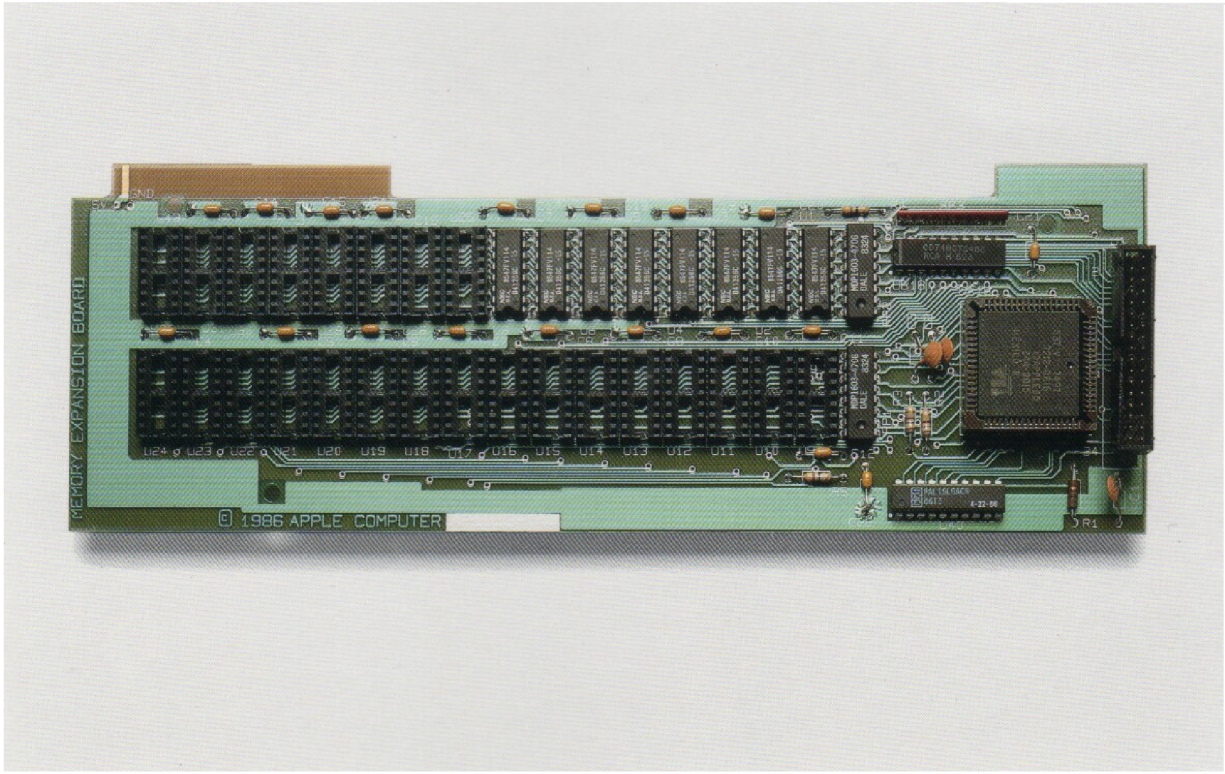
Apple II

Apple IIc Memory Expansion Card Owner's Guide



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WARNING

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. See instructions if interference to radio or television reception is suspected.

