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Legend RAM Card Operational Manual

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Legend Industries, Ltd.

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**CHECK BOTH
SIDES OF THE
DISK**

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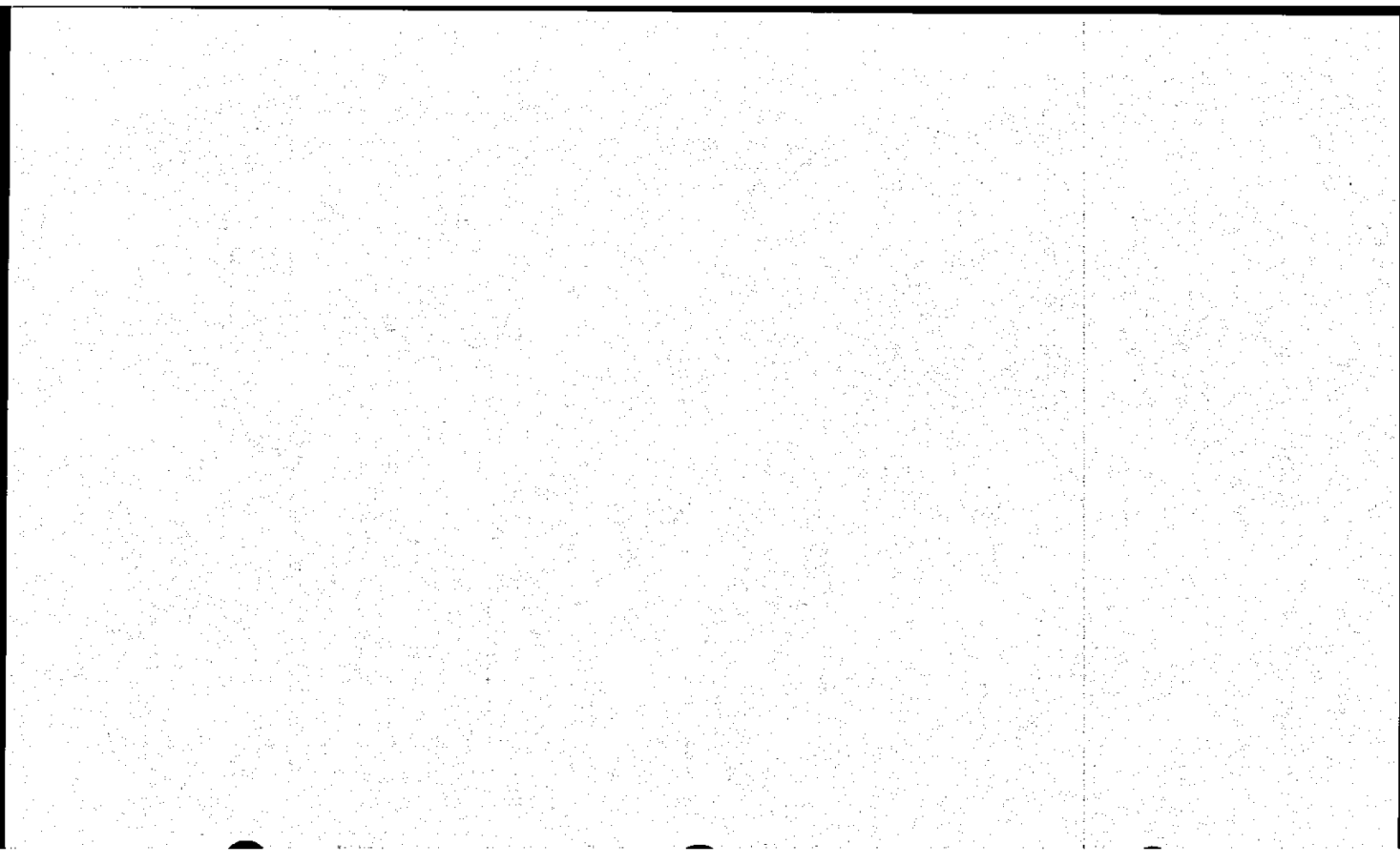
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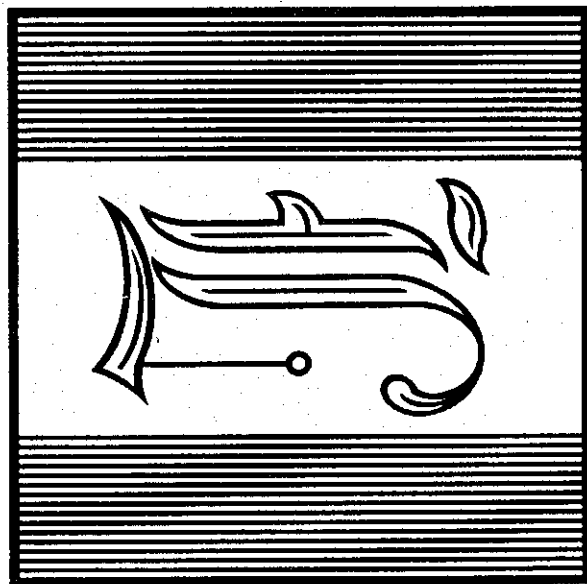
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Introduction

Legend would like to introduce you to your next step in making your Apple a faster and more powerful machine; the Legend RAM Card. This is state-of-the-art memory technology for the Apple II and Apple /// Computers. This includes the Legend 64KC, 128KDE and S'Card. The Legend RAM cards use "state-of-the-art" 64K RAM chips or 256K RAM chips in the case of the S'Card. Each of these cards requires only one slot to add an additional 64 Kilobytes to 1 Megabyte of RAM to your computer. At last the memory storage of a minicomputer is available for your microcomputer.

The Legend RAM cards are able to emulate complete, almost instant access, floppy disk drive(s). With no motor speed delay of the disk drive to contend with the Legend RAM cards are as much as 400% faster than the standard Apple disk drive. The Legend RAM cards may be put into any slot and can be accessed with the standard Apple disk drive commands (i.e. LOAD, SAVE, READ, and WRITE).

Further capabilities of the Legend RAM cards allow them to be used for such things as electronic spreadsheet memory expansion, buffering for data acquisition systems and buffers for quick access data.

A Legend RAM card will act exactly as an Apple Language Card when installed in slot 0 and used with Apple Pascal, CP/M or other systems which utilize a 16K RAM card.

Introduction

The Legend RAM cards are functionally equivalent to several 'banks' of 16K RAM cards depending on how much RAM you have stuffed into the card. The 64KC and 128KDE are fixed at 64K and 128K respectively. The S'Card has the capability of using a maximum of four (4) rows of either 64K or 256K dynamic RAM chips. This allows you to obtain up to 1 Megabyte (1024K) of RAM memory on one card. By switching 16K banks over the existing ROM space, each Legend RAM card multiplies your Apple's RAM capacity many times.

A limitation of microcomputers has been the lack of an appropriate amount of RAM storage. The barriers to this limitation were broken with the introduction of the Legend Industries' 64KC and 128KDE cards. With the introduction of the S'Card, this advancement in current state-of-the-art technology allows the Apple computer to now address up to 1 Megabyte of RAM memory per slot with the appropriate software.

The Legend Disk Emulator software presently available supports up to 4 Megabytes of semiconductor disk storage equivalent to thirty-two (32) 128K (35 track) fast access disk drives.

Introduction

Two new commands have been added to DOS 3.3 to make use of this capability. A "MOUNT" command enables the user to copy the contents of a complete Floppy Diskette on to one of the emulated disk drives and an "UPDATE" command copies the contents of the specified emulated disk back onto floppy diskette. This usually takes about eighteen (18) seconds.

The Legend RAM Card adds RAM (Random Access Memory) to the Apple Computer by bank switching 16K banks over the existing ROM (Read Only Memory) space. This memory is NOT directly addressable, that is to say you must bank switch to take advantage of the extra RAM on the board. Bank switching is the process of selecting one particular bank of RAM or ROM with which to read or write and is covered in the Theory of Operation section in this manual.

Although 1 Megabyte may seem like a lot of memory, it should be pointed out that just two (2) years ago 64K seemed like more than enough RAM for any one person. The question of how much Random Access Memory (RAM) is too much is like asking how smart you want to be. You can be intelligent and yet still learn more. The same applies to the computer; the more on-line storage it has, the more it can do. This manual will help you to understand the function of the Legend RAM cards and the power they add to the computer.

Introduction

Almost any information can be stored in the RAM Card with the appropriate software. Software written for the 64KC and 128KDE cards will also work with the S'Card. Please read this manual before using the card so you are more familiar with the card and the necessary software. This will enable you to use the card to it's fullest extent.

Legend Industries is always developing software for it's products and as Legend and other software houses make available programs using the Legend RAM cards, this card will prove to be one of the best investments you will make.

Legend Industries, Ltd. encourages the development of sophisticated system software by OEM's which supports the Legend RAM cards. The engineering staff will be happy to evaluate any software that is developed for use with the Legend RAM cards on a non-disclosure basis. Please feel free to contact the engineering staff at Legend Industries Ltd, Industrial Computer Division.

We at Legend Industries encourage you to experiment with the card and hope you enjoy using the card as much as we do.

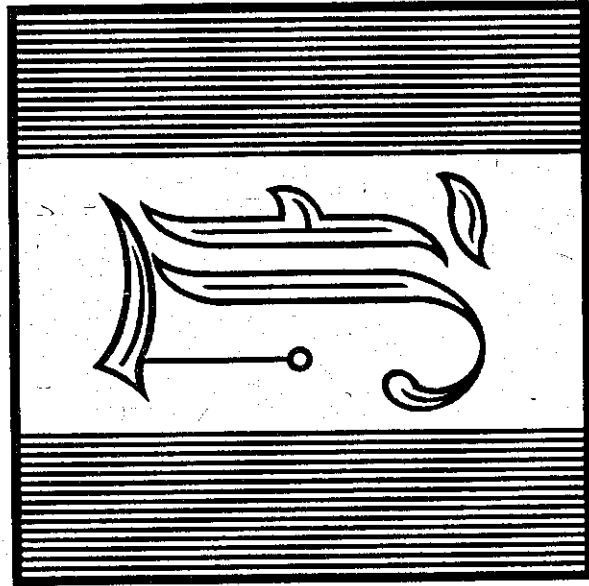
Package Contents

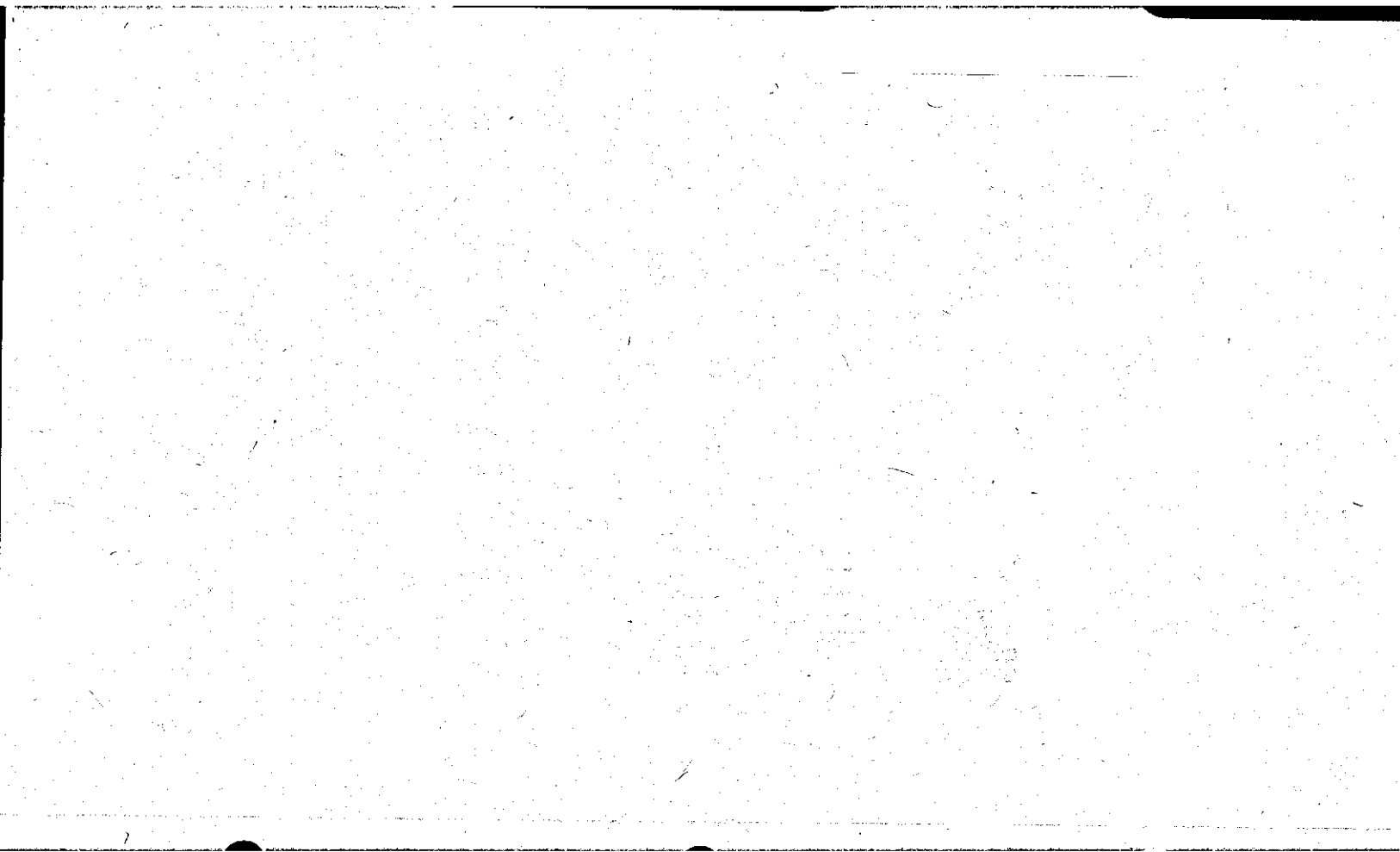
The Legend RAM card package contains a dynamic RAM card configured with at least 64K of memory. This manual and a program diskette will also accompany the package. If you have purchased the S'Card with 256K of RAM, there will also be an additional package called "Super Emulator". If all of this is not in the box, go to the dealer you purchased the peripheral from and ask for the rest of the package.

When you open the RAM card package there may be a blue static protection bag containing the RAM card. DO NOT open the bag until you are ready to install the card.

The diskette found in the package will contain several programs and DOS on it. The disk is NOT protected and you are encouraged to back it up and use the copy instead of the original. If the package contains the Super Emulator, the same applies here. Please use a copy of the original diskette instead of the original so you do not accidentally destroy the programs on the diskette. This will prevent much grief and time lost because of a blown disk.







Machine Configuration

The configuration of your machine determines how it will operate with other programs available on the market. Therefore, care and consideration should be exercised when setting-up your Apple. Please read this manual before setting-up your machine with the RAM card.

Where

The Legend RAM card can be installed in any slot from number 0 (if you have an Apple //e, there is no slot 0) next to the power supply, through number 7, nearest the game connector socket. The slot number that you choose is related to the type of peripheral cards that already are in the I/O slots on the motherboard and the languages and operating systems that you use, as well as the intended use of the RAM card.

The Apple Disk Controller, for example, is almost always installed in slot 6 while a printer card is almost universally installed in slot 1. A fully loaded Apple will look something like the listing in Figure 1. It should be noted, however, that some cards will not work in slot 7 in the EuroApples.

This is not what is necessary to run a Legend RAM card, but what a loaded Apple may look like. You should take this into consideration when configuring your machine. At the end of this section there is a sheet you can copy and use to help set up your own configuration.

Machine Configuration

Slot 0

If you choose to install the RAM card in slot 0, the card will be recognized as a 16K RAM card when used with Apple DOS. The card can be loaded with the language not contained in ROM on the Apple motherboard when you initially 'Boot-up' the DOS System Master diskette, making both languages available to you. Pascal and CP/M will also recognize the RAM board as a 16K card when it is installed in slot 0.

Machine Configuration

Figure 1. Suggested Apple Configuration.

- Slot 0 => RAM card or Firmware card.
Apple //e already has a 16K card here
- Slot 1 => Printer interface or Serial card
- Slot 2 => Modem, Printer interface or other card
- Slot 3 => 80 Column card or Serial card
- Slot 4 => RAM card, Disk drive or other card
- Slot 5 => Disk drive, RAM card, Clock card or other card
- Slot 6 => Disk drive, Hard disk
- Slot 7 => Slot 8 card, Z-80 card, 6809 card, Disk drive, RAM card or other card.

Machine Configuration

Firmware Card

If you program entirely in BASIC or assembly language and you have an Integer or Applesoft ROM (Firmware) card installed in slot 0, then you may decide to install the RAM card in slot 4, or any other slot. This provides you with both languages available in ROM as well as the advantages found in the RAM card by using it as an emulated drive to retain those frequently used programs, or DOS.

16K Card

If you have an 18SRC or 16K RAM card then you have a choice. You can leave the 16K RAM card in slot 0 and install the Legend RAM card in slot 4 (or any other slot). Or remove the 16K RAM card completely and install the Legend RAM card in slot 0 and use bank 0 of the Legend RAM card as the 16K card.

