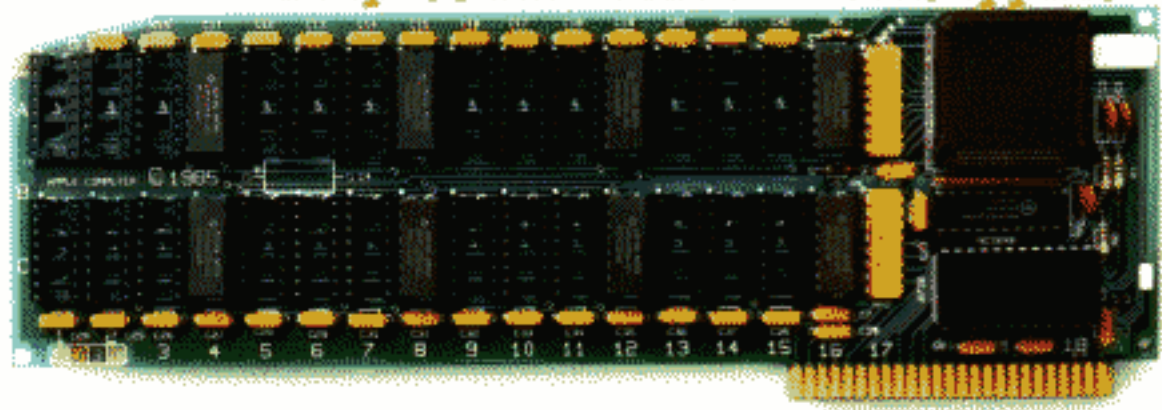




# Apple® II Memory Expansion Card User's Manual

<http://www.turbo-2.com/apple/>



Memory Expansion Card User's Manual  
Carte Extension Mémoire: Manuel de l'utilisateur  
Speichererweiterungs-Karte  
Manuale Utente della Scheda di Espansione di Memoria  
Manual del usuario de la tarjeta de expansión de memoria

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Carte Extension Mémoire:

Manuel de l'utilisateur

Speichererweiterungs-Karte

Manuale Utente della Scheda  
di Espansione di Memoria

Manual del usuario de la tarjeta  
de expansión de memoria

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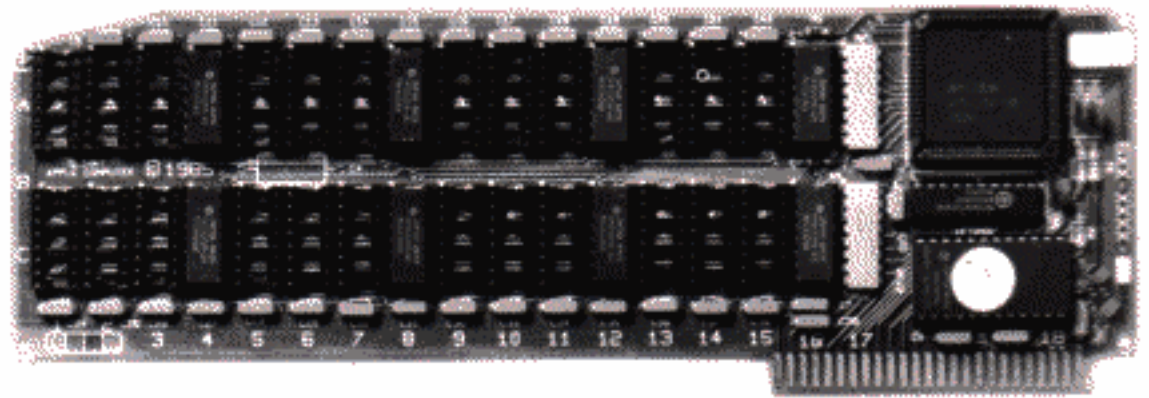
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# Apple® II Memory Expansion Card User's Manual

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## About the Apple II Memory Expansion Card

You can't use the memory expansion card with an Apple IIc because the Apple IIc doesn't accommodate cards.

### Important!

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

Because RAM on the main circuit board and on an extended 80-column card is handled differently from RAM on the Apple II Memory Expansion Card, adding a memory expansion card to an Apple II or an Apple II Plus won't enable you to run software designed for an Apple IIc or an Apple IIe with an extended 80-column card.

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™ to the memory expansion card. This makes your program 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 regularly.