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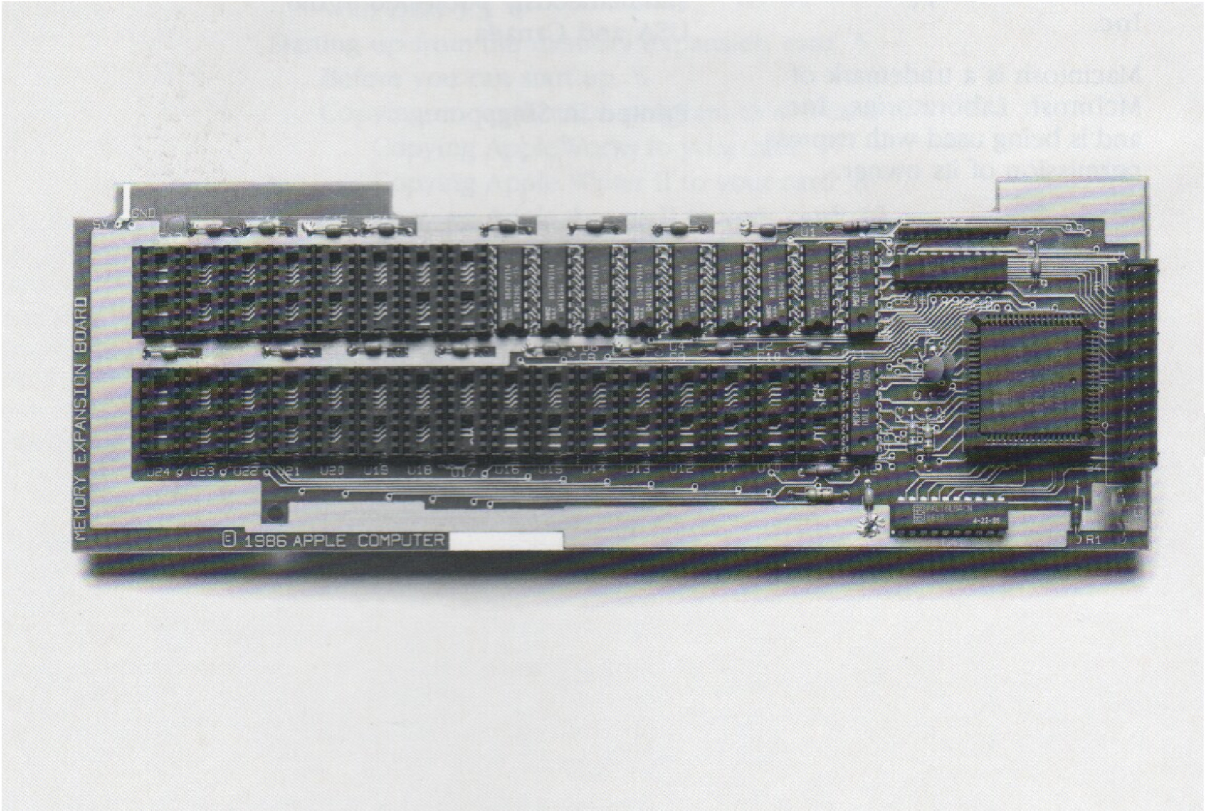
Apple IIc Memory Expansion Card Owner's Guide



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Simultaneously published in the USA and Canada.

Printed in Singapore.

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Radio and television interference

The equipment described in this manual generates and uses radio-frequency energy. If it is not installed and used properly—that is, in strict accordance with Apple's instructions—it may cause interference with radio and television reception.

This equipment has been tested and complies with the limits for a Class B computing device in accordance with the specifications in Subpart J, Part 15, of FCC rules. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that the interference will not occur in a particular installation, especially if a "rabbit-ear" television antenna is used. (A rabbit-ear antenna is the telescoping-rod type usually found on television receivers.)

You can determine whether your computer is causing interference by turning it off. If the interference stops, it was probably caused by the computer or its peripheral devices. To further isolate the problem, disconnect the peripheral devices and their input/output (I/O) cables one at a time. If the interference stops, it was caused by either the peripheral device or the I/O cable. These devices usually require shielded I/O cables. For Apple peripheral devices, you can obtain the proper **shielded cable** from your authorized Apple dealer. For non-Apple peripheral devices, contact the manufacturer or dealer for assistance.

A **shielded cable** uses a metallic wrap around the wires to reduce the potential effects of radio-frequency interference.

Important This product was FCC-certified under test conditions that included use of shielded cables and connectors between system components. It is important that you use shielded cables and connectors to reduce the possibility of causing interference to radio, television, and other electronic devices.

If your computer does cause interference to radio or television reception, you can try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.
- Move the computer to one side or the other of the television or radio.
- Move the computer farther away from the television or radio.
- Plug the computer into an outlet that is on a different circuit than the television or radio. (That is, make certain the computer and the radio or television set are on circuits controlled by different circuit breakers or fuses.)
- Consider installing a rooftop television antenna with a coaxial cable lead-in between the antenna and television.

If necessary, consult your authorized Apple dealer or an experienced radio/television technician for additional suggestions.