64K, 128K, or S'Card

If you plan to use the Legend RAM card with another large RAM card, the same still applies. All Legend RAM cards are completely compatible with each other's software.

Machine Configuration

The final conflict (not the movie)

As you finalize the configuration in your machine, it may be a good idea to write down the configuration of your computer on a piece of paper and stash it away where the kids won't color on it.

Some operating systems need certain cards in certain slots in order to use them correctly. If you decide to put a 80 column card in slot 2 instead of slot 3, CP/M and Pascal will not use the 80 column card and still display 40 columns. By the same token some programs must be booted from slot 6 or they will not work properly. Pascal must be booted from slot 6, have a RAM card in slot 0 and, optionally, an 80 column card in slot 3.

In summary, to avoid any conflict with other cards, you should examine all aspects of what you want your machine to do. If in doubt, check with your local user group or computer store for assistance in setting up your computer. If all else fails, you may wish to give us a call. We will do our utmost to assist.

Use the Configuration Map (see Figure 2) to help you set up your machine configuration. You may wish to copy the Map (more than once) and try different machine configurations.

Machine Configuration

Figure 2. Apple][Configuration Map.

Use this page to assist you in configuring your machine.

Slot 0
.....

Slot 1
.....

Slot 2
.....

Slot 3
.....

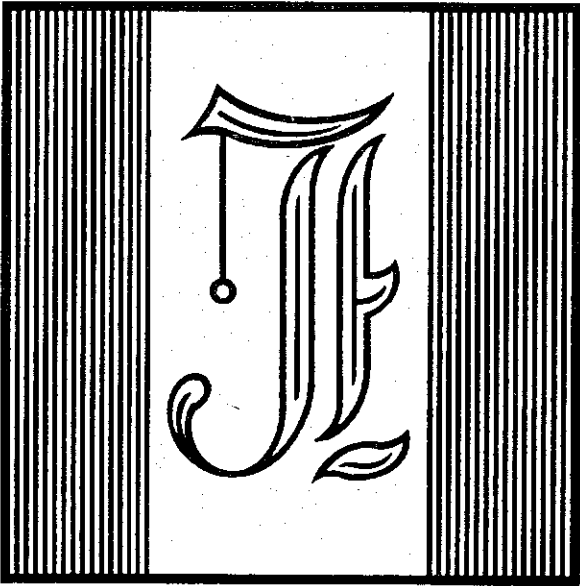
Slot 4
.....

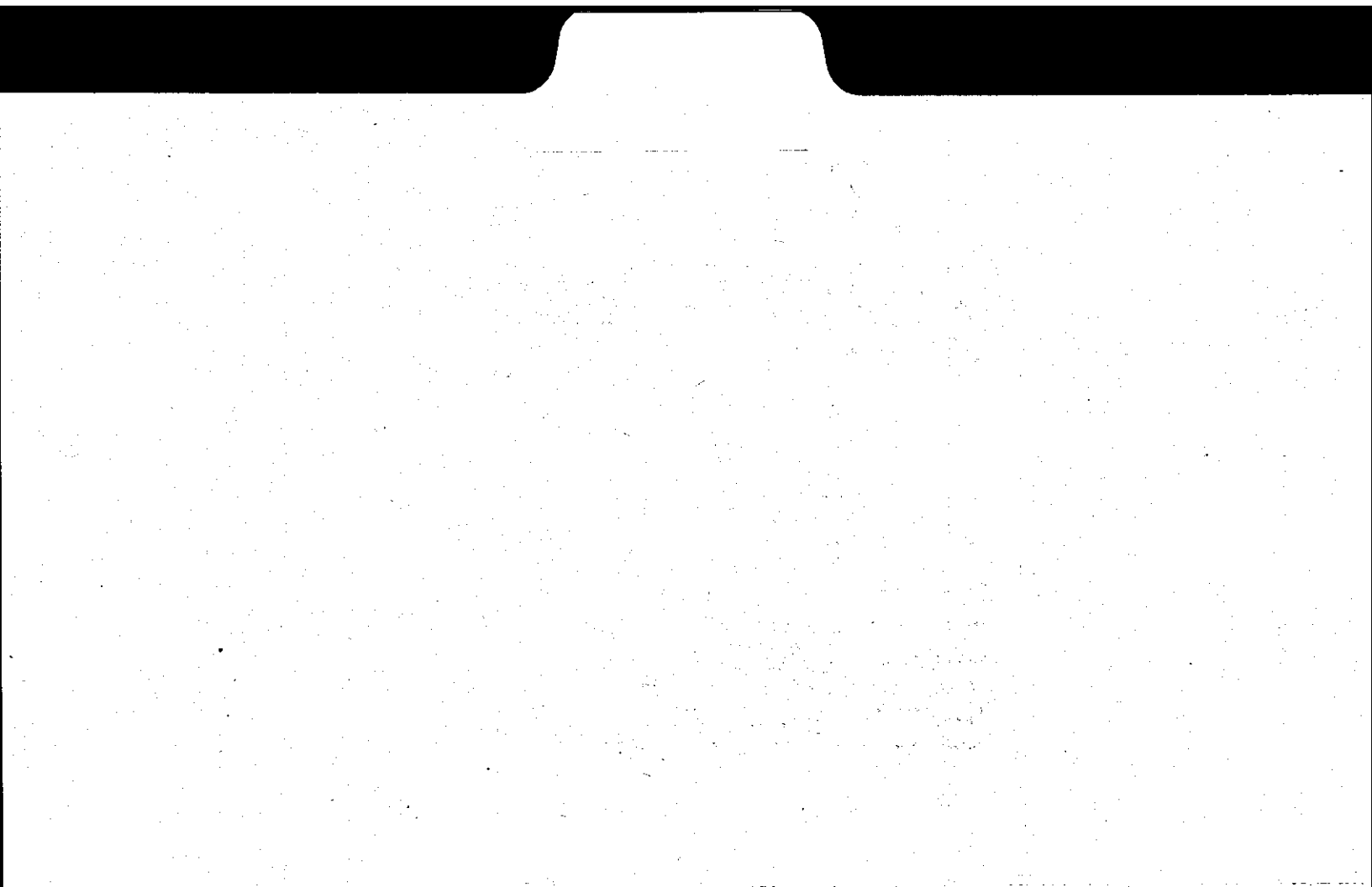
Slot 5
.....

Slot 6
.....

Slot 7
.....

Slot 8
.....
.....





Installation

After you have decided where the Legend RAM card should go, the next thing to do is to install it. This should be done by following the installation instructions carefully. Improper installation can result in damage to your computer and the RAM card. Hammers are not necessary for this installation, so close your tool box, sit back and read on.

- 1) Turn off the power. You should always turn off the power before removing or installing any peripheral cards in any computer. Removing or installing a peripheral with the power on can cause severe damage to your computer and/or the peripheral card.

Before we go on there are four types of Legend RAM cards made. Three of these cards are made for one particular machine or another and the last card is made to fit all of the machines. The cards can be put into two categories: Strapped and Strapless.

Installation

Strapped RAM cards

128KDE for Apple][and][+
128KDE for Franklin
64KC for Apple][and][+
64KC for Franklin

Strapless RAM cards

128KDE for Apple][,][+, //e, ///
and Franklin
S'Card for Apple][,][+, //e, ///
and Franklin

Apple //e installation

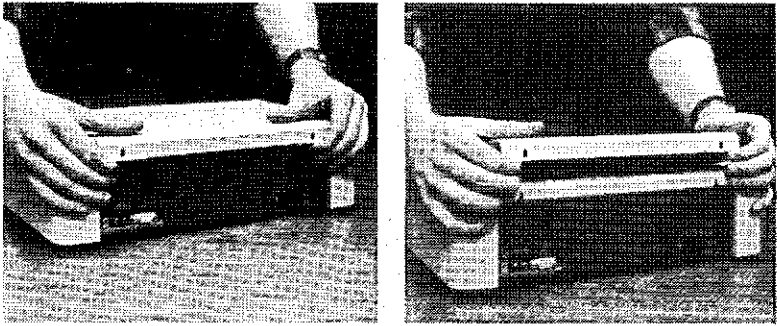
Strapless

Only the strapless RAM cards may be installed in the Apple //e. If you are attempting to install a strapped card into the Apple //e, call Legend for assistance. Follow these instructions for installation of the RAM card in the Apple //e.

- 1) Turn off the power if it is not already off.
- 2) Remove the cover of the Apple. This is done by grasping the tabs at the rear of the computer and pulling up until the fasteners pop. Lift the cover slightly and pull back, away from the keyboard. Now remove the cover and set it aside.

Installation

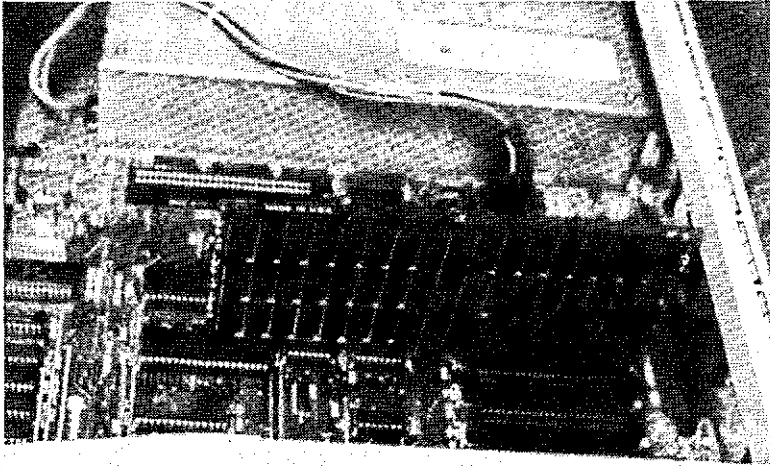
Illustration 1. Apple //e cover



- 3) Before we continue, we should make sure you are not full of static electricity. As you examine the inside of the Apple //e you will find a silver or gold box to your left. Put your hand on the box and pick up the RAM card.
- 4) If the card is in an anti-static bag, remove your hand and break the seal of the bag. Put your hand back on the box and remove the card from the bag.
- 5) If this card is NOT marked for the AUX slot in the //e, do not attempt to install the card into the AUX slot.
- 6) Install the card into the slot of your choice by matching the edge connector to the I/O connector at the rear of the computer. Push the card down into the slot to be sure it is well seated.

Installation

Illustration 2. Apple //e inside



Apple //e Summary

After you have put the card into the machine and made sure it is well seated, you should proceed to the check out section of this manual to complete the installation procedure. Do not put the top back on the machine until you have checked out the RAM card.

Installation

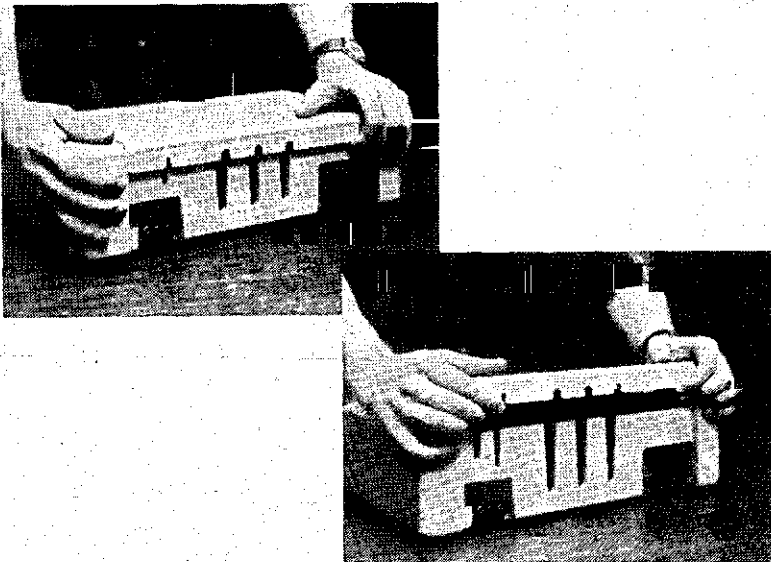
Apple][and][+

Strapped

If you are installing a strapped version of the RAM card into the Apple][or][+, you will have to remove a RAM chip from the motherboard.

- 1) Turn off the computer if it is not already off.
- 2) Remove the cover of the computer by grasping the rear of the overhang the cover creates and lift up. The cover should unstrap (pop up) and then lift up easily. Now pull back to clear the cover from the rest of the case. Set the cover aside.

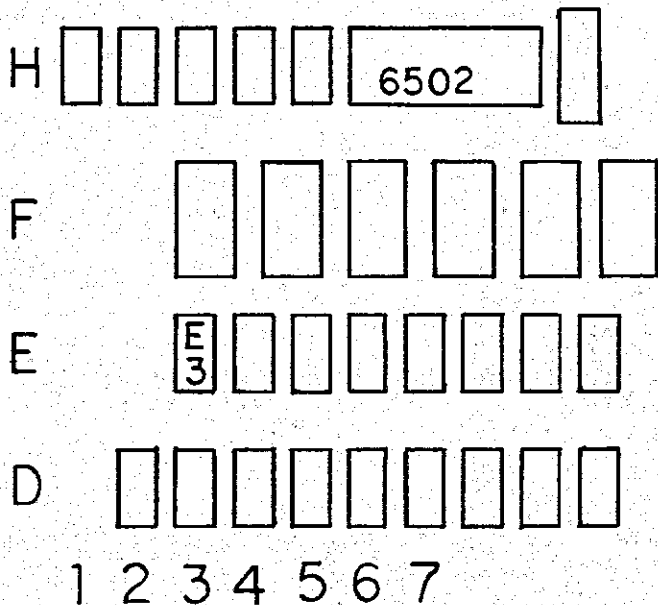
Illustration 3. Cover removal Apple][.



Installation

- 3) Examine the inside of the computer. There will be letters to your left that correspond to the rows of chips in the computer. Locate row E. Refer to Illustration 4.
- 4) Remove the RAM chip in the third location from the left (Location E3. It is not necessary to use E3 as the RAM chip. Any RAM will work.) and set it aside.

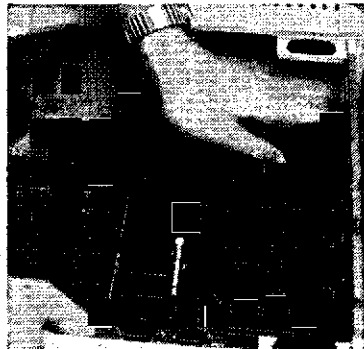
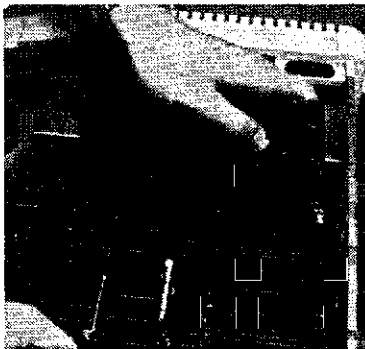
Illustration 4. Apple][RAM location.



Installation

- 3) Before we go on you will have to make sure you are not full of static electricity. Inside the machine there is a silver or gold box to your left. Put your hand on the box and pick up the card.
- 4) If the card is in an anti-static bag, remove your hand and open the bag. Put your hand back on the box and remove the card from the bag.
- 5) Carefully insert the connector at the open end of the cable into the empty socket on the motherboard. The ribbon should come out of the socket toward the power supply.
- 6) Now install the card by seating the edge connector of the RAM card into the I/O connector of the computer. Make sure the card is seated properly by pushing down after initial installation.

Illustration 5. Apple][installation.



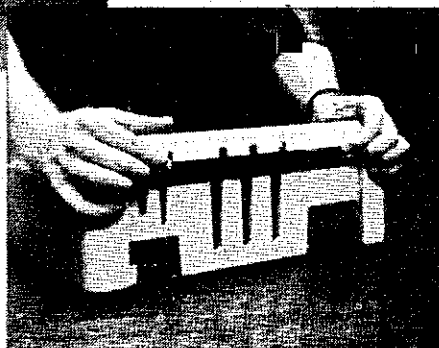
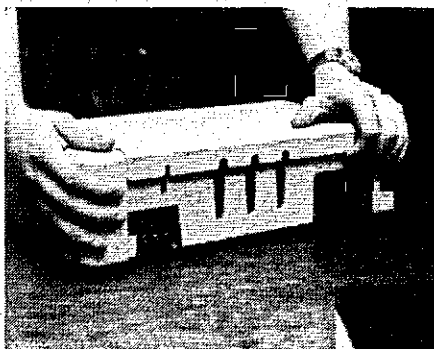
Installation

Strapless

It is very easy to install a strapless RAM card into the Apple][or][+.

- 1) Turn off the computer if it is not already off.
- 2) Remove the cover of the computer by grasping the rear of the overhang the cover creates and lift up. The cover should unsnap (pop up) and then lift up easily. Now pull back to clear the cover from the rest of the case. Set the cover aside.

Illustration 6. Cover removal Apple][.