*Note to Programmers:* If you will be writing programs that use the memory expansion card's RAM, see Appendix B, "Assembly-Language Interface."

## Installing the Card

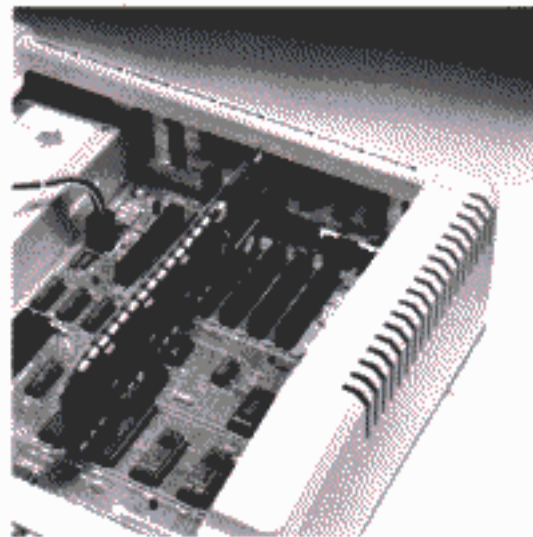
---

Installing the memory expansion card is easy. Here's how:

1. Turn off the Apple II power switch, but don't unplug the power cord.
2. Remove the Apple II cover.
3. Touch the power supply case (the large metal box on the left side of the main circuit board) to discharge any static electricity that may have accumulated on your clothes or body.
4. Insert the card in any available slot (except slot 3, or the AUX. CONNECTOR slot on the Apple IIe). *Don't touch* the gold fingers along the bottom edge of the card or the components on the card. Install the card by rocking it from back to front until it is firmly seated in the slot. See Figure 1.

*Figure 1.* Inserting the Card

---



### **Important!**

If you're not sure whether a program is based in Pascal, ProDOS, or DOS, you can usually find out by checking the label on the program disk or by checking the manual that came with the program.

If any of the application programs you'll be using with the memory expansion card are Pascal based, the card must be installed in slot 4, 5, or 6.

5. Replace the Apple II cover.



## How It Works

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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.

*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.

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 the way 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 slot number. 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.

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 turning on the Apple II power switch.

## An Exception

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If you have an original Apple IIe that hasn't been enhanced, there are certain occasions when the card won't be formatted automatically. The occasion arises when you use a ProDOS™-based program, in 80-column mode, and you switch to another program without having accessed the card. Subsequent programs, assuming the card has already been formatted, won't format the card, and you won't be able to save data on it. You can avoid this problem by formatting the card with the *ProDOS User's Disk*, or by turning the computer off between applications.

How do you know if your Apple IIe is enhanced? If you have an enhanced IIe, you'll see the words **Apple IIe** at the top of your screen when you start up your computer. If you have an original Apple IIe, you'll see the words **Apple II**.



### **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 `/RAMn`, where `n` is the slot number containing your memory expansion card. (A memory expansion card in slot 4, for example, would have 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**

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 `RAMn`, where `n` is the slot number containing your memory expansion card. To save a file called MEMO on the memory expansion card, you'd type `RAM4:MEMO` as the name of the file.

*Note:* ProDOS and Pascal can't share the memory expansion card. It must be formatted for one or the other.

### **With DOS 3.3**

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#n`, where `n` is the slot number containing your memory expansion card.

#### **Important!**

Before you type `IN#n` 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, then press `CONTROL-RESET` to get into the BASIC environment.

#### **▲Warning**

After you initialize the memory expansion card by typing `IN#n`, you won't be able to format flexible disks until you restart your Apple II.

Programs written with earlier versions of Pascal (1.1 or 1.2) won't know how to use the additional memory on the memory expansion card.

*Initializing* is the DOS term for *formatting*.

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 the number of the slot containing your memory expansion card and drive 1.

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

## Starting Up From the Memory Expansion Card

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In addition to saving and retrieving data files from the memory expansion card, you can save time and disk swapping by saving and starting up programs from the memory expansion card. But this is practical only with ProDOS-based applications. The reasons are that, first, you can't start up DOS 3.3 programs from the card; second, loading Pascal-based programs onto the memory expansion card requires the Pascal system disks.

### 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 using the formatting utility on the *ProDOS User's Disk* or 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*.

*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.

For more information on copying files, read the appropriate section of the *ProDOS User's Manual*.