Apple® II

Apple IIc Memory Expansion Card Owner's Guide

About the Apple IIc Memory Expansion Card

Important Before reading this guide or attempting to use your Apple IIc Memory Expansion Card, read the *Apple IIc Owner's Manual*.

The Apple® IIc Memory Expansion Card adds extra random-access memory (RAM) to your Apple IIc computer. The standard memory expansion card comes with 256K RAM, but it can be expanded to 512K, 768K, or 1 megabyte.

There are several ways you can use the additional memory you get by adding a memory expansion card to your computer system:

- You can run sophisticated application programs that take advantage of the memory expansion card's extra memory.
- You can copy programs like AppleWorks™, Apple Access™ II, and Apple Writer™ II onto the memory expansion card. This makes your programs start up and run faster by saving the time ordinarily spent accessing the program disk.
- You can temporarily save data on your memory expansion card. This is particularly useful when you have more than one program that uses the same data, or if you refer to certain data frequently.

Warning Your authorized Apple dealer will install the memory expansion card for you. Do not try to install the card yourself. The card goes inside the Apple IIc case, and opening the case will void your warranty.

Original Apple IIc's will need to be upgraded to accommodate the memory expansion card. Your dealer has more details.

❖ *Note to programmers:* If you plan to write programs that use the memory expansion card's RAM, see Appendix B, "Assembly-Language Interface."

How it works

You don't need to know anything about how the memory expansion card works to use application programs that automatically take advantage of the extra memory on the card. If that's all you plan to do with the memory expansion card, you can stop reading right here.

If you would like to use the memory expansion card to speed up the way your application programs run, or as a temporary storage area for data, you need to understand a little more about how the card works.

Think of the memory expansion card as a cross between a disk and random-access memory. (That's why you'll sometimes hear the card called a "RAM disk.") Like a disk, it must be formatted before you can put files on it. Also like a disk, it must be addressed by its volume name or by its location. Like RAM, the computer can access the information on it very quickly. Also like RAM, what's stored on it is stored temporarily—when the power is turned off, the information on it disappears.

Important Because the memory expansion card's storage is temporary, it's important to save your data to disks at regular intervals. (How you save data to disks depends on the application program you're using.)

For your convenience, the memory expansion card is automatically formatted to be used as a data disk for the program disk in the startup drive. This occurs the first time the memory expansion card is accessed after you turn on the Apple IIc power switch.

Different programs run on different operating systems (usually ProDOS®, Pascal, or DOS 3.3), and the memory expansion card can be formatted for only one operating system at a time. So ProDOS, for example, can't share the memory expansion card with Pascal or DOS 3.3 at the same time.

- *By the way:* The next few sections ask you to indicate a volume name or device location for the memory expansion card—RAM4 or IN#4. The *4* refers to the card's device location assignment, which is the Apple IIc's equivalent to slot assignments in Apple II systems that use peripheral slots on their main circuit board. Because most Apple II software runs on both the Apple IIc and Apple II's that have slots, you will occasionally be asked to indicate a slot number. Just remember that the memory expansion card is in "slot" 4.

With ProDOS

If the program disk in your startup drive is ProDOS-based, the memory expansion card formats itself for ProDOS with the volume name `/RAM4`. To save a file called MEMO on the memory expansion card, you'd use the pathname `/RAM4/MEMO`.

With Pascal 1.3

Programs written with earlier versions of Pascal (1.1 or 1.2) are not able to use the additional memory on the memory expansion card.

If the program disk in your startup drive is Pascal 1.3–based, the memory expansion card formats itself for Pascal with the volume name `RAM4`. To save a file called MEMO on the memory expansion card, you'd type `RAM4:MEMO` as the name of the file.

With DOS 3.3

Initializing is the DOS term for *formatting*.

The memory expansion card does not automatically initialize itself when you start up a DOS 3.3 program. To initialize the memory expansion card for DOS 3.3, type `IN#4` while you're in the BASIC environment and press Return. When you see a backslash (\) character, your memory expansion card has been initialized.

❖ *Note:* Before you type IN#4, you need to be in the BASIC environment. If you're not there already—that is, if you don't see a BASIC prompt character ( ]) on your screen—remove the disk from your startup drive, press ⌘-Control-Reset to exit from the program you're in, and then, while the disk drive is still whirring, press Control-Reset to get into the BASIC environment.