Installation

- 3) The installation requires you to discharge all static electricity. As you examine the inside of the computer, you will notice a large box to your left. Put your hand on the box and pick up the RAM card.
- 5) If the card is in an anti-static bag, you will have to remove your hand from the box and open the bag. Put your hand back on the box and remove the card from the bag.
- 6) Install the card into the machine by putting the edge connector of the RAM card into the I/O connector of the computer. Push down on the card to insure the card is seated properly.

Apple][and][+ Summary

After you have installed the card into the slot of your choice and are sure it is seated properly, proceed to the check-out section of this manual. Do not put the cover back on the computer at this time.

Installation

Franklin

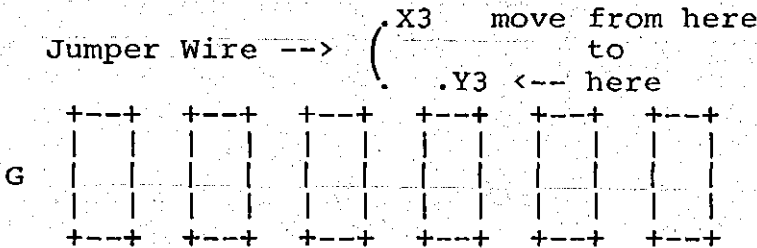
The Franklin computer is very similar to the Apple with a few exceptions. The ROM space in the Franklin is switched only for slot 0 and RAM locations are physically different. These exceptions are great enough to cause Legend to have to make a different card for the Franklin. The Franklin card has a longer cable on it to enable you to reach the RAMs in row "E".

- 1) Turn off the computer if it is not already off.
- 2) Open the cover. If you have difficulties with this, refer to the Franklin manual. The removal of the cover is in section 3, page 3.
- 3) Locate the larger chips in the middle (row G) of the computer towards the I/O connector. These are ROMs. Right above these chips is a jumper and two pins marked X3 and Y3. The jumper wire should be moved from the X3 post to the Y3 post. Refer to Figure 3.

This action will disable the on-board language card so the Legend RAM card will work properly.

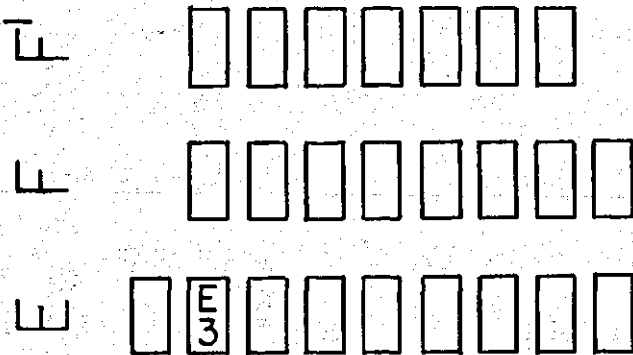
Installation

Figure 3. Franklin Jumper.



- 4) Examine the inside of the computer. There will be letters to your left that correspond to the rows of chips in the computer. Locate row E. Refer to Illustration 5.
- 5) Remove the RAM chip in the third location from the left (Location E3. It is not necessary to use E3 as the RAM chip. Any RAM will work.) and set it aside.

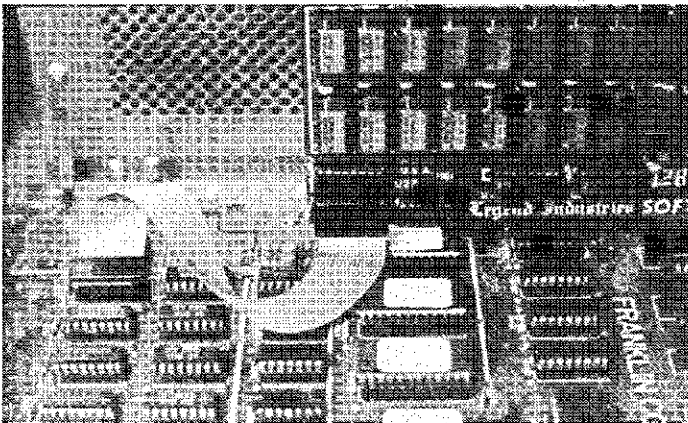
Illustration 7. Removing Franklin RAM.



Installation

- 6) Before we go on you will have to make sure you are not full of static electricity. Inside the machine there is a silver or gold box to your left. Put your hand on the box and pick up the card.
- 7) If the card is in an anti-static bag, remove your hand and open the bag. Put your hand back on the box and remove the card from the bag.
- 8) Carefully insert the connector at the open end of the cable into the empty socket on the motherboard. The ribbon should come out of the socket toward the power supply.
- 9) Now install the card by seating the edge connector of the RAM card into the I/O connector of the computer. Make sure the card is seated properly by pushing down after initial installation.

Illustration 8. Franklin installation.



Installation

Strapless

If you are attempting to install a strapless card in the Franklin, omit steps 4, 5 and 8 from the previous installation procedure.

Because of the inconsistency of the timing signals from one Franklin to the next, we cannot guarantee the operation of a strapless Legend RAM card in a Franklin computer.

Franklin Summary

After you have installed the card into the slot of your choice and are sure it is seated properly, proceed to the check-out section of this manual. Do not put the cover back on the computer at this time.

Installation

Apple /// Installation

Strapless

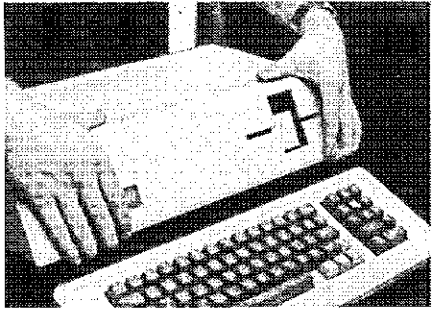
Only the strapless RAM cards may be installed in the Apple ///. DO NOT attempt to install a strapped card into the Apple ///. Follow these instructions for installation of the RAM card in the Apple ///.

- 1) Turn off the power if it is not already off.
- 2) Unplug any connections to the back of the Apple ///. This includes your power cable and monitor cable as well as any cables running to cards in the I/O slots.
- 3) Remove the cover of the Apple. Turn the machine over. There are two screws located at either side of the computer under the front of the cover. Using a blade screwdriver turn each of the screws 1/4 turn counterclockwise. Refer to Illustration 6 for assistance.

Turn the machine back over. Stand in front of the machine. Lift the cover off by pulling it up and toward you. Set the cover aside.

Installation

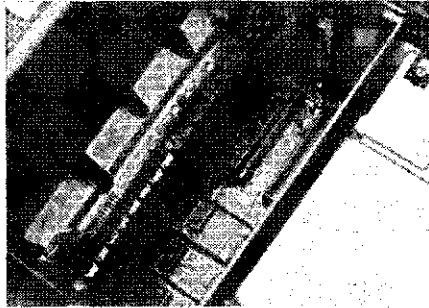
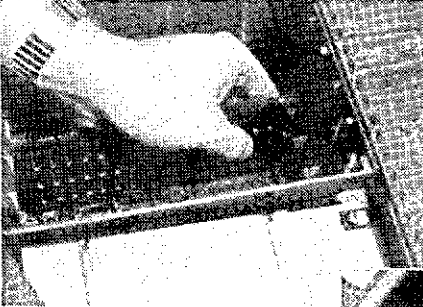
Illustration 9. Apple /// cover



- 4) Before we continue, we should make sure you are not full of static electricity. Touch the cover over the disk drive or the chassis.
- 5) If the card is in an anti-static bag, remove your hand and break the seal of the bag. Put your hand back on the chassis and remove the card from the bag.
- 6) Install the card into the slot of your choice (preferably slot 2) placing the edge connector of the card into the I/O connector at the rear of the computer. Push the card down into the slot to be sure it is well seated.

Installation

Illustration 10. Apple /// Installation.



Apple /// Summary

After you have put the card into the machine and made sure it is well seated, you should proceed to the check-out section of this manual to complete the installation procedure. Do not put the ~~top back on the machine~~ until you have checked out the RAM card.

Installation

Check-Out Procedures

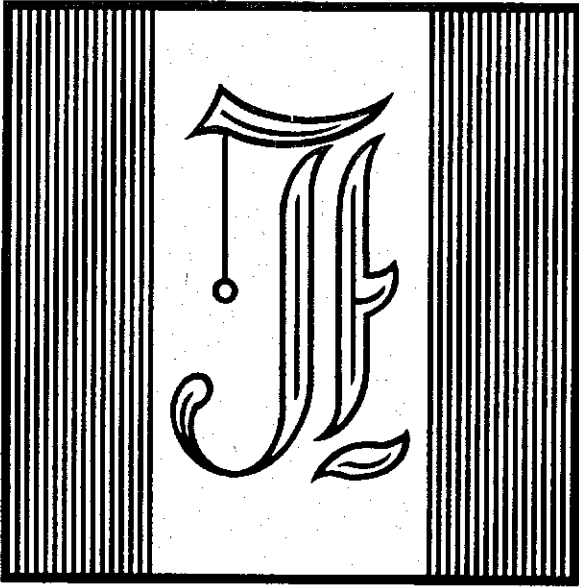
Insert the Legend Utilities disk into Drive 1 (if you have an Apple ///, boot the emulation disk first) and boot-up in the normal manner as described in "The DOS Manual". The menu will appear on the screen. If you boot the System Master, the alternate language, the one that is not in ROM on the motherboard (Integer BASIC if you have an Applesoft machine and vice versa), will be loaded into the RAM card (if it is in slot 0). You can verify that the language has been loaded correctly by switching between languages with the INT and FP commands. If the card is operating properly, you should be able to switch between languages. This feature is not built into the Apple ///.

If the Apple does not appear to be operating correctly then turn off the power immediately and check for proper installation of the RAM card. You may wish to consult the Problem Determination Procedures elsewhere in this manual. If you are still having a problem contact your local Dealer. He should be able to help you isolate the problem. If you are still having problems, call Legend.

Installation

After you have verified the RAM card is operating properly and the Legend disk boots, the menu will display several programs. At this time it would be wise to run the Legend Memtest and completely test the card. This test may take a long period of time and is very boring. However, it will check out the card for complete, reliable operation. To run the Memtest, refer to the section "Legend Memtest". You will find this in the Table of Contents.

After the Memtest has verified that the card is operating properly replace the cover of the computer using the reverse of the instructions to remove the cover.





Memory Master

Memory Master is a memory management program on the system disk that relocates DOS into the Legend card. This program will work with the Legend RAM card, 18SRC in the write enable mode and most 16K cards currently available. The program provides a full 44K bytes of program storage within the 48K on the Apple motherboard. With the use of this program, an additional 8.5K of RAM is made available by relocating DOS into one of the 16K banks on the Legend card.

Memory Master will also manage your Integer or Applesoft firmware card, providing you have one installed, in any slot in your Apple.

Two versions of Memory Master are available on the Legend diskette. Version 2.0 is for older programs (this program will not work with the Disk Emulator) which specify it and version 3.0 is used for compatibility with Disk Emulator 5.0.

Memory Master provides many features and several powerful extensions to the standard Apple DOS 3.3 Disk Operating System. It is not compatible with Apple ProDOS or SOS on the Apple ///.

- 1) Machine language programs can access the DOS RWTS routines through the standard DOS page 3 vectors (\$3D0 through \$3EC) and no additional page 3 space is used by Memory Master.

Memory Master

- 2) The <.Flip> command allows the user to "flip" between DOS 3.3 and DOS 3.2 without re-booting, and best of all, any programs residing in memory are unaffected by the "flip". What a great way to move a single file from DOS 3.3 to DOS 3.2, or vice-versa. (Memory Master 2.0 only)
- 3) The <.Show> command promptly displays the current DOS version in use. (Memory Master 2.0 only)
- 4) The <.Bstat> command displays the hexadecimal starting address and length of the last Binary file either BLOADED or BRUN, a valuable feature for BSAVEing Binary files.
- 5) The <.Apple> command places the user into the Apple Monitor.
- 6) The <.Mount> and <.Update> commands are used in conjunction with Disk Emulator 5.0 and are only available under Memory Master 3.0.

These commands may be entered by typing in a period (".") and the first letter of the command. For example: .A is the command for .APPLE. These commands should not be confused with the dot commands used in the Super Emulator. There is no ".F" command in the Super Emulator and the ".S" command is used to show the status of the emulated drives, whereas in Memory Master, it is used to show the status of the DOS in use.

Memory Master 2.0

Insert the Legend diskette into the drive and boot-up in the normal manner as described in the Apple DOS Manual and then type:

```
BRUN MEMORY MASTER 2.0
```

The program will begin execution after it has been loaded into memory and checks to make sure that DOS is already in the machine at the correct address. If there is any problem, the program returns to BASIC and displays the following message:

```
INCORRECT DOS INSTALLED IN THE MACHINE.
```

Set-up

The program will prompt the user with three important set-up questions. These questions are:

```
WHAT SLOT IS FIRMWARE CARD IN (0-7) ? 0  
WHAT SLOT IS THE RAM CARD IN (0-7) ? 0  
WHICH BANK SHOULD DOS GO INTO (0-3) ? 0
```

The user supplied answers to these questions are used to set up the memory management routines incorporated into MEMORY MASTER. Let's go through these questions, one at a time.

Memory Master 2.0

WHAT SLOT IS FIRMWARE CARD IN (0-7) ? 0

Type in the slot number, in the range from 0 through 7, of the Integer or Applesoft Firmware card. If no Firmware card is installed then simply press RETURN.

WHAT SLOT IS THE RAM CARD IN (0-7) ? 0

Type in the slot number, in the range from 0 through 7, of the LEGEND RAM card (or 16K RAM card if you're not using the Legend RAM card). Using this program with the 18SRC requires that the Switch be in the Write Enable position (switch up).

WHICH BANK SHOULD DOS GO INTO (0-3) ? 0

If you are using one of the 16K RAM cards then simply press RETURN in response to this question.

If you are using the Legend RAM card then type in the Bank number to be used for the relocated Disk Operating System (DOS). Please note, when the Legend card is installed in slot 0 that Bank 0 on the card will contain the Language missing in ROM on the Apple motherboard. If a Firmware card is being used (question 1) then you may use any of the 64K Banks on the S'Card for DOS.

Memory Master 3.0

Insert the Legend diskette into the drive and boot-up in the normal manner as described in the Apple DOS Manual and then type:

```
BRUN MEMORY MASTER 3.0
```

The program will begin execution after it has been loaded into memory and checks to make sure that DOS is already in the machine at the correct address. If there is any problem the program returns to BASIC and displays the following message:

```
MUST HAVE 48K DOS
```

Set-up

The program will prompt the user with important set-up questions.

```
RESERVE 16K IN SLOT 0 FOR LANGUAGE ?Y
```

If you wish to reserve space in the card in slot zero, type return or Y. If you have no need for an alternate language, type N.

```
ARE YOU USING THIS PROGRAM IN CONJUNCTION  
WITH DISK EMULATOR 5.0 ?N
```

If you are using Disk Emulator 5.0, answer Y. Remember, you must first install the Disk Emulator and then return to this program. Also, you must answer the questions the same in both programs.

Memory Master 3.0

DO YOU WISH TO DECREASE DOS LOADING
TIMES BY A FACTOR OF 4 ?

If you wish to have a quick loading DOS, answer Yes to this question. If you have experimented with the quick loader provided and found that it doesn't work with your application, answer No. If you are using Disk Emulator in conjunction with Memory Master 3.0, you could answer No even if you have answered Yes to this same question when you installed the Disk Emulator.

A)BORT, I)NSTALL OR C)REATE TURNKEY FILE

If you made a mistake and don't want to go any further, answer Abort to cancel the program. Answering with an I will install the resulting configuration and C will create a custom turnkey program named TURNKEY.MM (This is a binary file.). See page 4-17, Turnkey Set Up for further information.

Memory Master

The modified Disk Operating System installed in RAM on the Legend RAM card (or 16K RAM card) by Memory Master is used in exactly the same manner as standard Apple DOS 3.3, with the following exceptions:

- 1) The DOS "INIT" command has been disabled. When you need to initialize diskettes simply boot-up the SYSTEM MASTER diskette which loads standard (and unmodified) Apple DOS into the machine and then initialize your blank diskettes.
- 2) The DOS "CATALOG" command displays the number of unused sectors remaining on each diskette as you catalog it.
- 3) Four new DOS commands have been added to the system. These new commands and their uses are described below.

.F or .FlipDOS (Memory Master 2.0)

The .Flip command will automatically switch between DOS 3.3 and DOS 3.2. The command works in either direction, that is, if you are currently in DOS 3.3 then the .Flip command will place you into DOS 3.2, and vice-versa.

The .Flip command can be typed in directly from the Apple keyboard or it can be used inside your programs by using the standard Apple DOS print control-D syntax.

Memory Master

Example 1

```
100 D$=CHR$(4) :REM CTRL-D
110 PRINT D$; ".FLIP"
```

All programs, pointers and variables remain unchanged during the "FLIP" operation. This gives the user the capability to transfer files between different types of DOS diskettes (13 and 16 sector) with a simple LOAD, .Flip and SAVE sequence of operations.

.S or .ShowDOS (Memory Master 2.0)

This command displays the current DOS in use, either DOS 3.3 (16 sector) or DOS 3.2 (13 sector).