## **Copying an Application Program to the Card**

Here's how you would copy AppleWorks™, Apple Access II, Apple Writer II or any other ProDOS-based application program to the memory expansion card using the *ProDOS User's Disk*.

*By the Way:* If you have an enhanced Apple IIe with 128K and access to the *System Utilities Disk* (Version 2 or later), you might want to use the *System Utilities Disk* instead of the *ProDOS User's Disk* to copy files from application programs to the memory expansion card.

The *System Utilities Disk* has two advantages over the *ProDOS User's Disk*: it doesn't require you to know the volume names of the disks you're copying, and it copies the contents of subdirectories without special instructions from you.

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. Type the slot number containing your memory expansion card.
6. Type a name for your memory expansion card (for example, **RAM4**), and press **[RETURN]**.
7. Type **[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**.

What you do next depends on whether you're copying AppleWorks, 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.

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



## **Copying AppleWorks to Your Card**

If AppleWorks is the first or only program you're copying onto your memory expansion card, follow instructions 1-10 in the section "Copying an Application Program to the Card," then follow the seven 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," then follow the seven instructions in this section.

1. Type: `/APPLEWORKS/ =`. Then 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
```

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**

*Starting AppleWorks:* To get out of the ProDOS Utilities and into AppleWorks, press **[ESC]** twice to get back to the Filer menu, press **[Q]** for **QUIT**, press **[RETURN]** to get back to the Main Menu, press **[B]** for **APPLESOFT BASIC**, and type **PR#n** where *n* is the slot containing your memory expansion card.

If you have more than one program on the memory expansion card, type **-/RAMn/APLWORKS.SYSTEM** (where *n* is the slot containing your memory expansion card) instead of **PR#n**.

### **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 instructions 1-10 in the section "Copying an Application Program to the Card," then follow the ten 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," then follow the ten instructions in this section.

1. Type: **/AW2MASTER/-**. Then 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 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. Press **/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**.

*Starting Apple Writer II:* To get out of the ProDOS Utilities and into Apple Writer II, press **[ESC]** twice to get back to the Filer menu, press **[Q]** for **QUIT**, press **[RETURN]** to get back to the Main Menu, press **[B]** for **APPLESOFT BASIC**, and type **PR#n** where *n* is the slot containing your memory expansion card.

If you have more than one program on the memory expansion card, type **-/RAMn/AW.SYSTEM** (where *n* is the slot containing your memory expansion card) instead of **PR#n**.

### **Copying Apple Access II to Your Card**

If Access II is the first or only program you're copying onto your memory expansion card, follow instructions 1-10 in the section "Copying an Application Program to the Card," then follow the three instructions in this section which apply specifically to copying 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," then follow the three instructions in this section.

1. Type **/ACS/-**. Then 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 *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 13 files on the *Access II Program Disk*.)

**Starting Access II:** To get out of the ProDOS Utilities and into Access II, press **[ESC]** twice to get back to the Filer menu, press **[Q]** for **QUIT**, press **[RETURN]** to get back to the Main Menu, press **[B]** for **APPLESOFT BASIC**, and type **PR#n** where *n* is the slot containing your memory expansion card.

If you have more than one program on the memory expansion card, type  
- /RAM*n*/ACS80.SYSTEM for the 80-column version of Access II or  
- /RAM*n*/ACS40.SYSTEM for the 40-column version of Access II (where *n* is the slot containing your memory expansion card) instead of **PR#n**.