Format your disks first!

After you initialize the memory expansion card with DOS 3.3 by typing `IN#4`, you won't be able to format disks until you restart your Apple IIc, losing any data on the memory expansion card. If you intend to save your data from the card onto disks at the end of your working session, format some disks *before* you initialize the memory expansion card.

To save a DOS 3.3 file on the memory expansion card, follow the application program's instructions for saving files. When you're asked for the slot and drive number, type slot 4 and drive 1.

❖ *By the way:* DOS 3.3 handles only 400K volumes, so a maximum of 400K of the memory expansion card's RAM is available to DOS 3.3 users.

Starting up from the memory expansion card

You can copy application programs onto the memory expansion card and start them up directly from the card. But there are some limitations. Just about any ProDOS application can be copied onto the memory expansion card and started from the card, but you can't start up DOS 3.3 programs from the memory expansion card. Loading Pascal-based programs on the card requires the Apple II Pascal 1.3 system disks.

❖ *By the way:* If you *do* have the Pascal system disks, just use FORMATTER.CODE to format the card as if it were a disk, transfer all the system files to the card, and then start the program by pressing ♁-Control-Reset.

Before you can start up

Here's what you must do before you can start up from the memory expansion card:

1. Format the memory expansion card with the appropriate operating system—in most cases ProDOS. Even though the memory expansion card is automatically formatted as a *data* disk when you start up a ProDOS-based program disk, it isn't formatted as a *startup* disk. To put startup information on the memory expansion card, you have to format it by using the formatting utility on the *ProDOS User's Disk,* or by using the format option on a ProDOS program disk.
2. Copy the program file(s) onto the memory expansion card by using the Copy a File utility on the *ProDOS User's Disk.*

For more information on copying files, read the appropriate section of the *Apple II Utilities Guide.*

❖ *Disks that can't be copied:* If your program is copy protected, you won't be able to copy its files to the memory expansion card or start it up from the memory expansion card.

❖ *Something extra:* The *ProDOS User's Disk* comes packed with the Apple IIc Memory Expansion Card so you can format the card. But there are lots of other utilities on the disk that let you copy files, delete files, rename volumes, and so on. Also, on the other side of the disk you'll find *System Utilities*—the same utility disk described in the *Apple IIc Owner's Manual*. The manual that explains how to use both disks—the *Apple II Utilities Guide*—replaces the *System Utilities* section of the *Apple IIc Owner's Manual*.

Copying an application program to the card

Here's how you copy AppleWorks (versions earlier than 2.0), Apple Access II, Apple Writer II, or any other ProDOS-based application program to the memory expansion card by using the *ProDOS User's Disk:*

1. Start up the *ProDOS User's Disk.*
2. Press F for `PRODOS FILER (UTILITIES).`
3. Press V for `VOLUME COMMANDS.`
4. Press F for `FORMAT A VOLUME.`
5. Press 4.
6. Type a name for your memory expansion card (for example, `RAM4`) and press Return.
7. Press Y (to indicate that it's OK to erase what's on the memory expansion card).
8. When you see the message `FORMAT COMPLETE`, press Esc twice to get back to the ProDOS Filer menu.
9. Press F for `FILE COMMANDS.`
10. Press C for `COPY FILES.`

Formatting the memory expansion card is much faster than formatting a disk. It's almost instantaneous.

What you do next depends on whether you're copying AppleWorks, Apple Access II, Apple Writer II, or some other ProDOS-based application program onto your memory expansion card. Find the instructions that apply to you, and read on.

Copying AppleWorks to your card

Important If you're using AppleWorks version 2.0, you won't need to copy the program onto the memory expansion card. Version 2.0 automatically copies itself onto the card when you start up the program, and it uses available RAM on the card as extra space for the AppleWorks Desktop. If you're using earlier versions of AppleWorks, follow the instructions in this section.

If AppleWorks is the first or only program you're copying onto your memory expansion card, follow all the instructions in the section "Copying an Application Program to the Card," and then follow the instructions in this section, which apply specifically to copying AppleWorks to the memory expansion card.

If you've already copied a ProDOS-based application program onto the memory expansion card, follow instructions 1, 2, 9, and 10 in the section "Copying an Application Program to the Card," and then follow the instructions in this section.