.B or .Bstat

This command displays the hexadecimal starting address and length of the last Binary type file that was either BLOADED or BRUN. This provides the user with the starting address and length parameters required by Apple DOS when BSAVEing Binary type files onto disk.

.A or .Apple

This command, when typed in from the keyboard, places the user into the Apple monitor. If you executed this command and did not wish to, you may type 3DOG to get back into BASIC.

Memory Master

Memory Usage

Normally Apple DOS 3.3 will reside from \$9600 through \$BFFF in a 48K Apple and DOS will set HIMEM to a value of \$9600 (decimal 38400 or -27136). Memory Master uses the top eight pages of memory on the motherboard for the Memory Management routines (\$BF00-\$BFFF) and the three DOS file buffers (\$B800-\$BEFF) and the rest of DOS is relocated into RAM on the Legend RAM card. This allows DOS to set HIMEM to a value of \$B800 (decimal 47104 or -18432). See Figure 4 for more information on the memory usage of the Memory Master program. By typing PRINT 65536+FRE(0) you can show the amount of free memory available in Applesoft.

RWTS Access

Memory Master provides machine language access to the DOS Read or Write a Track & Sector (RWTS) routine through the standard DOS page 3 vectors as described in the Apple DOS Manual, Chapter 9, pages 94 - 98. The DOS IOB is not relocated into RAM on the Legend RAM card but is moved to the \$BFEB-\$BFF8 address range within the Memory Management routines for direct access by your machine language programs.

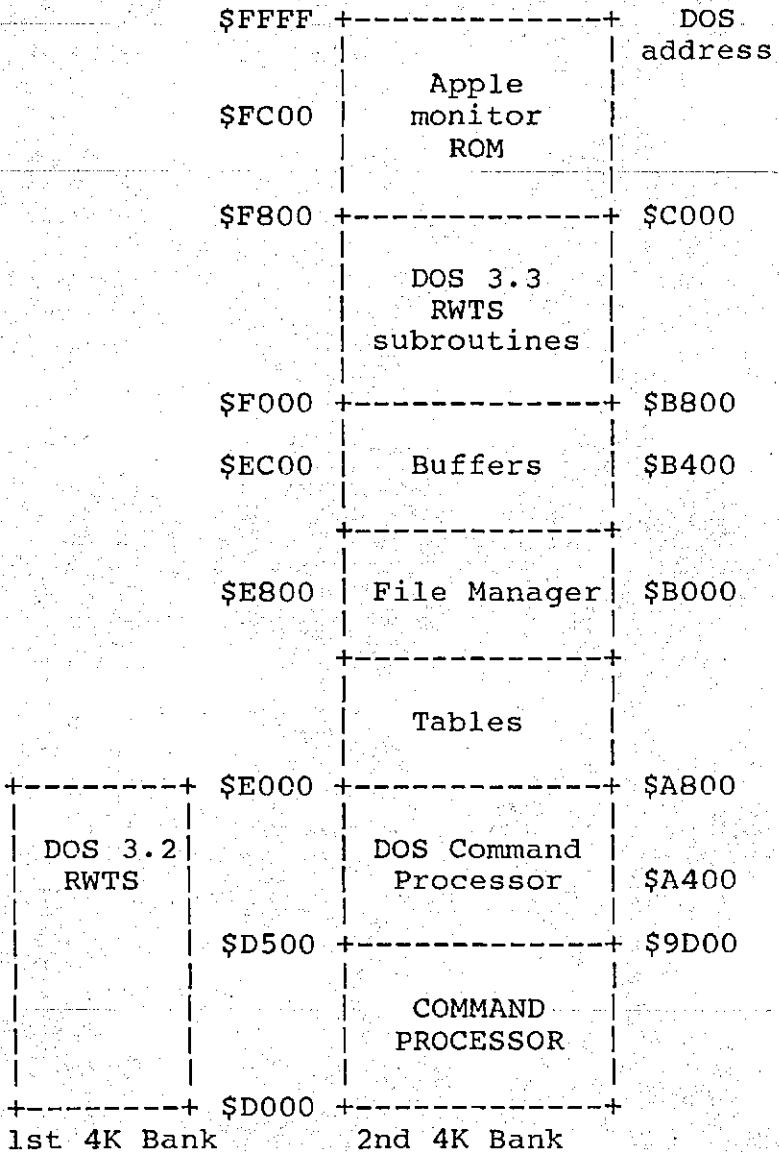
Memory Master

Limitations

Memory Master remains active in memory until you re-boot. It should be pointed out that any program disks that must be booted into operation will disconnect Memory Master and install their own DOS into memory at the standard 48K address (\$9600-\$BFFF) in the machine. These programs, unfortunately, can not take advantage of the extra memory and other features of the Memory Master program. Also, any programs that modify pointers internal to DOS or access RWTS directly and not through the page 3 vectors, will not work correctly with the Memory Master program active.

Memory Master

Figure 4. Memory Map.



Memory Master

Turnkey Operations

Memory Master Turnkey allows you to use Memory Master software as an Applesoft Turnkey program. This program is used after you have configured your system and are not going to be changing it. The Memory Master Turnkey program is used to eliminate the need to answer the setup questions when using Memory Master software. All the great features of Memory Master will be implemented each time the Turnkey program is used, reducing the amount of time and chance of error when using Memory Master. If you are using Memory Master 3.0, the program itself is the turnkey program and will have to be "BRUNed".

If you change the location of the Legend cards without changing the parameters in the Turnkey program, Memory Master will perform with unpredictable results, and most likely the system will "hang". The Turnkey program for 2.0 can be used as a greeting program on a diskette to automatically install Memory Master and then you can run a program using the features of Memory Master without having to answer the questions.

Memory Master

Memory Master erases BASIC's pointers when it moves DOS and resets HIMEM (HIMEM will be reset to 47104, -14336 or \$B800). Therefore, when you call it from the BASIC Turnkey program, control will not return to the BASIC program, but rather to DOS. You can then RUN or BRUN the program. You may wish to try some of the Memory Master extensions to confirm that Memory Master is operating properly. These commands can be found in the Memory Master section of the manual.

Configuration for Turnkey

In configuring the system, if you are not using a Firmware card, you should install the RAM card in slot 0. The RAM card in slot 0 will be loaded with the missing BASIC language when "booting" the System Master diskette. Here is an interesting situation; bank 0 (the Legend RAM card must be in slot 0 for this to happen) will contain the missing BASIC, therefore, you would not relocate DOS to bank 0 if the other BASIC is needed.

The most common mistake is to relocate DOS in bank 0 and attempt to use the language you just killed by loading DOS into bank 0. Your custom application of the Legend card may dictate the location of the relocated DOS. In any case use the Memory Master manual version before implementing a Turnkey system.

Memory Master

Memory usage will remain the same as the manual version of Memory Master, so will the RWTS access. As stated in the limitations of Memory Master, any program that loads in under it's own DOS will disconnect Memory Master. This also applies to programs that modify pointers internal to DOS or access RWTS directly.

Turnkey Set Up for 2.0

It is assumed that you are familiar with how to boot and initialize diskettes. If you are not knowledgeable in these areas, please consult the The DOS Manual for assistance. When setting up the Turnkey program, the first thing is to clear the Apple. Type NEW then press <RETURN>. Now load the turnkey program (If you are using Memory Master 3.0, go to the 3.0 Turnkey section) by typing LOAD TURNKEY MM. Retype lines 64, 74 and 82 in the Turnkey MM version using the following guidelines:

64 RC = -1: REM ROM CARD

This line is used to indicate the location of the Firmware card. Use a value from 0 to 7 to reflect the location of the Firmware card. If a Firmware card is not being used, do not change this line.

74 RAM = 0: REM SLOT OF RAM CARD

Memory Master

This line is used to reflect the location of the Legend card or 16K RAM card. If you do not have a Firmware card, this will most likely be installed in slot 0. If it is not in slot 0, change this line to reflect the location of the RAM card. However a RAM card is necessary in slot 0 if a Firmware card is not used.

82 BANK = 0: REM BANK OF RAM

This line is used to reflect the bank of RAM that DOS will be loaded into. On a 16K card that bank must be 0. If you load DOS into bank 0, the alternate language will be "clobbered". If you have a Legend RAM card, you may select any of the other banks (bank 1 is suggested) to contain DOS.

Now you have the option to use the TURNKEY MM program as a greeting program to automatically load Memory Master 2.0. There are two options available to you at this time.

- 1) You can "INIT" the turnkey program onto a blank diskette by typing INIT TURNKEY MM. Then transfer Memory Master Turnkey onto the disk you just initialized, by BLOADING MEMORY MASTER TURNKEY into memory, and then type (all on one line):

BSAVE MEMORY MASTER TURNKEY,
A\$2000,L\$1500

Memory Master

- 2) You may choose to SAVE your customized turnkey program on the Legend disk by typing SAVE TURNKEY MM. Now type LOAD HELLO. Add the following line to the HELLO program by typing:

```
160 PRINT CHR$(4);"RUN TURNKEY MM"
```

Now save the HELLO program by typing:

```
SAVE HELLO
```

Memory Master

Turnkey Set Up for 3.0

In the 3.0 version of Memory Master, the program will ask you if you wish to set up a turnkey in the process of setting the program up to run. The way you set the program up will be entered as the turnkey information in the file called TURNKEY.MM.

After the Memory Master program is told to make a turnkey file, it will ask you what program you wish to run after it is set up. You will be able to BRUN, RUN or even EXEC this program, to allow you more flexibility. There are no restrictions as to the content of this program. Just type in the name of the next program you wish to run and press RETURN. Then enter the letter for the BRUN, RUN or EXEC command. The program will now save the turnkey version off to disk.

To run the turnkey version of Memory Master 3.0, enter the following line into your Hello program.

```
10000 PRINT CHR$(4);"BRUN TURNKEY.MM"
```

Memory Master

Listing 1. Memory Master

```

24D5      609 *****
24D5      610 *
24D5      611 *      <DOS MEMORY MANAGEMENT ROUTINES>      *
24D5      612 *(C) Copyright 1981-Legend Industries, Ltd.*
24D5      613 ;
BF00      614           PHS $BF00
BF00      617 ;
BF00 203FBF 618 DOSWARM JSR DOSON           ;To bank in DOS
BF03 4CBFD5 619           JMP $9DBF+OFFSET
BF06 203FBF 620 DOSCOLD JSR DOSON
BF09 C84D5  621           JMP $9D84+OFFSET
BF0C 203FBF 622 IOPKG   JSR DOSON
BF0F 20FDE2 623           JSR $AAFDF+OFFSET
BF12 4C63BF 624           JMP DOSOFF
BF15 203FBF 625 GORWTS  JSR DOSON
BF18 20B5EF 626           JSR $B7B5+OFFSET
BF1B 4C63BF 627           JMP DOSOFF
BF1E 203FBF 628 PKGLOC  JSR DOSON
BF21 AD0FD5 629           LDA $9D0F+OFFSET
BF24 ACOED5 630           LDY $9D0E+OFFSET
BF27 4C63BF 631           JMP DOSOFF
BF2A 203FBF 632 IOBLOC  JSR DOSON
BF2D ADC2E2 633           LDA $AAC2+OFFSET
BF30 ACC1E2 634           LDY $AAC1+OFFSET
BF33 4C63BF 635           JMP DOSOFF
BF36 203FBF 636 DOSHOOKS JSR DOSON
BF39 2051E0 637           JSR $A851+OFFSET
BF3C 4C63BF 638           JMP DOSOFF
BF3F      639 ;
BF3F 48     640 DOSON   PHA           ;Save accumulator
BF40 AD82C0 641           LDA $C082       ;Write prot.cd.#0
BF43 AD81C0 642           LDA $C081       ;Turn off slot #0
BF46 ADFABF 643           LDA BANKNBR
BF49 8D84C0 644           STA $C084       ;Select DOS bank#
BF4C AD83C0 645           LDA $C083       ;Turn on slot # X
BF4F AD83C0 646           LDA $C083       ;Write enable # X
BF52 68     647           PLA
BF53 60     648           RTS
BF54      649 ;
BF54 203FBF 650 DOSIN   JSR DOSON       ;Select DOS bank.
BF57 2D81D6 651           JSR $D681       ;DOS input rout's
BF5A 4C63BF 652           JMP DOSOFF
BF5D 203FBF 653 DOSOUT  JSR DOSON       ;Select DOS bank.
BF60 20BDD6 654           JSR $D6BD       ;DOS Output routs
BF63      655 ;
BF63 08     656 DOSOFF  PHP           ;Save P.
BF64 48     657           PHA           ;Save A.
BF65 A900   658           LDA #0
BF67 8D84C0 659           STA $C084
BF6A AD82C0 660           LDA $C082       ;Turn off slot #X
BF6D ADF9BF 661           LDA LANGID      ;Get lang.ID byte

```

Memory Master

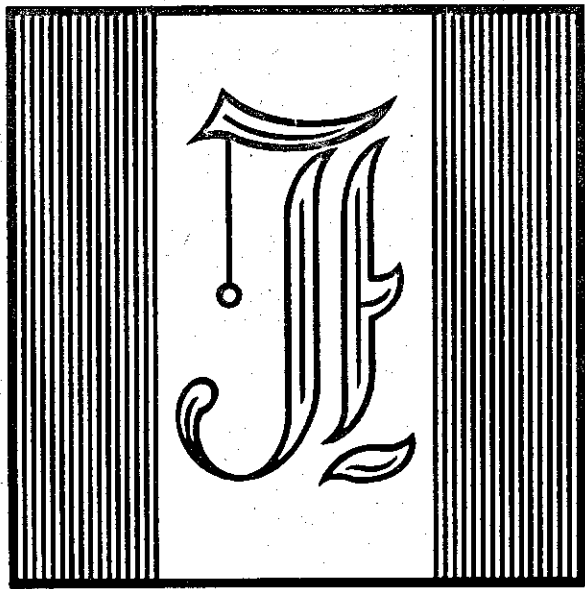
Listing 1 (cont.)