## 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 to find out.



## **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 Memory Expansion 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. See the *ProDOS User's Manual* for more information on creating subdirectories. 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, like Apple Writer II, that have lots of files, 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 II scans the slots starting at slot 7 looking for a startup device (a disk drive—or equivalent—containing a program disk). The Apple II recognizes the memory expansion card as a startup device, and your program is loaded. Because the Apple II starts at the highest numbered slot and works its way down, make sure your memory expansion card is in a higher-numbered slot than your disk drive controller card if you want to start up programs from it, or you should use the following alternative startup method.
- Type **PR#n** (where **n** is the number of the slot containing your memory expansion card).

**Note:** Before you type **PR#n**, 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 (**1**) on your screen—press **⌘-CONTROL-RESET** to exit from the program you're in, then press **CONTROL-RESET** to get into the BASIC environment.



*Unable to Start Up?* If you get the message **UNABLE TO START UP 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 (- /RAM<sub>n</sub>/APLWORKS.SYSTEM for AppleWorks, for example), or the program's prefix (/RAM<sub>n</sub>) followed by the program's system file name (APLWORKS.SYSTEM, for example). The specifics of leaving one program and starting another differ depending on your software.

### **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 our 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 contained 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 peripherals. To further isolate the problem, disconnect the peripheral devices and their input/output 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 peripherals, you can obtain the proper **shielded cable** from your dealer. For non-Apple peripheral devices, contact the manufacturer or dealer for assistance.

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 coaxial cable lead-in between the antenna and television.

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

## Consider Your Memory Expanded

---

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

- Run sophisticated programs especially designed to take advantage of the memory expansion card;
- Make regular programs run faster;
- Temporarily store often-used data.

The rest of this manual covers information that is primarily of interest to programmers.

## Appendix A: Diagnostic Test

---

The Apple II 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 drive 1 and press **CONTROL-RESET**.
2. Type **CALL -151** and press **RETURN**.
3. Type **CnθAG** and press **RETURN** (where *n* is the number of the slot containing your memory expansion card.)

After 90 seconds, you'll either see 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 card to your dealer for a tune-up.



## Appendix B: Assembly-Language Interface

---

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

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.)

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, we encourage 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.

## Appendix C: Apple 256K Memory Expansion Kit Installation Instructions

The Apple II Memory Expansion Card comes with 256K RAM. You can expand the card's memory in increments of 256K up to 1 megabyte (1024K).

### ▲ Warning

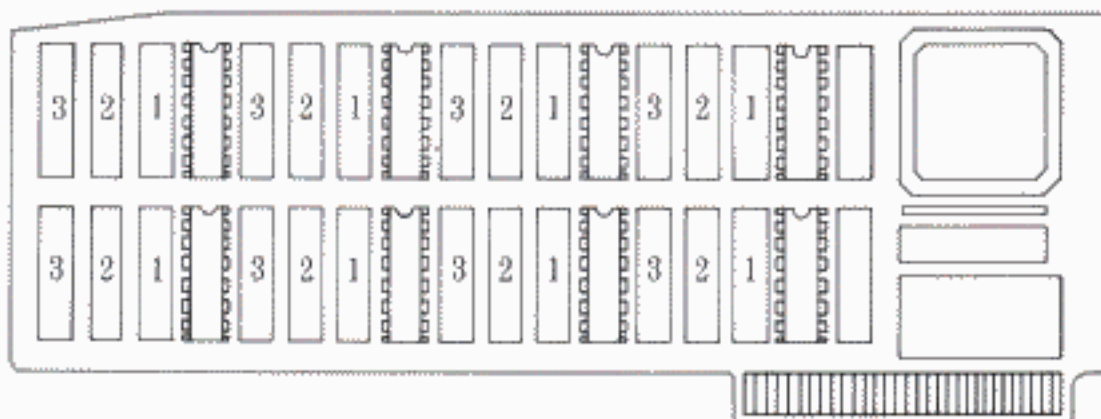
Installing a chip incorrectly can ruin the chip. We strongly recommend that you have your dealer perform this upgrade for you.

Keep these points in mind when you install chips on the memory expansion card:

- ❑ Install each chip so that the end marked with an *A* is pointing away from the gold fingers on the bottom of the card. (See Figure 2.)
- ❑ Align all of the pins on the chip with sockets, so you don't inadvertently bend or break a pin in the process of installing the chip.
- ❑ Press down evenly on each chip until it's firmly seated.

### Figure 2. Memory Expansion Card

*Note: To expand memory from 256K to 512K, insert RAM chips in the eight locations marked (1). To expand the card's memory from 512K to 768K, insert RAM chips in the eight locations marked (2). To expand the card's memory from 768K to 1 megabyte, insert RAM chips in the eight locations marked (3).*



## Appendix D: Testing the Memory Expansion Card

---

To test the new RAM chips, get into the BASIC environment (by starting up without a disk in drive 1 and pressing **CONTROL** **RESET**). Then type:

```
CALL -151 RETURN
```

```
CnDAG RETURN (where n is the slot containing the memory expansion card)
```

After 3 minutes you'll either see the words **CARD OK** or the words **CARD FAILED**, along with an indication of the card size (256K, 512K, 768K, or 1 MEG). If you get the message **CARD FAILED**, or if the card size is less than you anticipated, check to make sure you installed all the chips correctly, and if necessary, repeat the installation with a different set of chips. See the reference manual for the memory expansion card for more information.





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