1. Type `/APPLEWORKS/=` and press Return.
2. Type whatever name you gave your memory expansion card, followed by a slash and an equal sign (for example, `/RAM4/=`). Then press Return.
3. Put the *AppleWorks Startup* disk in one of your disk drives and press Return.

As each file is copied from the startup disk to the memory expansion card, you'll see a message like this on your screen:

```
PRODOS COPIED--> PRODOS
```

Important If you have already copied another ProDOS-based application onto the memory expansion card, you'll get the message

```
PRODOS DELETE EXISTING FILE? (Y/N)
```

You only need one `PRODOS` file for all the ProDOS-based application programs on the memory expansion card. This ProDOS file is identical to the one that's already on the card, so press N, and the program will skip over this file and proceed to the next file on the disk.

When all the files have been copied to the memory expansion card, you'll see the message

```
COPY COMPLETE
```

Now you need to go through the same procedure with your *AppleWorks Program* disk:

4. Press Return to get back to the start of the Copy Files display.
5. Type `/APPLEWORKS/=` and press Return.
6. Type whatever name you gave your memory expansion card, followed by a slash and an equal sign (for example, `/RAM4/=`). Then press Return.
7. Replace the *AppleWorks Startup* disk with the *AppleWorks Program* disk and press Return.

When all the files have been copied, you'll see the message

```
COPY COMPLETE
```

To get out of the ProDOS Utilities and into AppleWorks, follow these steps:

1. Press Esc twice to get back to the Filer menu.
2. Press Q for `QUIT`.
3. Press Return to get back to the Main Menu.
4. Press B for `APPLESOFT BASIC`.
5. Type `PR#4` and press Return.

If you have more than one program on the memory expansion card, type `-/RAM4/APLWORKS.SYSTEM` instead of `PR#4`.

Copying Apple Writer II to your card

If Apple Writer II is the first or only program you're copying onto your memory expansion card, follow all the instructions in the section "Copying an Application Program to the Card," and then follow the instructions in this section, which apply specifically to copying Apple Writer II to the memory expansion card.

If you've already copied a ProDOS-based application program onto the memory expansion card, follow instructions 1, 2, 9, and 10 in the section "Copying an Application Program to the Card," and then follow the instructions in this section.

1. Type `/AW2MASTER/=` and press Return.
2. Type whatever name you gave your memory expansion card, followed by a slash and an equal sign (for example, `/RAM4/=`). Then press Return.
3. Put the *Apple Writer II Master* disk in one of your disk drives and press Return.

As each file is copied from the program disk to the memory expansion card, you'll see a message like this on your screen:

```
PRODOS COPIED—> PRODOS
```

Important If you have already copied another ProDOS-based application onto the memory expansion card, you'll get the message

```
PRODOS DELETE EXISTING FILE? (Y/N)
```

You only need one `PRODOS` file for all the ProDOS-based application programs on the memory expansion card. This ProDOS file is identical to the one that's already on the card, so press N, and the program will skip over this file and proceed to the next file on the disk.

When all the files have been copied to the memory expansion card, you'll see the message

```
COPY COMPLETE
```

(Be patient, there are over 40 files on the *Apple Writer II Master* disk.)

Right before the message `COPY COMPLETE`, you'll hear a beep, and you'll see the message

```
HS4 File Expected
```

HS4 can't be copied because it's a subdirectory full of files, not an individual file. So the next step in copying the Apple Writer files to the memory expansion card is to create a subdirectory on the memory expansion card and copy the files from the subdirectory on the disk to the subdirectory on the card.

Here's how:

4. Press Esc to get back to the File Commands menu.
5. Press M for MAKE DIRECTORY.
6. Type /RAM4/HS4 and press Return.
7. Press Esc to get back to the File Commands menu.
8. Press C for COPY FILES.
9. Type /AW2MASTER/HS4/= and press Return.
10. Assuming that RAM4 is the name of your memory expansion card, type /RAM4/HS4/= and press Return. (If you named your card something else, type that name in place of RAM4.)
11. Put your *Apple Writer II Master* disk in one of your disk drives (if it's not still there) and press Return.