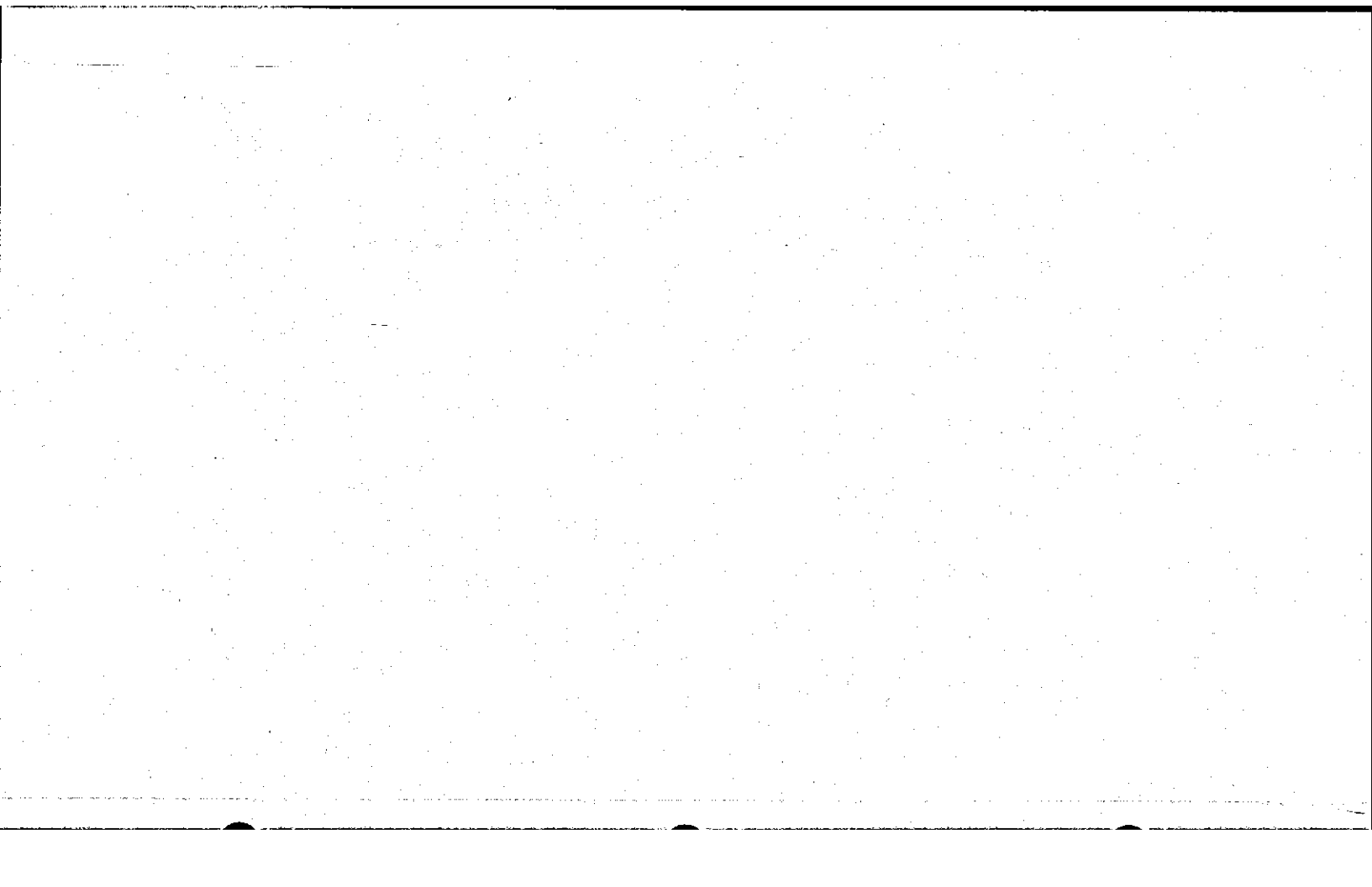
BF70	CDOCE0	662		CMP	\$E000	;Same as mboard ROM?
BF73	F003	663		BEQ	EXIT	;yes,ret.2 caller
BF75	AD80C0	664		LDA	\$C080	;Turn on slot #0
BF78	68	665	EXIT1	PLA		
BF79	28	666		PLP		
BF7A	60	667		RTS		
BF7B	2063BF	668	ROMSW	JSR	DOSOFF	
BF7E	2C81C0	669		BIT	\$C081	;turn off slot #0
BF81	CD00E0	670		CMP	\$E000	;is language in ROM?
BF84	F00E	671		BEQ	SETLANG	
BF86	2C80C0	672		BIT	\$C080	;is language in RAM?
BF89	CD00E0	673		CMP	\$E000	
BF8C	F006	674		BEQ	SETLANG	
BF8E	08	675	EXIT2	PHP		
BF8F	203FBF	676		JSR	DOSON	
BF92	28	677		PLP		
BF93	60	678		RTS		
BF94	8DF9BF	679	SETLANG	STA	LANGID	;save lang ID byte
BF97	F0F5	680		BEQ	EXIT2	
BF99		681				
BF99	2063BF	682	I.CHAIN	JSR	DOSOFF	
BF9C	4C36E8	683		JMP	\$E836	
BF9F	2063BF	684	I.ERR	JSR	DOSOFF	
BFA2	4CE3E3	685		JMP	\$E3E3	
BFA5	2063BF	686	I.COLD	JSR	DOSOFF	
BFAB	4C00E0	687		JMP	\$E000	
BFAB	2063BF	688	I.WARM	JSR	DOSOFF	
BFAE	4C03E0	689		JMP	\$E003	
BFB1	2036BF	690	A.CHAIN	JSR	DOSHOOKS	
BFB4	2065D6	691		JSR	\$D665	
BFB7	8533	692		STA	\$33	
BFB9	85D8	693		STA	\$D8	
BFBB	4CD2D7	694		JMP	\$D7D2	
BFBE	2063BF	695	A.ERR	JSR	DOSOFF	
BFC1	4C65D8	696		JMP	\$D865	
BFC4	2063BF	697	A.WARM	JSR	DOSOFF	
BFC7	4C3CD4	698		JMP	\$D43C	
BFCA	2063BF	699	A.RELO	JSR	DOSOFF	
BFCD	20F2D4	700		JSR	\$D4F2	
BFD0	4C3FBF	701		JMP	DOSON	
BFD3		702				
BFD3	6C3600	703	HOOKCSW	JMP	(\$0036)	
BFD6	6C3800	704	HOOKKSW	JMP	(\$0038)	
3FD9		705				
BFD9	000000	706		DFS	15,0	
BFEB		707				

Memory Master

Listing 1 (cont.)

BFE8	01	708	IB.TYPE	HEX	01	
BFE9	60	709	IB.SLOT	HEX	60	
BFEA	01	710	IB.DRVN	HEX	01	
BFEB	00	711	IB.VOL	HEX	00	
BFEC	11	712	IB.TRK	HEX	11	
BFED	00	713	IB.SECT	HEX	00	
BFEE	FBB7	714	IB.DCTP	ADR	\$B7FB	
BFEO	E8B7	715	IB.BUFP	ADR	\$B7E8	
BFF2	0000	716		HEX	0000	
BFF4	01	717	IB.CMD	HEX	01	
BFF5	00	718	IB.STAT	HEX	00	
BFF6	FE	719	IB.SM0D	HEX	FE	
BFF7	60	720	IOBPSN	HEX	60	
BFF8	01	721	IOBPDN	HEX	01	
BFF9		722	;			
BFF9	00	723	LANGID	HEX	00	
BFFA	00	724	BANKNBR	HEX	00	
BFFB		725	;			
BFFB	00	726	DEVPTC	HEX	00	
BFFC	01	727	PPTC	HEX	01	
BFFD	EFDB	728	MONTC	HEX	EFDB	
BFFF		729	;			
BFFF	B3	730	DOSTYPE	DFS	1	;DOS version 3.3
C000		731	;			
C000		732		END		





Disk Emulator

The Disk Emulator is a remarkably efficient program for the Apple (][and ///) computer. There are three programs on the Legend Utilities diskette which will accomplish this function. The one you use depends on your application. Each simulate up to four additional, almost instant access, disk drives for the storage and retrieval of standard DOS 3.3 disk files. Disk Emulator 4.0 and 2.1 cannot be used with Memory Master. Disk Emulator 5.0 is compatible with Memory Master 3.0.

Slot and drive is assigned to each emulated drive and is used to access that drive. You are able to assign any SLOT/DRIVE number to each emulated drive and the Emulator will not interfere with the operation of a peripheral card installed in that slot (other than a disk drive) inside the Apple.

Disk Emulator 4.0

The program needs to know the location of the Firmware card, if any, the Emulated slot and drive number(s) and the location of the Legend RAM card(s) in the Apple before it installs itself into the DOS. You can supply this information manually by BRUNing the Disk Emulator program, or you may supply this information with a Turnkey Applesoft program to bring up the Disk Emulator automatically.

Disk Emulator 4.0

Manually boot the Legend Utilities diskette and type:

BRUN DISK EMULATOR 4.0

The program will begin execution after it has been loaded into memory. It will check to make sure that DOS is already in the machine at the correct address. If there is any problem, the program returns to BASIC and displays the following message:

INCORRECT DOS INSTALLED IN THE MACHINE

This message is displayed if there is anything other than than a 48K DOS in the machine. If there are no problems, the Apple screen display should look something like the following:

[DISK EMULATOR 4.0](C) COPYRIGHT, 1981
[U.S. PATENT PEND] LEGEND INDUSTRIES

ROM FIRMWARE CARD [LOCATION- SLOT 0]

DISK EMULATOR #1 [SLOT X / DRIVE X]
[128K CARD SLOT X]

DISK EMULATOR #2 [SLOT X / DRIVE X]
[128K CARD SLOT X]

DISK EMULATOR #3 [SLOT X / DRIVE X]
[128K CARD SLOT X]

DISK EMULATOR #4 [SLOT X / DRIVE X]
[128K CARD SLOT X]

Disk Emulator 4.0

Let's enter the parameters required by the Disk Emulator. One parameter at a time.

ROM FIRMWARE CARD [LOCATION- SLOT 0]

Type in the slot number, in the range from 0 through 7, of the Firmware card. If no Firmware card is installed then just press <RETURN>.

The Disk Emulator will manage the selection of the language contained on the Firmware card or the language contained in ROM on the motherboard when the location of the Firmware card is reported here.

The Emulator will use slot 0 as the default slot for the language missing in ROM on the motherboard when no Firmware card is present and consequently will recognize a 16K RAM card like the Apple Language card or Bank 0 on the Legend RAM card when either of these cards is present in slot 0. One bank of the Legend RAM card is used in this case.

DISK EMULATOR #1 [SLOT X / DRIVE X]

Type in the slot number (0 - 7) then the drive number (1 or 2) that the first Emulator will respond to. If you have a single disk drive in slot 6 then use SLOT 6 / DRIVE 2 for the emulated drive. If you have two disk drives in slot 6, use SLOT 5 / DRIVE 1 for the emulated drive. This is the suggested configuration for the Apple ///.

Disk Emulator 4.0

You can use any slot for the emulated drive and it will not interfere with the operation of a peripheral card installed in that slot (it will intercept commands to a disk drive). This means that you can use SLOT 5 / DRIVE 1 for the emulated drive and it will not interfere with the operation of a printer, clock or any other type of card that is physically installed in that slot.

**** Special Note **** You should not assign a SLOT / DRIVE number to the emulator that is already being used by an Apple disk drive because this will disable the disk drive.

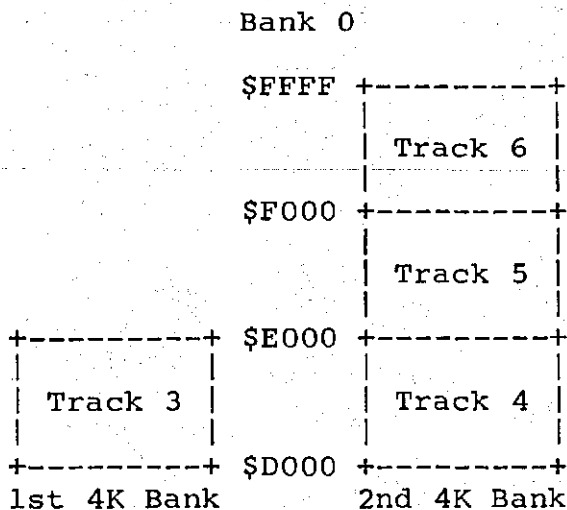
[128K CARD SLOT X]

Type in the slot number (from 0 to 7) of the Legend RAM card.

If a Firmware card is present, or if the Legend RAM card is installed in any slot other than slot 0, then DISK EMULATOR will use this card for the storage of 512 sectors of information (128K bytes) organized as disk tracks 3 through 34. The memory map for this configuration is shown in Figure 5.

Disk Emulator 4.0

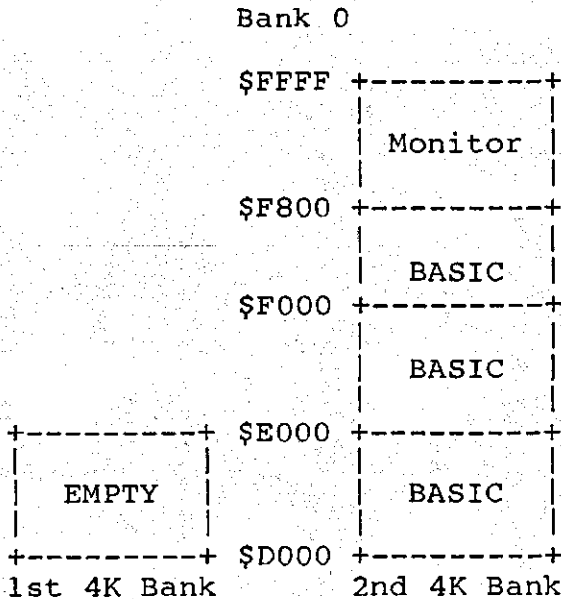
Figure 5. RAM Card Memory Map w/o BASIC



If a Firmware card is not present and the Legend RAM card is installed in slot 0 then the Disk Emulator will retain the first 16K bank of RAM on the card (Bank 0) for the language missing in ROM on the Apple motherboard and will utilize banks 1 through 7 for the storage of 448 sectors of information (112K bytes) organized as disk tracks 7 through 34. The memory map of bank 0 is shown in Figure 6.

Disk Emulator 4.0

Figure 6. RAM Card Memory Map with BASIC



DISK EMULATOR 4.0 does not provide for the storage of tracks 0, 1 and 2 on the emulated drive. These tracks usually contain the Disk Operating System (DOS) on a floppy disk and are not normally available for the storage of disk files.

Disk Emulator 4.0

You have just supplied the parameters necessary for operation of EMULATOR #1. If you are not going to implement EMULATOR #2, EMULATOR #3 or EMULATOR #4 then simply press <RETURN> in response to the emulated Slot / Drive prompts and the LEGEND card Slot assignment prompts for each of the remaining three emulators.

If you have more than one Legend card and you wish to implement EMULATOR #2 then type in the Slot and Drive that this emulator will respond to as well as the location of the second Legend card just like you did for EMULATOR #1. Similarly, type in the parameters for EMULATOR #3 and EMULATOR #4 if you wish, or simply press <RETURN> in response to the emulated Slot / Drive and 128K Slot prompts for the last two emulators.

(A)BORT, (I)NSTALL OR (R)ESTORE ? I

Press 'A' to Abort and return to BASIC without installing or restoring the Disk Emulator.

Press 'I' to Install the Disk Emulator and initialize the directory on all of the emulated drives. The Disk Emulator will automatically set up the directory on each emulated drive with 496 free sectors (432 free sectors if bank 0 of the 1st RAM card contains BASIC).

Disk Emulator 4.0

Press 'R' to Restore or reconnect the Disk Emulator without initializing the directory on the emulated drives. Disk Emulator is disconnected when you reboot DOS into the Apple, the Restore command is used to reconnect the Disk Emulator with all of the information on the emulated drive(s) intact.

Mount and Update

Mount

Disk Emulator provides two new DOS commands for each of the four emulated drives. The Mount command copies the floppy diskette in the Slot and Drive that you specify to the emulator that you specify. This command allows you to mount your application software into the emulator quickly, usually in less than 18 seconds. See Figure 7.

Figure 7. Mount Commands.

Command	Function
.M1,S6,D1	Copy the floppy diskette in Slot 6 / Drive 1 into Emulator #1.
.M2,S6,D2	Copy the floppy diskette in Slot 6 / Drive 2 into Emulator #2.
.M3,S6,D1	Copy the floppy diskette in Slot 6 / Drive 1 into Emulator #3.
.M4,S6,D1	Copy the floppy diskette in Slot 6 / Drive 1 into Emulator #4.

Disk Emulator 4.0

The Mount command is a true DOS command and it can be used in immediate mode by typing it in at the keyboard or deferred mode from within a program by using the standard Apple DOS print control-D syntax. For example:

```
800 PRINT CHR$(4);".M1,S6,D1"
```

The Mount command copies only those tracks on the floppy diskette that the Disk Emulator can store. If you are emulating a full disk then you will mount tracks 3 through 34 into the emulated drive. If you are using bank 0 to contain the language missing from the motherboard you will start mounting at track 7 instead of track 3. Refer to Figures 4 and 5 for a comparison.

When you emulate anything less than a full disk (32 tracks) you must insure that the disk files on the floppy diskette that you mount are all located within the specified range of tracks.

The SPECIAL FORMAT program on your Legend diskette is a utility program which helps you set up partial disks especially for use with the Mount and Update commands. Use of the SPECIAL FORMAT program is described later in this manual.

Disk Emulator 4.0

Update

The Update command copies the contents of the emulator that you specify onto a floppy disk in the Slot and Drive that you specify. This is useful when any data files have been modified during the operation of your application program. The Update command lets you to record the changes on the emulated disk permanently on a floppy diskette. See Figure 8.

Figure 8. Update Commands

Command	Function
.U1,S6,D1	Copy Emulator #1 onto the floppy diskette in Slot 6 / Drive 1.
.U2,S6,D2	Copy Emulator #2 onto the floppy diskette in Slot 6 / Drive 2.
.U3,S6,D1	Copy Emulator #3 onto the floppy diskette in Slot 6 / Drive 1.
.U4,S6,D2	Copy Emulator #4 onto the floppy diskette in Slot 6 / Drive 2.

The Update command is a true DOS command and, like the Mount command, it can be used in immediate mode by typing it in at the keyboard or deferred mode from within a program by using the standard Apple DOS print control-D syntax. For example:

Disk Emulator 4.0

```
900 PRINT CHR$(4);".U1,S6,D1"
```

The Update command copies only those tracks onto the floppy diskette that are contained on the emulated drive. If the emulated drive is a full disk then tracks 3 through 34 or tracks 7 through 34 will be written onto the floppy diskette, depending on whether or not BASIC is contained in bank 0 on the RAM card.

**** CAUTION ****

The Mount and Update commands should be used with extreme care. You should format several floppy diskettes as 'Partial' diskettes with the SPECIAL FORMAT program when the Disk Emulator is set up to emulate anything less than a full disk (tracks 3 through 34). Any files that the user copies onto these diskettes will be placed in the correct area of the diskette.

Disk Emulator is the perfect solution for those applications that require a lot of timely disk access.

Now, for the first time, every byte of memory on the Legend RAM card can be accessed with the standard DOS 3.3 disk commands (i.e. LOAD, SAVE, OPEN, READ and WRITE) in BASIC, or the DOS RWTS subroutines in machine language.

Disk Emulator 4.0

Your application programs and its associated disk files can be copied into the emulated drive and run from there with great speed improvement. To gain access to the emulated drive(s) simply use the optional slot and drive parameters of the emulated disk in one of the DOS commands. For example: if emulator #1 emulates Slot 5 / Drive 1 then type in the following command.

```
CATALOG,S5,D1
```

Once the emulated drive has been accessed it remains the default drive until another slot and drive is used in a DOS command.

The emulated drive's directory does not contain any files when you initially install the Disk Emulator. You may copy single files from floppy disk onto the emulated disk by using the FID program on the DOS 3.3 System Master disk or you can copy an entire floppy disk onto the emulated drive with the COPY or COPYA programs on the System Master disk. These programs provide the same features as the Mount and Update, but more time is needed for the operation.

