are correctly and securely seated. (Often, just reseating the chips and connectors has a magical healing effect on a sick computer!) Turn the system on and run the memory test again, if it still fails, refer to the Technical Support section in the preface of this manual.

C: *RGB Color Option for Ram Works*

For those users who want RGB color graphics and expanded memory, Applied Engineering offers the Digital Prism and the ColorLink RGB options for the RamWorks. The Digital Prism option is fully compatible with Apple's Extended 80 Column Color Card and Applied Engineering's earlier version of the RGB option card while the ColorLink supports both IBM digital and Apple analog compatible screens. Since virtually all //e software which supports RGB conforms to this standard, you are assured of the highest degree of software compatibility when using one of the Applied Engineering RGB options.

Both of the RGB options consist of a circuit board which plugs into the connectors on the solder side of the RamWorks card and interface cables which connect the output of the RGB card to the rear panel of the computer.

Hardware output of the Digital Prism RGB option interface card is true digital RGB (as opposed to the analog RGB supported by ColorLink). Both provide output to 9 pin and 15 pin "D-shell" connectors. Some manufacturers provide special cables which interface their monitors and the standard connectors.

Below is a list of RGB monitors that Applied Engineering has tested and knows to be compatible with the RGB options. Applied Engineering recommends the monitors indicated by an asterisk (*) for their excellent color and sharp, clear image.

Monitors Tested with RGB Option

RGB Monitor	RGB Option Compatible	Digital Prism Compatible	ColorLink Compatible	Comments
Apple Color 100	Y	Y	N	Comes with cable and 15 pin connector
AppleColor~ RGB Monitor*	N	N	Y	Comes with cable and 15 pin connector
Sony KV1311 CR*	N	Y	Y	Requires Sony CTG-503 RGB cable.
NEC Multisync JCl4Ol3PA	N	Y	Y	
Taxan 420* (discontinued)	Y	Y	N	Requires Taxan cable, part number 410-05.

This is only a partial list of the many compatible RGB monitors available. Although every attempt has been made to ensure the accuracy of this list, Applied Engineering is not liable for errors. We suggest you use this list only as a guide when shopping for your monitor. We also recommend that you purchase your monitor through a dealer who will allow you to return it after a few days if it does not perform as expected.

D: *A Brief ProDOS Tutorial*

This is a brief explanation of the **Pro**fessional **D**isk **O**perating **S**ystem, **ProDOS** for those who are completely new to it. All of this information and more is included in your *Apple Owner's Guide*, but we have provided it here for your convenience.

Operating System

ProDOS is one of several operating systems for the Apple. Others include DOS 3.3 and Pascal. Operating systems, as defined in the *Apple Owner's Guides*, are programs that control how information is loaded into memory, how the computer handles the information, how the information is stored on a disk, and how the computer communicates with the printer and other peripherals.

Naming Volumes

ProDOS must have a way to locate which disk (often called "volume") you want to access. Instead of typing in the location of the disk as in DOS 3.3 (ex: S6,D1), you simply type in the name of the disk (the volume name). Some rules for volume names are

1) Name can include letters, numbers, or periods but not spaces
2) Name must begin with a letter
3) Name can be up to 15 characters long

These rules also hold true for subdirectory names.

Root Directory and Subdirectory

The main directory of the volume is called the root directory. The root directory uses the same name as your disk. Subdirectories are ProDOS' way of organizing information on a disk.