When all files in the subdirectory have been copied to your memory expansion card, you'll see the message

```
COPY COMPLETE
```

To get out of the ProDOS Utilities and into Apple Writer II, follow these steps:

1. Press Esc twice to get back to the Filer menu.
2. Press Q for QUIT.
3. Press Return to get back to the Main Menu.
4. Press B for APPLESOFT BASIC.
5. Type PR#4 and press Return.

If you have more than one program on the memory expansion card, type -/RAM4/APLWORKS.SYSTEM instead of PR#4.

Copying Apple Access II to your card

If Apple Access II is the first or only program you're copying onto your memory expansion card, follow all the instructions in the section "Copying an Application Program to the Card," and then follow the instructions in this section, which apply specifically to copying Apple Access II to the memory expansion card.

If you've already copied a ProDOS-based application program onto the memory expansion card, follow instructions 1, 2, 9, and 10 in the section "Copying an Application Program to the Card," and then follow the instructions in this section.

1. Type `/ACS/=` and press Return.
2. Type whatever name you gave your memory expansion card, followed by a slash and an equal sign (for example, `/RAM4/=`). Then press Return.
3. Put the *Apple Access II Program Disk* in one of your disk drives and press Return.

As each file is copied from the program disk to the memory expansion card, you'll see a message like this on your screen:

```
PRODOS COPIED--> PRODOS
```

Important If you have already copied another ProDOS-based application onto the memory expansion card, you'll get the message

```
PRODOS DELETE EXISTING FILE? (Y/N)
```

You only need one `PRODOS` file for all the ProDOS-based application programs on the memory expansion card. This ProDOS file is identical to the one that's already on the card, so press N, and the program will skip over this file and proceed to the next file on the disk.

When all the files have been copied to the memory expansion card, you'll see the message

```
COPY COMPLETE
```

(Be patient, there are 14 files on the *Apple Access II Program Disk*.)

To get out of the ProDOS Utilities and into Apple Access II, follow these steps:

1. Press Esc twice to get back to the Filer menu.
2. Press Q for `QUIT`.
3. Press Return to get back to the Main Menu.
4. Press B for `APPLESOFT BASIC`.
5. Type `PR#4` and press Return.

If you have more than one program on the memory expansion card, type `-/RAM4/LOADER.SYSTEM` instead of `PR#4`.

Copying other ProDOS applications to your card

If you're copying a different ProDOS-based application program to the memory expansion card, use the preceding instructions for guidance—just be sure to type the volume name of the program disk you're copying instead of `/APPLEWORKS`, `/ACS`, or `/AW2MASTER`.

If you don't know the name of your application program disk, put the disk in one of your disk drives and use the List Volumes command on the *ProDOS Utilities Disk* to find out.

- *By the way:* You may get the message FILE EXPECTED while copying files. That's because some applications have program files that are actually subdirectories full of other files. If so, you'll need to create subdirectories on the memory expansion card. Use the section "Copying Apple Writer II to Your Card" as an example for creating subdirectories.

Putting more than one program on the card

If you wish, you can copy more than one program's files onto the memory expansion card, but to start one of them up, you need to know the name of the program's system file. Read the section titled "Starting Up With More Than One Program on the Card."

If two or more of the programs you want to put on your memory expansion card happen to have system files with identical names, you'll need to create subdirectories before you copy the files onto the memory expansion card. You may also need to reset the prefix so that the program can find the files it needs to start up. See the *Apple II Utilities Guide* for more information on creating subdirectories and setting prefixes.

Another good reason for putting programs into subdirectories on your memory expansion card is that there's a limit to how many files you can fit in a ProDOS directory. (The limit is 51.) With programs that have lots of files (like Apple Writer II, for instance), you'll run out of room in the volume directory long before you run out of memory space on the card.

Two ways to start up programs

If you've copied only one program's files onto the memory expansion card, there are two ways to start up that program:

- Press ⌘-Control-Reset. When you do this, the Apple IIc scans the device location assignments, looking for a startup device (a disk drive—or equivalent—containing a program disk). The Apple IIc recognizes the memory expansion card as a startup device, and your program is loaded. (The Apple IIc first looks in the memory expansion card, then looks in the built-in disk drive, and then in the external drive.)
- Type `PR#4` from the BASIC environment and press Return.