Disk Emulator 4.0

Technical

DISK EMULATOR 4.0 is remarkably compact, using only 512 bytes of memory when installed within DOS, yet so very powerful because it takes advantage of the organization and power built into DOS 3.3. The emulator is as much as 300% faster than the Apple disk drive because it eliminates delays such as motor speed and stepping, which are associated with the disk drive hardware. Since the Emulator does use 512 bytes of memory, DOS will start at 37888 (\$9400) instead of 38400 (\$9600) which is 512 bytes lower than the normal DOS HIMEM:. HIMEM: will be reset accordingly.

DISK EMULATOR 4.0 emulates 256 sectors for every 64K of RAM on a Legend RAM card. A 128K card can emulate 32 tracks (tracks 3 thru 34). Tracks 0 through 2 are normally reserved for DOS and are therefore not emulated by this program. Disk Emulator 4.0 will support up to four Legend 128K RAM cards providing a total of 512K bytes (half megabyte) of online memory, all organized as four 128K byte, fast access, disk drives. Although the S'Card will go to 1 Megabyte, this program will only use 128K of its capacity. See the section on version 5.0 for full S'Card usage.

Disk Emulator 4.0

Turnkey

The Disk Emulator can be installed into the Apple with an Applesoft Turnkey program, thus eliminating the need to type in all of the slot and drive parameters that Disk Emulator requires for operation.

The Turnkey program will BLOAD the Disk Emulator into memory and then POKE in the required Slot and Drive parameters before installing the Disk Emulator into the Apple. The Turnkey program remains in control of the Apple after the installation and consequently the last line in the program may be a disk command such as CATALOG, to display the directory of the disk, or RUN, to run one of your programs.

Before you can use the Turnkey program you must customize it to reflect the Slot and Drive numbers of the emulated drives and the location of the Legend RAM cards installed in your Apple. The sample Turnkey program called 'TURNKEY' on your Legend disk is listed for your convenience in Listing 5. This program can be modified to reflect the configuration of your Disk Emulator.

LOAD TURNKEY (DEM 4.0) program into memory and retype lines 100 through 240 using the following guidelines:

Disk Emulator 4.0

100 RC = 0

Use a value in the range from 0 through 7 that corresponds to the location of the Integer or Applesoft Firmware card. If no Firmware card is installed then use the value 0.

110 S1 = 6

Use a value in the range from 1 through 7 that corresponds to the SLOT number that EMULATOR #1 will respond to.

120 D1 = 2

Use the value 1 or 2 that corresponds to the DRIVE number that EMULATOR #1 will respond to.

130 K1 = 0

Use a value in the range from 0 through 7 that corresponds to the location of the RAM card.

160 S2 = 15

Use a value in the range from 1 through 7 that corresponds to the SLOT number that EMULATOR #2 will respond to or use the value 15 to indicate that EMULATOR #2 will not be implemented.

170 D2 = 15

Use the value 1 or 2 that corresponds to the DRIVE number that EMULATOR #2 will respond to or use the value 15 to indicated that EMULATOR #2 will not be implemented.

Disk Emulator 4.0

180 K2 = 15

Use a value in the range from 0 through 7 that corresponds to the location of a second Legend card or use the value 15 to indicate that a second card is not available.

210 S3 = 15

Use a value in the range from 1 through 7 that corresponds to the SLOT number that EMULATOR #3 will respond to or use the value 15 to indicate that EMULATOR #3 will not be implemented.

220 D3 = 15

Use the value 1 or 2 that corresponds to the DRIVE number that EMULATOR #3 will respond to or use the value 15 to indicate that EMULATOR #3 will not be implemented.

230 K3 = 15

Use a value in the range from 0 through 7 that corresponds to the location of a third Legend card or use the value 15 to indicate that a third card is not available.

280 K4 = 15

Use a value in the range from 1 through 7 that corresponds to the location of a fourth Legend card or use the value 15 to indicate that a fourth card is not available.

Disk Emulator 4.0

Line 540 may reflect the next command you would execute if this set-up were done manually. For example: if you are going to Mount the data from the disk in drive 2, you would change line 540 to:

```
540 PRINT CHR$(4);".M1,S6,D2"
```

SAVE this custom Turnkey program onto another diskette for testing:

```
SAVE TURNKEY
```

The DISK EMULATOR 4.0 program can also be transferred onto another diskette by BLOADing it into memory and then typing:

```
BSAVE DISK EMULATOR 4.0,A$2000,L$A00
```

Disk Emulator

Special Format program

The Special Format program lets you create special 'partial' diskettes which may be used for the storage of data. This program will initialize blank diskettes and then mark the Volume Table Of Contents (VTOC) in the directory of the diskettes to show that only the tracks in the specified range are available for the storage of data.

Once the floppy diskette has been formatted and marked as a Partial Disk you may copy individual files to it with the Apple FID program on the System Master disk. All files will be written to the disk in the specified range of tracks. This insures that the Mount and Update commands will move a valid range of tracks to and from the emulated disk.

To use the Special Format program simply insert the Legend disk into the drive and type:

RUN SPECIAL FORMAT

The program clears the screen and then prompts you with three important set-up questions.

GREETING PROGRAM -

Disk Emulator

Type in the name of the greeting program you intend to use on the new diskette. The Special Format program does not place the greeting program on the new disk, it simply places the greeting program name into the proper area of the DOS on the new disk.

BEGINNING TRACK (3 OR 7) -

If the RAM card is installed in slot 0 and no Firmware card is installed in the computer, then Disk Emulator will retain the first 16K Bank of RAM on the card for the BASIC language missing in ROM on the Apple motherboard. This prevents the use of the first four tracks on the emulated drive (tracks 3 through 6). Type in the value '7' in response to this question.

If the RAM card is installed in any slot other than 0 OR if a Firmware card is installed, then type in the value '3' in response to this question.

ENDING TRACK (18 OR 34) -

If 64K of RAM is installed in the RAM card and you wish to format a half disk using this card, type in the number 18. If the card contains 128K of RAM and you wish to emulate a full disk, type in the number 34.

Disk Emulator

INSERT BLANK DISK AND PRESS <RETURN>

Insert a blank disk into the drive and press any key. When the disk has been initialized, you can place the greeting program and other application programs on it.

Disk Emulator 2.1

This program is a Disk Emulator for Legend RAM cards that only have 64K of memory. Disk Emulator 2.1 is really Disk Emulator 4.0 in disguise. That is to say they are the same program with a different setup screen and questions for you to answer. The program uses the same 512 bytes of memory as Disk Emulator 4.0 when installed. The program will also provide the same speed improvement as 4.0 with up to 300% faster transfer times.

Disk Emulator 2.1 will support multiple 64K RAM cards in an Apple][,][+, //e, /// (under emulation mode) and Franklin. The cards will be set up as three (3) emulated disk drives with up to six (6) cards in one machine.

When using a single 64K RAM card in the machine, it will be set-up as a single disk with 256 sectors, using tracks 3 - 18 in what we call "Half-Disk" mode. Two (2) 64K RAM cards will simulate 512 sectors as tracks 3 - 34 in what we call "Full-Disk" mode.

Disk Emulator 4.0 and 2.1 as the same programs have the same Mount and Update commands. Here again these commands should not be mistaken for the extended commands found in the Super Emulator.

You may wish to look over the configuration, mount, update and Special Format sections of this manual

Disk Emulator 2.1

Getting Started

The Disk Emulator needs to know information about the configuration of your machine and what disk drives you would like to emulate.

Insert the utility diskette into the disk drive. Do not close the door of the drive. Turn on the machine. Now close door of the disk drive. Please notice the sequence of boot-up. Although you have probably read of putting the disk into the drive and turning on the machine, this procedure will save on "Bombed" diskettes and should be practiced with all of your software.

Now that I have made my speech the HELLO program will display the programs on the disk. Type in:

```
BRUN DISK EMULATOR 2.1
```

In a few seconds the screen will appear something like that found in Figure 8. If there is any thing other than a 48K DOS in the machine the screen will display the following message:

```
INCORRECT DOS INSTALLED IN MACHINE
```

Disk Emulator 2.1

Figure 8. Disk Emulator 2.1

[DISK EMULATOR 2.1] (C) COPYRIGHT 1981
LEGEND INDUSTRIES

ROM FIRMWARE CARD [LOCATION- SLOT 0]

DISK EMULATOR #1 [SLOT X / DRIVE X]
[64KC CARD SLOT X]
[64KC CARD SLOT X]

DISK EMULATOR #2 [SLOT X / DRIVE X]
[64KC CARD SLOT X]
[64KC CARD SLOT X]

DISK EMULATOR #3 [SLOT X / DRIVE X]
[64KC CARD SLOT X]
[64KC CARD SLOT X]

These questions are very easy to answer. We will go through them now.

ROM FIRMWARE CARD [LOCATION- SLOT 0]

If you have a FIRMWARE card, enter the slot (0 - 7) that corresponds to the location of that card.

DISK EMULATOR #1 [SLOT X / DRIVE X]

These two (2) questions are for setting up the first emulator. SLOT refers to the slot you want the emulated drive to be in. If you wish this drive to be in slot 6, type a "6". DRIVE refers to the drive you wish to emulate. If you want to emulate drive 2, type "2".

Disk Emulator 2.1

**** **Special Note** **** You should not assign a SLOT / DRIVE number to the emulator that is already being used by an Apple disk drive because this will disable the disk drive. On the other hand, emulation of drive 2 can be useful when using a program that has a data disk in drive 2. The rate of data retrieval is far greater than from a standard floppy.

[64KC CARD SLOT X]

This question is asked six (6) times and all refer to the same thing; where the RAM card is located. The first question is for the first card, the next question is for the second card and so on. Answer with the slot number the card(s) is installed in.

If you have no more cards to enter, press RETURN for each of the questions to ignore them.

After you have answered all of the questions, the program will ask if you want to Abort, Install or Restore. The screen will appear as follows:

(A)BORT, (I)NSTALL OR (R)ESTORE ? I

If you want to abort the installation of the Disk Emulator within DOS, type "A".

If you want to install the emulator into DOS, press RETURN or type "I".

Disk Emulator 2.1

If you had the emulator installed and you disconnected it from DOS (by rebooting), type "R" to reconnect the emulator to DOS.

To gain access to the emulated drive you use the standard DOS commands as you would any other drive (with the exception of the "INIT" command). If you set up the emulated drive as slot 5, drive 1, then type CATALOG S5,D1. The catalog of the emulated drive should show DISK VOLUME 254. Notice that there are no catalog entries.

You have to transfer files to the card before they show up in the catalog. This can be done with the Mount/Update commands, copy, copya or FID. Information of how the Mount/Update works can be found elsewhere in this section.

Turnkey

The Disk Emulator can be installed into DOS using an Applesoft "Turnkey" program. The turnkey program will BLOAD the Disk Emulator into the machine and poke the information into the proper location.

To set up a turnkey system follow these instructions:

- 1) Put the Legend disk into the disk drive.

Disk Emulator 2.1

- 2) Turn on the machine.
- 3) Close the door of the disk drive and allow the HELLO program to display the programs available on the screen.
- 4) Type: LOAD TURNKEY (DEM 2.1). Press RETURN
- 5) After the program is loaded into memory, retype the following lines;

100 RC = 0

Use a value in the range from 0-7 to indicate the location of the FIRMWARE card. If there is no FIRMWARE card in the machine, use 0.

110 S1 = 6

Use a value from 1-7 to indicate the slot you want emulator #1 to respond to.

120 D1 = 2

Enter a 1 or 2 for the drive number that emulator #1 will respond to.

130 K1 = 4

This value will reflect the location of the first RAM card.

140 K2 = 5

This value will reflect the location of the second RAM card.

Disk Emulator 2.1

- 160 S2 = 15
Use the value to indicate the slot the second emulator is to correspond to.
- 170 D2 = 15
Enter a 1 or 2 for the drive the second emulator is to be accessed as.
- 180 K3 = 15
This value relates the location of the third RAM card in the machine.
- 190 K4 = 15
This value relates to the location of the fourth RAM card in the machine.
- 210 S3 = 15
Use the value to reflect the slot that you want emulator #3 to correspond to.
- 220 D3 = 15
Use this value to reflect the drive that you want emulator #3 to correspond to.
- 230 K5 = 15
This value reflects the location of the fifth RAM card in the machine.
- 240 K6 = 15
This is the last value to be answered and it reflects the location of the sixth RAM card in the machine.

Disk Emulator 2.1

- 6) Remove the Legend disk (or backup) from the disk drive.
- 7) Put a blank disk into the drive and close the door.
- 8) Type: INIT HELLO. Press RETURN.
- 9) After the disk is initialized, remove it from the drive and insert the System Master.
- 10) Type: BRUN FID. Press RETURN.
- 11) When the program has finished loading, a menu will appear on the screen.
- 12) Type: 1. Press RETURN.
- 13) Remove the System Master from drive 1 and insert the Legend Utility diskette.
- 14) The source is slot 6, drive 1. The destination is slot 6, drive i.
- 15) You will be prompted to exchange disk for file transfer. Sounds complicated, but isn't. Follow the instructions completely.
- 16) After the program finishes you will have a new boot disk that automatically sets up the Disk Emulator when booted.

Disk Emulator 5.0

Disk Emulator 5.0 is a stripped-down version of the Super Emulator. It locates the emulator code entirely within the DOS. The most important feature of this emulator is that it can be used in conjunction with Memory Master 3.0.

Another difference between this program and the previous Emulators is that you may select whether or not you wish to install the Mount/Update routines in DOS. This is for greater compatibility with other programs.

This program also includes the option of patching DOS with a quick loader routine so you may increase the speed of your DOS loads.

You should read over the section on the Super Emulator set-up before continuing with this section. Please do so now.

The questions asked in the setting up of this emulator are exactly the same except for the question:

DO YOU WISH TO RELOCATE DOS?

This is replaced by:

ARE YOU USING THIS PROGRAM IN
CONJUNCTION WITH MEMORY MASTER 3.0?

Disk Emulator 5.0

If you are planning on using this program with Memory Master 3.0, you must install the Disk Emulator first. If you don't, the Emulator will not be installed.

The Turnkey setup of this program is identical with that of the Super Emulator. Refer the that chapter for further assistance in this area.

Disk Emulator

Listing 2. Turnkey for Disk Emulator 4.0

```
20 REM *****
24 REM * < TURNKEY EMULATOR > *
28 REM * (C) COPYRIGHT 1981 *
32 REM *LEGEND INDUSTRIES, LTD.
42 REM *****
50 HOME : PRINT "WAIT"
55 :
100 RC = 00: REM ROM CARD (0 DEFAULT NO CARD)
110 S1 = 06: REM DEM#1 EMULATES SLOT 6
120 D1 = 02: REM DEM#1 EMULATES DRIVE 2
130 K1 = 00: REM 1ST 128K SLOT 0
150 :
160 S2 = 15: REM DEM#2 EMULATES SLOT (15 DEFAULT NO EMULATOR)
170 D2 = 15: REM DEM#2 EMULATES DRIVE (15 DEFAULT NO EMULATOR)
180 K2 = 15: REM 2nd 128K SLOT (15 DEFAULT NO CARD)
200 :
210 S3 = 15: REM DEM#3 EMULATES SLOT (15 DEFAULT NO EMULATOR)
220 D3 = 15: REM DEM#3 EMULATES DRIVE (15 DEFAULT NO EMULATOR)
230 K3 = 15: REM DEM#3 128K SLOT (15 DEFAULT NO CARD)
250 :
260 S4 = 15: REM DEM#4 EMULATES SLOT (15 DEFAULT NO EMULATOR)
270 D4 = 15: REM DEM#4 EMULATES DRIVE (15 DEFAULT NO EMULATOR)
280 K4 = 15: REM DEM#4 128K SLOT (15 DEFAULT NO CARD)
285 :
290 PRINT CHR$(4);"BLOAD DISK EMULATOR 4.0"
295 :
300 POKE 9697,RC * 16: REM ROM FIRMWARE SLOT
310 POKE 9704,S1 * 16: REM DEM#1 EMULATED SLOT
320 POKE 9705,D1 * 01: REM DEM#1 EMULATED DRIVE
330 POKE 9712,K1 * 16: REM DEM#1 128K SLOT
340 POKE 9713,K1 * 16: REM DEM#1 128K SLOT
350 :
360 POKE 9706,S2 * 16: REM DEM#2 EMULATED SLOT
370 POKE 9707,D2 * 01: REM DEM#2 EMULATED DRIVE
380 POKE 9714,K2 * 16: REM DEM#2 128K SLOT
390 POKE 9715,K2 * 16: REM DEM#2 128K SLOT
400 :
410 POKE 9708,S3 * 16: REM DEM#3 EMULATED SLOT
420 POKE 9709,D3 * 01: REM DEM#3 EMULATED DRIVE
430 POKE 9716,K3 * 16: REM DEM#3 128K SLOT
440 POKE 9717,K3 * 16: REM DEM#3 128K SLOT
450 :
460 POKE 9710,S4 * 16: REM DEM#4 EMULATED SLOT
470 POKE 9711,D4 * 01: REM DEM#4 EMULATED DRIVE
480 POKE 9718,K4 * 16: REM DEM#4 128K SLOT
490 POKE 9719,K4 * 16: REM DEM#4 128K SLOT
495 :
500 CALL 8960: REM CALL INSTALL ROUTINE
510 :
520 PRINT "DONE....."
540 PRINT CHR$(4);"CATALOG,S";S1;","D";D1
```