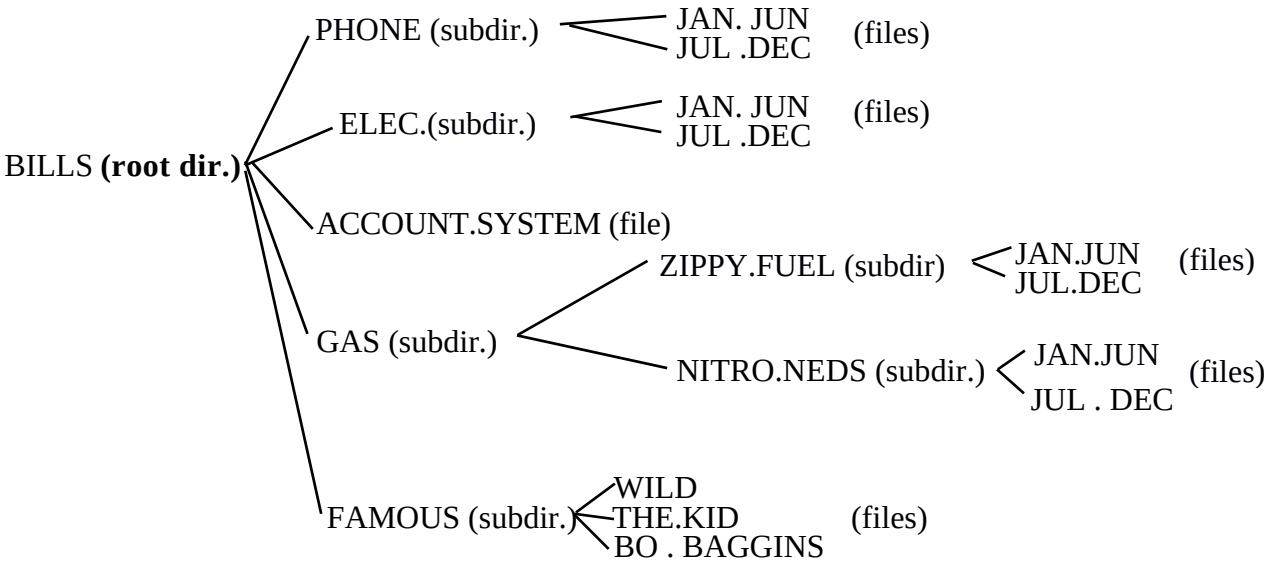
Think of the root directory as a file drawer and the subdirectories as folders within the drawer. You can

1) Put files directly into the root directory like putting documents straight into the file drawer
2) Place files within subdirectories like putting documents in folders
3) Put subdirectories within subdirectories like putting folders within folders.

Pathname

The name of the directory combined with the names of one or more subdirectories is called a pathname. Volume names and subdirectory names are preceded by a slash, "/". (Note that some applications add the slash for you.) For example, you could have a volume named /MY . DISK and a file called /MY.FILE on the root directory of that disk. To access that file, you would use the pathname /MY . DISK/MY. FILE. You could also have a file /JuL . AUG in a subdirectory (folder) called /PHONE on a disk called /BILLS.

To access that file, you would use the pathname /BILLS/PHONE/JUL.DEC. Refer to the diagram below.



ProDOS Directory Structure

Now when an application asks you for the pathname of a file, you'll have a basic understanding of what it expects.

System Files

A system file is a ProDOS file that starts an application. Typically, these files have the suffix .SYSTEM (e.g. /APLWORKS.SYSTEM, /ACCOUNT.SYSTEM [see above], etc.). When you boot ProDOS, it runs the first system file listed in its directory. So, if BASIC.SYSTEM is the first system file on your ProDOS boot disk, ProDOS will boot and then put you in BASIC.

Additional Resources

The following books are available through most book stores:

Apple II Owner's Manual (Apple Computer, Inc.) Supplied with your Apple Computer. Take the time to read it.

Basic Programming with ProDOS (Addison-Wesley Publishing) Gives a detailed explanation of how to use ProDOS from AppleSoft Basic.

Beneath Apple ProDOS (Quality Software) Provides information about ProDOS for both the novice Apple user and the advanced programmer.

ProDOS Inside and Out (TAB Books) Very good book for both the beginning and advanced BASIC Programmer.

ProDOS User's Manual (Apple Computer, Inc.) Provides an overview of ProDOS and explains how to use the ProDOS User's Disk.

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