If you get the message `UNABLE TO START FROM MEMORY CARD`, it means you forgot to format the memory expansion card before copying program files onto it. See the section titled "Before You Can Start Up" for more information.

Starting up with more than one program on the card

If you have copied more than one program's files onto the memory expansion card, the first startup program in the directory will be the one that starts up. To start up one of the other programs on the memory expansion card, you need to know the name of the program's system file. (Hint: Check the directory of the program disk. The system file will have the word *system* in it.) Once you know the name of the program's system file, you can exit from the program you're in, type a hyphen, then type the pathname of the other program's system file (`-/RAM4/APLWORKS.SYSTEM` for AppleWorks, for example), or the program's prefix (`/RAM4`) followed by the program's system file name (`APLWORKS.SYSTEM`, for example).

❖ *By the way:* If you get the error message PATH NOT FOUND, you may need to reset the prefix so that your program can find the files it needs to start up. You can find more information about using multiple programs on a single disk in Appendix D of *Apple II Utilities Guide*.

Another way to move from one program to another on the memory expansion card is to install a switcher application program, like Catalyst™ by Quark Incorporated or MouseDesk™ by International Solutions. Switcher applications let you *switch* between programs more quickly.

Consider your memory expanded

By now you should have a pretty good idea of how you can use your Apple IIc memory expansion card to

- run sophisticated programs especially designed to take advantage of the memory expansion card
- make regular programs start up and run faster
- temporarily store often-used data

❖ *Problems?* If you think your card isn't working as it should, you can test it by using a diagnostic program that's built into the card. See Appendix A, "Diagnostic Test," for details.

❖ *By the way:* If you need more complete technical information about the Apple IIc, read the *Apple IIc Technical Reference Manual*. If you need more information about the memory expansion card, read the *Apple IIc Memory Expansion Card Reference*.

Appendix A: Diagnostic test

The Apple IIc Memory Expansion Card has a built-in program that tests the RAM and other circuitry on the card.

Warning This test will erase any information stored on the card.

If you suspect that your memory expansion card isn't working properly, follow these steps to start the diagnostic test:

1. Start up your computer without a disk in the startup drive and press Control-Reset.
2. Type `CALL -151` and press Return.
3. Type `C40AG` (that's a zero, not the letter *O*) and press Return.

After a few moments, you'll see either the words `CARD OK` or the words `CARD FAILED` (accompanied by some beeps). If your card fails, make a note of the data error number that appears on the screen and take your Apple IIc to your authorized Apple dealer for a tune-up.

Appendix B: Assembly-language interface

Experienced programmers can call the memory expansion card to move blocks of data of any size. This makes it possible for your applications to deal directly with data elements smaller than 512 bytes, bypassing the space management of the operating systems on each call. Programmers who use these commands through assembly-language calls must make sure that this use does not conflict with the ProDOS or Pascal use of the device as a RAM disk. (ProDOS and Pascal handle memory allocation and deallocation invisibly to the user by keeping track of which blocks of data have been written to.)

These techniques are discussed in the technical reference manuals for their respective environments.

There are several ways you can make sure your program doesn't interfere with the ProDOS or Pascal use of the memory expansion card as a RAM disk. The best way is to create a large dummy file through operating-system calls to reserve space on the disk.

- *By the way:* Because using the assembly-language protocol is fairly complicated, Apple encourages you to use the memory expansion card as a RAM disk through ProDOS or Pascal block device calls.

Direct assembly-language calls to the memory expansion card follow the conventions of the protocol converter used for devices attached to the external disk port on the Apple IIc.

THE APPLE PUBLISHING SYSTEM

This Apple manual was written, edited, and composed on a desktop publishing system using the Apple Macintosh™ Plus and Microsoft® Word. Proof and final pages were created on the Apple LaserWriter™ Plus. POSTSCRIPT™, the LaserWriter's page-description language, was developed by Adobe Systems Incorporated.

Text type is ITC Garamond® (a downloadable font distributed by Adobe Systems). Display type is ITC Avant Garde Gothic®. Bullets are ITC Zapf Dingbats®. Program listings are set in Apple Courier, a monospaced font.

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, California 95014
TLX 171-576

030-1330-A
Printed in Singapore.