Disk Emulator

Listing 3

```
20 REM *****
22 REM *
24 REM * < SPECIAL FORMAT > *
26 REM *
28 REM * (C) COPYRIGHT 1981 *
30 REM
32 REM LEGEND INDUSTRIES, LTD.
34 REM P.O. BOX 112
36 REM PONTIAC, MI. 48056
40 REM *
42 REM *****
44 :
50 HOME : PRINT "WAIT"
55 :
100 FOR I = 1 TO 40: PRINT "=";: NEXT
110 PRINT " SPECIAL DISK FORMAT PROGRAM"
120 PRINT " (C) COPYRIGHT 1981, LEGEND INDUSTRIES"
130 FOR I = 1 TO 40: PRINT "=";: NEXT : PRINT
140 :
150 VTAB 7: INPUT "GREETING PROGRAM - ";GN$
170 IF GN$ = "" THEN GN$ = "HELLO"
180 :
200 VTAB 9: INPUT "BEGINNING TRACK (3 OR 7) - ";BT$
210 BT = VAL (BT$)
220 IF BT < 3 OR BT > 11 THEN PRINT "": GOTO 200
230 :
250 VTAB 11: INPUT "ENDING TRACK (18 OR 34) - ";ET$
260 ET = VAL (ET$)
270 IF ET < > 18 AND ET < > 34 THEN PRINT "": GOTO 250
280 :
300 VTAB 14: PRINT "INSERT BLANK DISK AND PRESS <RETURN> ";
310 GET A$: PRINT
320 :
350 POKE - 20813,BT * 4: REM BEGIN TRACK
360 POKE - 20811,(ET + 11) * 4: REM END TRACK
370 :
380 PRINT CHR$(4);"INIT";GN$
390 PRINT CHR$(4);"DELETE";GN$
400 :
410 POKE - 20813,12: POKE - 20811,140
```


Disk Emulator

Listing 4

```

0800      101 *****
0800      102 *
0800      103 *           <DISK EMULATOR 4.0>
0800      104 *           (Version 11/02/81)
0800      105 *(C) Copyright 1981-Legend Industries, Ltd.*
0800      106 *           ALL RIGHTS RESERVED
0800      107 *           Patend Pending
0800      108 *****
0800      109 ;
0008      110 PTRL      EPZ $08           ;$2F
003E      111 ADRL      EPZ $3E
0048      112 IOB       EPZ $48
0800      113 ;
BF41      114 DOSON     EQU $BF41
BF65      115 DOSOFF    EQU $BF65
0800      116 ;
9C00      117           ORG $9C00
9C00      118           OBJ $0800
9C00      119 ;
9C00      120 SCF806    EMTEST1  STY $6F8
9C03      121 A206      LDX #$06           ;Index for 4 test
9C05      122 88        DEY           ;Index for IOB #
9C06      123 B148      DEMTEST  LDA (IOB),Y
9C08      124 DDE89C    CMP EMSLOT,X           ;Same as EM#X nbr
9C0B      125 D009      BNE TESTNXT           ;No,try next emul
9C0D      126 C8        INY           ;Index for IOB d#
9C0E      127 B148      LDA (IOB),Y
9C10      128 DDE99C    CMP EMSLOT+1,X           ;Same as EM#X dr#
9C13      129 F008      BEQ EMULATE           ;Yes,then emulate
9C15      130 88        DEY
9C16      131 CA        TESTNXT DEX           ;Index next EM pa
9C17      132 CA        BEX           ;Tested all 3 par
9C18      133 10EC     BPL DEMTEST           ;No,test next EM.
9C1A      134 4C09BD    JMP $BD09           ;Else,ret to RWTS
9C1D      135 ;
9C1D      136 A00C     EMULATE  LDY #$0C           ;Index for IOB co
9C1F      137 B148      LDA (IOB),Y
9C21      138 F06D      BEQ EXIT1           ;Yes?,exit emulat
9C23      139 C904      CMP #$04           ;Is it format com
9C25      140 F069      BEQ EXIT1           ;Yes then exit em
9C27      141 8DE29C    STA IOBCMD           ;Save IOB command
9C2A      142 A004      LDY #$04           ;Index for IOB t#
9C2C      143 B148      LDA (IOB),Y
9C2E      144 DDF89C    CMP TRKLMT,X           ;Is it tr 0,1 or2
9C31      145 905D      BCC EXIT1           ;Yes then exit em
9C33      146 DDF99C    CMP TRKLMT+1,X           ;Beyond last trk?
9C36      147 B058      BCS EXIT1           ;Yes then exit em
9C38      148 E902      SBC #$02           ;64KC add offset
9C3A      149 4B        PHA           ;Save new trk val
9C3B      150 C8        INY           ;Index for IOB se
9C3C      151 B148      LDA (IOB),Y
9C3E      152 8DE19C    STA SECTOR           ;Save pg.# $00-OF
9C41      153 68        PLA           ;Retreive tr valu

```

Disk Emulator

Listing 4 (cont.)

```

9C42 A8      154      TAY          ;Save new tr valu
9C43 20B79C  155      JSR SAVLANG  ;Save lan ID byte
9C46 20929C  156      JSR ADRCALC ;Set up 128KC add
9C49 A008    157      LDY #008    ;Index for IOB bu
9C4B B148    158      LDA (IOB),Y ;Get buffer lo by
9C4D 853E    159      STA ADRL
9C4F C8      160      INY          ;Index for buf hi
9C50 B148    161      LDA (IOB),Y
9C52 853F    162      STA ADRL+1
9C54 A000    163      LDY #000    ;Init Y index reg.
9C56 8408    164      STY PTRL
9C58 ADE29C  165      LDA IOBCMD
9C5B 4A      166      LSR          ;Is it RD command
9C5C B013    167      BCS RDSECT  ;YES read sector
9C5E EAEAEA  168      HEX EAEAEA ;Future DEM xtension
9C61 BD83C0  169      LDA $C083,X ;Turn on 128KC
9C64 BD83C0  170      LDA $C083,X ;Write enable car
9C67 B13E    171      WRSECT     LDA (ADRL),Y
9C69 9108    172      STA (PTRL),Y
9C6B C8      173      INY          ;All 256 bytes mov
9C6C D0F9    174      BNE WRSECT  ;If not,move more
9C6E F00C    175      BEQ EXIT    ;Else do norm ext
9C70 EA      176      HEX EA
9C71 BD83C0  177      RDSECT     LDA $C083,X ;Select 128KC crd
9C74 9108    178      RDSECT1    LDA (PTRL),Y
9C76 913E    179      STA (ADRL),Y
9C78 C8      180      INY          ;All 256 bytes mo
9C79 D0F9    181      BNE RDSECT1 ;If not,move more
9C7B EA      182      HEX EA
9C7C         183      ;
9C7C BD82C0  184      EXIT      LDA $C082,X ;Turn off 128KC
9C7F 98      185      TYA          ;Load A w zero va
9C80 9DB4C0  186      STA $C084,X ;Select bank# 0
9C83 A00E    187      LDY #00E    ;Index for IOB vl
9C85 ADE39C  188      LDA VOLUME  ;Set vol nbr 254
9C88 9148    189      STA (IOB),Y
9C8A ADE09C  190      LDA LANGID  ;Get lang ID byte
9C8D 20B2A5  191      JSR $A5B2   ;DOS ROM switch r
9C90 18      192      EXIT1     CLC          ;Indicates no err
9C91 60      193      RTS          ;Return to call r
9C92         194      ;
9C92 195     195      ;ADRCALC- Y register - Track value $000XXXXX
9C92 196     196      ; Indicates one of 32 (4K) tracks
9C92 197     197      ; X register - 128KC index $000000XX
9C92 198     198      ; Indicates one of three EMULATORS
9C92 199     199      ; SECTOR - Sector nbr. $0000XXXX
9C92 200     200      ; Indicates page number $00 to $0F
9C92 201     201      ;
9C92 202     202      ; ADRCALC subroutine returns with hi-byte
9C92 203     203      ; of 128Kc add. in PTRL+1 ptr.Register
9C92 204     204      ; X contains index for correct 128KC slot.
9C92 205     205      ;
9C92 98     206      ADRLC   TYA          ;Retrieve track v

```

Disk Emulator

Listing 4 (cont.)

```

9C93 2910      207      AND  #$00010000      ;1st or 2nd card?
9C95 F001      208      BEQ  CONT1           ;Branch if card#1
9C97 EB        209      INX                    ;Index for card#2
9C98 BDF09C    210      CONT1 LDA  NDXTBL,X       ;Get 128K slot
9C9B AA        211      TAX                    ;Put in X index r
9C9C 98        212      TYA                    ;Retrieve trk val
9C9D 291C      213      AND  #$             ;Mask for bank no
9C9F 4A        214      LSR                    ;
9CA0 4Ae       215      LSR                    ;
9CA1 9D84C0    216      STA  $C084,X         ;Set correct bank
9CA4 98        217      TYA                    ;Retrieve trk val
9CA5 2903      218      AND  #$             ;Mask for 4K2bnks
9CA7 A8        219      TAY                    ;Index for 128KC
9CA8 D004      220      BNE  CONT2           ;Branch if not 1
9CAA BA        221      TXA                    ;
9CAB 6908      222      ADC  #$08            ;1st 4K sub-bank
9CAD AA        223      TAX                    ;
9CAE B9E49C    224      CONT2 LDA  ADRTBL,Y     ;Get 128Kc add hi
9CB1 6DE19C    225      ADC  SECTOR          ;Add sector 00-0F
9CB4 8509      226      STA  PTRL+1         ;Save pointer hi-b
9CB6 60        227      RTS                    ;Return to call r
9CB7          228      ;
9CB7 AD00E0    229      SAVLANG LDA  $E000
9CBA 8DE09C    230      STA  LANGID
9CBD AD82C0    231      LDA  $C082          ;Wr.Prot.slot #0.
9CC0 AD81C0    232      LDA  $C081          ;Turn off slot #0
9CC3 60        233      RTS                    ;Return to call r
9CC4          234      ;
9CC4 B13E      235      WRDEM LDA  (ADRL),Y
9CC6 9900BD    236      STA  $BD00,Y
9CC9 C8        237      INY                    ;
9CCA D0F8      238      BNE  WRDEM
9CCC 4C65BF    239      JMP  DOSOFF
9CCF 2065BF    240      RDDEM JSR  DOSOFF
9CD2 BD83C0    241      LDA  $C083,X       ;Select 128KCard
9CD5 B108      242      RDDEM1 LDA  (PTRL),Y
9CD7 9900BD    243      STA  $BD00,Y
9CDA C8        244      INY                    ;
9CDB D0F8      245      BNE  RDDEM1
9CDD 4C41BF    246      JMP  DOSON
9CE0          247      ;
9CE0 00        248      LANGID HEX  00
9CE1 00        249      SECTOR  HEX  00
9CE2 00        250      IOBCMD  HEX  00
9CE3 FE        251      VOLUME  HEX  FE      ;Vol.# found 254.
9CE4          252      ;
9CE4 D0        253      ADRTBL  HEX  D0      ;1st 4K sub-bank
9CE5 D0        254      HEX  D0      ;2nd 4K sub-bank
9CE6 E0        255      HEX  E0      ;2nd 4K sub-bank
9CE7 F0        256      HEX  F0      ;2nd 4K sub-bank

```

Disk Emulator

Listing 4 (cont.)

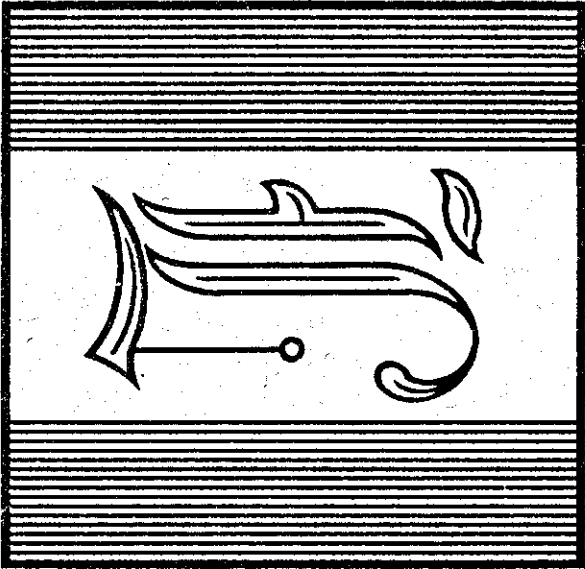
```
9CE8      257      ;
9CE8      258      ;Hardware configuration block
9CE8      259      ;
9CE8 5001  260      EMSLOT  HEX 5001      ;EM#1 slot/drive
9CEA FFFF  261      HEX FFFF      ;EM#2 slot/drive
9CEC FFFF  262      HEX FFFF      ;EM#3 slot/drive
9CEE FFFF  263      HEX FFFF      ;EM#4 slot/drive
9CF0 2040  264      NDXTBL  HEX 2040      ;EM#1 1st/2nd card
9CF2 FFFF  265      HEX FFFF      ;EM#2 1st/2nd card
9CF4 FFFF  266      HEX FFFF      ;EM#3 1st/2nd card
9CF6 FFFF  267      HEX FFFF      ;EM#4 1st/2nd card
9CF8 0323  268      TRKLMT  HEX 0323      ;EM#1 beg/end track
9CFA 0323  269      HEX 0323      ;EM#2 beg/end track
9CFC 0323  270      HEX 0323      ;EM#3 beg/end track
9CFE 0323  271      HEX 0323      ;EM#4 beg/end track
          272      END
```

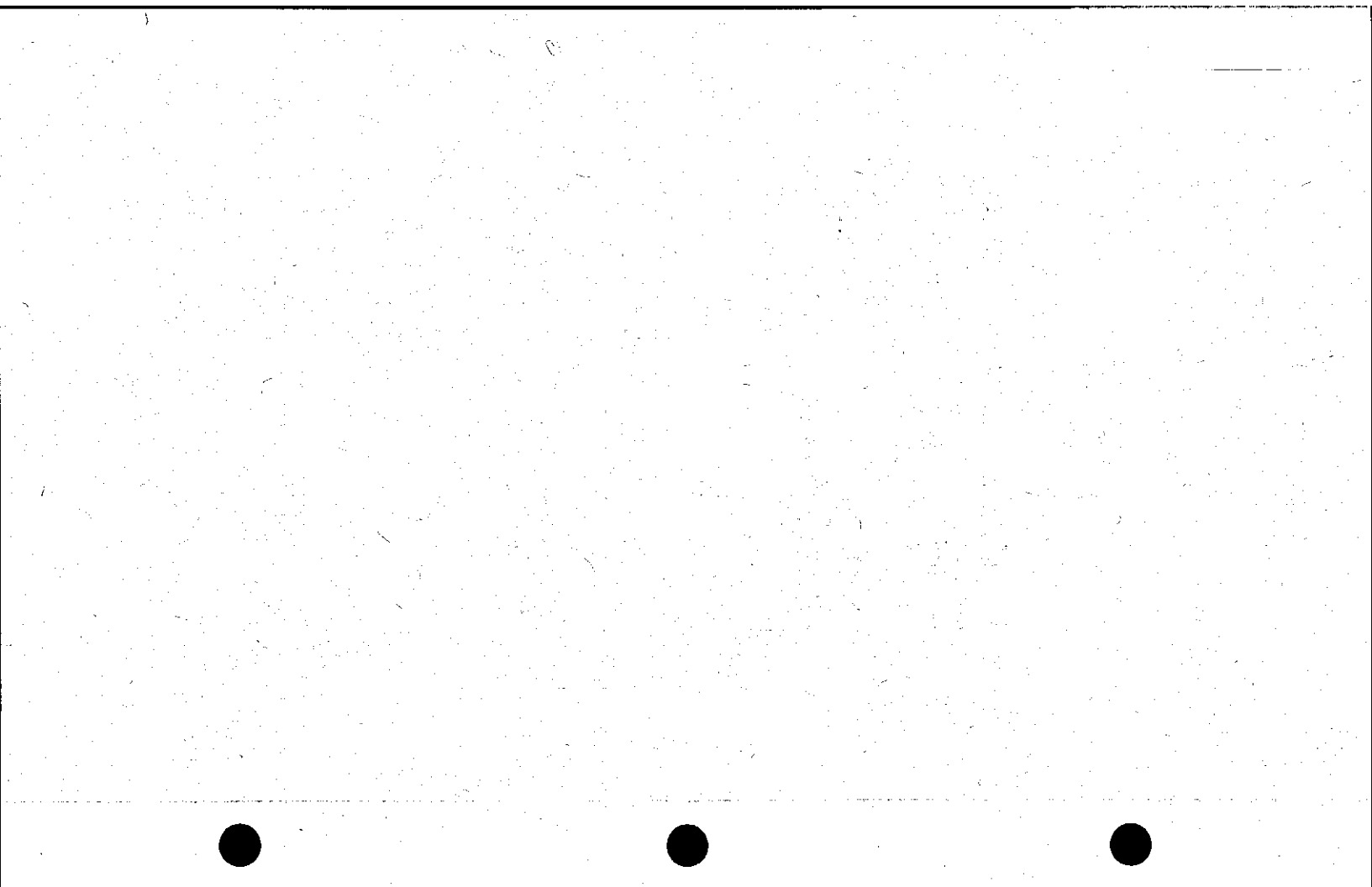
Disk Emulator

Listing 5. Turnkey for Disk Emulator 2.1

```
20 REM *****
22 REM *
24 REM * < TURNKEY EMULATOR > *
28 REM * (C) COPYRIGHT 1981 *
30 REM
32 REM LEGEND INDUSTRIES, LTD.
40 REM *
42 REM *****
44 :
50 HOME : PRINT "WAIT"
55 :
100 RC = 0: REM ROM CARD (0 DEFAULT NO CARD)
110 S1 = 6: REM DEM#1 EMULATES SLOT 5
120 D1 = 2: REM DEM#1 EMULATES DRIVE 1
130 K1 = 0: REM 1ST 64KC SLOT 0
140 K2 = 15: REM 2ND 64KC SLOT (15 DEFAULT NO CARD)
150 :
160 S2 = 15: REM DEM#2 EMULATES SLOT (15 DEFAULT NO EMULATOR)
170 D2 = 15: REM DEM#2 EMULATES DRIVE (15 DEFAULT NO EMULATOR)
180 K3 = 15: REM 3RD 64KC SLOT (15 DEFAULT NO CARD)
190 K4 = 15: REM 4TH 64KC SLOT (15 DEFAULT NO CARD)
200 :
210 S3 = 15: REM DEM#3 EMULATES SLOT (15 DEFAULT NO EMULATOR)
220 D3 = 15: REM DEM#3 EMULATES DRIVE (15 DEFAULT NO EMULATOR)
230 K5 = 15: REM 5TH 64KC SLOT (15 DEFAULT NO CARD)
240 K6 = 15: REM 6TH 64KC SLOT (15 DEFAULT NO CARD)
250 :
260 PRINT CHR$(4);"BLOAD DISK EMULATOR 2.1"
270 :
300 POKE 9697,RC * 16: REM ROM FIRMWARE SLOT
310 POKE 9704,S1 * 16: REM DEM#1 EMULATED SLOT
320 POKE 9705,D1 * 01: REM DEM#1 EMULATED DRIVE
330 POKE 9712,K1 * 16: REM DEM#1 1ST 64KC SLOT
340 POKE 9713,K2 * 16: REM DEM#1 2ND 64KC SLOT
350 :
360 POKE 9706,S2 * 16: REM DEM#2 EMULATED SLOT
370 POKE 9707,D2 * 01: REM DEM#2 EMULATED DRIVE
380 POKE 9714,K3 * 16: REM DEM#2 3RD 64KC SLOT
390 POKE 9715,K4 * 16: REM DEM#2 4TH 64KC SLOT
400 :
410 POKE 9708,S3 * 16: REM DEM#3 EMULATED SLOT
420 POKE 9709,D3 * 01: REM DEM#3 EMULATED DRIVE
430 POKE 9716,K5 * 16: REM DEM#3 5TH 64KC SLOT
440 POKE 9717,K6 * 16: REM DEM#3 6TH 64KC SLOT
450 :
500 CALL 8960: REM CALL INSTALL ROUTINE
510 :
520 PRINT "DONE....."
540 PRINT CHR$(4);"CATALOG,S";S1;","D";D1
```







Super Emulator

The Super Emulator is provided, free of charge, to those who have purchased an S'Card with 256K or more of RAM installed. Please read this section before using this program as there are certain aspects of this program that do not correspond to the standard Legend Industries' Memory Master or Disk Emulator programs. It is assumed that you have read the instructions for our Disk Emulator 4.0 and Memory Master 2.0 and understand their operation.

The Super Emulator is a very powerful program which incorporates all of the features of the Memory Master and Disk Emulator programs (which are available from Legend Industries) into one program. For the first time all of the commands in Memory Master and Disk Emulator are combined into one. It also incorporates several extensions to the basic programs. We have sacrificed the access to DOS 3.2 for this. Therefore, the .Flip command is no longer available.

When the diskette is booted, it will show you the diskette catalog. The instructions for running the program are coming up in just a few pages. Until then, let's point out a few of the features of the program.

Since the Super Emulator incorporates Disk Emulator and Memory Master, there will be parts of both in the resulting program. The Disk Emulator portion of the program is improved over the old Disk Emulator in several ways.

Super Emulator

First, the Emulator portion is incorporated entirely inside of DOS. This will give added compatibility to those programs which previously didn't work with the Disk Emulator.

Second, the flexibility of emulation has been increased to allow the use of up to 512K of RAM. This will let you build large drives (up to 100 tracks) to speed the running of your programs.

It has been decided that, since the Mount and Update commands may still be in the way, you will have a choice of locating them external to DOS or having them saved as a BRUNable file.

Finally, to speed up the processing of programs, a quick loader option has been added to the system. This will speed up load times by 400%.

The DOS relocation section of the program will relocate DOS to reside in one of the 16K banks of RAM on your Legend card to provide 43.5K bytes of free RAM space within the 48K of RAM on the Apple's motherboard.

The Super Emulator program will work with any combination of Legend RAM cards up to a maximum of 512K. By configuring the cards as fast access disk drives in conjunction with the features of the powerful Memory Master program, this program can be one of the most powerful you will ever use.

Super Emulator

Questions About Configuration

The Super Emulator is designed to "intellegently" help you set up your system configuration. It will automatically scan the peripheral slots and set up the default parameters to match your system. The default parameters are meant to set up your system so as not to conflict with the peripheral cards you already have in your computer. For example: if you have a disk controller in slot 6, the program will not assign an emulator to that slot. You may change this, if you wish, in the Edit mode.

Although the program will allow you to allocate space for the language missing on the motherboard, it will not load the missing language into one of your RAM cards. If you are going to use this program on an Apple][Plus, then you will have to load Integer BASIC into the machine or use your Apple Firmware card, provisions for the Firmware card are in the program. If you do not wish to reserve space for a language, you will not have to load it.

Super Emulator

In configuring the system you should install your Legend RAM card in the slot of your choice following those steps outlined in this manual under Installation. You may wish to put the card in slot 0 and use it as a language card when not using this program. It is not necessary to put it in slot 0, any slot will do. If you do elect to put the card in slot 0, the program will wipe-out any language stored in the card on a cold BOOT. Therefore, it will be necessary to reload Integer (or Applesoft) into the card.

Initial Setup

After you have installed your Legend RAM card, you can now set up and install the Super Emulator. The program will set up defaults so you only have to press <RETURN> when you want the defaults. Otherwise, enter your choices. The program searches for RAM cards so you will not have to enter the RAM card slot numbers. The following steps will guide you into the setting up of your Super Emulator configuration.

- 1) If you wish to use the language alternate to the one you have on your motherboard (Integer BASIC if you have an Apple][plus or Applesoft if you have an Integer machine), boot your DOS 3.3 System Master disk to load that language.

Super Emulator

- 2) BRUN the Super Emulator program on the Super Emulator diskette. The program will search the slots in your machine and return to you with a signon message and several questions.

The first question asked is whether or not you wish to reserve space for an alternate language. This question is asked conditionally. If you don't have a RAM card in slot 0 or you have a firmware card in any slot, it will not be asked. If you have loaded (or are going to load) a language into the machine, answer 'Y'.

Remember: saving a bank for a missing language will also subtract 16k from the space available for emulation.

- 3) The next question asked will be whether or not you wish to relocate DOS into the RAM card. This question is only asked based on the following conditions. There is a RAM card in slot 0 and it must have enough memory to hold not only DOS, but the missing language if you selected that option. This option will subtract 16k from available emulation RAM if used.

Super Emulator

- 4) If you have elected to move DOS, this next question will not be asked. The program would like to know if you wish to have the Mount/Update commands located in DOS (this takes up 256 bytes on the motherboard). For greater compatibility with other programs, select "NO" for this option.
- 5) The program will now ask you if you wish to speed up program (and data) loading times by 400%. If you wish the quick loader installed, answer 'Y'. This will preclude initializing diskettes (you will not be able to initialize a diskette when you have not relocated DOS).
- 6) The system default configuration will be shown to you and you will be asked if you wish to Abort the program, Install the modifications, Restore an old configuration destroyed by a warm boot or Edit the default parameters (Editing will be covered in a later section). For now, Install the Emulator. This will set up the directory on the emulated drive(s) (Restoring will not destroy an old directory).

Super Emulator

Usage

If you have selected to relocate DOS (Go back and try this the first time through if you don't have to reconfigure your system.), you will be given several extra commands. If you do not wish to relocate DOS, these commands will not be available. You may have the ".M" and ".U" commands if you elected to locate this in DOS, the others will not be available.

Enter ".H" and you will be shown a list of available commands (see Figure 9). We will go through these commands, one at a time, and explain their use.

Figure 9. Super Emulator Extended Cmds

". " COMMAND EXPLANATIONS

- .A - JUMP TO MONITOR
- .B - BINARY STATUS OF LAST LOADED FILE
- .C - CATALOG (ANY DISK)
- .D - DISK MAP OF VTOC (35 TRACKS)
- .H - DISPLAYS THIS LIST
- .I - INITIALIZE A DISKETTE
- .M - MOUNT A DISKETTE
- .S - DISK EMULATOR STATUS
- .U - UPDATE A DISKETTE
- .V - VERSION NUMBER
- .W - WRITE PROTECT EMULATOR
- .X - FREE SPACE AVAILABLE ON DISK

Super Emulator

The first command is simple in its use; ".A" will jump to the system monitor. DOS will be inactive when you do this. To restart DOS, type in 3DOG from the monitor.

".B" will show you the starting address and length of the last loaded file. These numbers will be shown in hexadecimal. If the last loaded file was a BASIC program, the starting address will not mean much but the length will be the size of the program.

We have made it easy for you to catalog your diskettes. The ".C" doesn't replace the CATALOG command, but complements it. It will work with any combination of slot and drive parameters you wish to specify after it. The syntax of this command is exactly as in the catalog command (e.g. .C,S6,D1 will catalog slot 6, drive 1).

You may obtain a map of the used and unused portions of a diskette by issuing the ".D" command. This will show you the last used drive map.

In the ".H" command, the "H" stands for Help. It does just that and shows you the list of commands. The current version of the Super Emulator is obtained with the ".V" command.

Super Emulator

In order to add these new commands, the INIT command was removed from the normal DOS. Using it will return a syntax error. If you wish to initialize a diskette, use ".I". This command will initialize a DATA diskette, there will be no DOS or Hello file on the initialized disk. You should not try to initialize an emulator.

If you haven't noticed by now, the CATALOG command has been extended to show you the number of free sectors remaining on your diskette. The ".X" command will show you this number without giving you a catalog. The free space shown will be on the last accessed drive.

The commands ".M" and ".U" are kept for the Disk Emulator portion of the program. They are fully explained in the Disk Emulator section of the 128KDE manual. There is one further thing to add; you will notice a speed decrease of 2 when using these commands in a relocated DOS as opposed to a non-relocated DOS. To allow the use of the Emulator to load programs into a RAM card, the sector loaded is first buffered onto the motherboard.

Super Emulator

There are two commands which operate with the Emulator portion of this program only. They are ".S" and ".W". The ".S" command will show you the current status of the Disk Emulator. This will be the emulator number used in the Mount or Update commands, the track numbers that are being emulated and will also show you if the drive is write protected.

The ".W" command is special. It allows you to write protect the data on the emulated drive. Because the RAM cards don't have write protect notches that you can cover up like on diskettes, there was a command established to accomplish this. You will need to specify the emulator number you wish to write protect when you issue this command. To write protect emulator number one, you should type in ".W1". To write enable the drive again, you must Update it to a diskette. This insures the integrity of your data once you write it to the Emulator.

Remember this:

In order to extend the command list, it was necessary to delete the DOS 3.2 access portion of the Memory Master program. We realized that we never used this option, so it was the most vulnerable. It should prove no inconvenience to you.

Super Emulator

If you Mount a diskette, it will destroy the information contained in the emulated drive. Conversely, if you Update an emulator, it will destroy the information you may have on your diskette. Use these commands with CAUTION. They may be dangerous to your data if used improperly.

Without the Mount/Update commands in DOS, you will need to BRUN MOUNT/UPDATE off of your Super Emulator diskette in order to accomplish these functions. To ease the use of this small utility program, you may transfer this to your disks using the FID utility on the DOS 3.3 System Master diskette. The instructions for this are found starting on page 183 in The DOS Manual.

Super Emulator

Edit Mode

After going through the initial setup procedure and you are not satisfied with the default configuration (Slot, Drive and Track numbers) the Super Emulator has assigned you, you should now be ready to use the Edit mode commands. Boot the Super Emulator diskette and type BRUN SUPER EMULATOR. After answering the initial questions the way you wish your system configured, answer 'E' to the final question on this page to enter the Edit mode. The Edit page will appear on the screen as shown in Figure 10. You should pay particular attention to the number of 'K' of RAM available to each emulator.

At the top of the screen, there will be a line showing the slot numbers and what cards the program has found in each slot. The default setup will not assign an emulator to a slot which already has a disk controller in it.

The only keys active in the Edit mode are the <RETURN> key, left and right arrow keys, plus (+, you need not shift) and minus (-) keys. The right arrow and <RETURN> keys move the cursor to the next alterable entry (down) on the screen. The left arrow key will move you to the previous entry (up) on the screen. The plus and minus keys will add or subtract one (1) from the entry. If the cursor is on the Drive entry, the cursor keys will toggle it (1 or 2).

Super Emulator

Figure 10. Edit Screen.

```
CONFIGURATION FOUND:  SLOT/HARDWARE
0   1   2   3   4   5   6   7
                        128K   DISK
```

```
EMULATOR #1   START TRACK: 3
128K      END   TRACK: 34
          SLOT 5/ DRIVE 1

EMULATOR #2   START TRACK: 3
OK          END   TRACK: 2
          SLOT X/ DRIVE X

EMULATOR #3   START TRACK: 3
OK          END   TRACK: 2
          SLOT X/ DRIVE X

EMULATOR #4   START TRACK: 3
OK          END   TRACK: 2
          SLOT X/ DRIVE X
```

The cursor will be positioned next to the first entry on the screen. This should be the starting track of the first emulated drive. Try pressing the minus key and see what happens. The program should have decremented the starting track number. If you have only one emulated drive available, it will also have decremented the ending track (it has to get that extra track from somewhere!). If you have more than one emulated drive, the program will decrement the ending track on the last emulator.

Super Emulator

Because each drive on your system requires track 17 to contain the directory, the program will not allow a drive to be active without that track. You may find this useful information when you try this next trick.

Move the cursor down to the next entry with the left arrow key. Now, increment this entry with the plus key. If you have only one emulated drive, it will increment the starting track as well. If you keep incrementing the ending track, the program will stop and beep when the starting track tries to go past track 17. If you have more than one emulated drive, the program will take memory away from the last drive and give it to the first one until it runs out. It will then start incrementing the starting track.

Remember this law of conservation of RAM space when you play around with the Super Emulator parameters. You may now set up the disk drive to whatever configuration you wish. The following rules apply to any configuration:

- 1) If you reserve space for a language and there is no firmware card in the system already holding a language, 16k will be allocated out of any RAM you have for that language.
- 2) If you relocate DOS, 16k will be taken away from the available emulation space.

Super Emulator

- 3) An Apple disk drive has 35 tracks numbered 0 through 34. If you wish to emulate an entire Apple floppy the starting track number is zero and the ending track is 34. Likewise, if you wish to emulate an entire 40-track drive (such as Micro-SCI's A-40 or RANA Systems' Elite One), the ending track should be set to 39.
- 4) If you set the slot and drive of an emulated disk to be equal to one that is occupied by a normal disk drive, you will lose the capability of accessing that disk drive.
- 5) When mounting or updating, the actual drive MUST have at least as many tracks as the ending track of the emulated drive you are working with.

****** Special Note ****** You should not assign a SLOT / DRIVE number to the emulator that is already being used by an Apple disk drive because this will disable the disk drive. On the other hand emulation of drive 2 can be useful when using a program that uses a data disk in drive 2. The rate of data retrieval is far greater than from a standard floppy.

Super Emulator

Turnkey

The Super Emulator can be configured into a Turnkey. You may do this any time the program asks you to Abort, Edit, Install, Restore or Create Turnkey File. If you enter the letter "C" or the "Create" command, the program will create a Turnkey Super Emulator program. Make sure you have set up the Super Emulator as you wish it to run as a turnkey. This includes changing any configurations in the Edit mode.

The program will ask you which program you wish to run after the Emulator is installed. Just type in the name of the program (i.e. STARTUP).

The next question is whether you wish to Run, Brun or Exec the next program. Type in the letter of the command. Don't press <RETURN>. The Super Emulator will now save itself out to disk as "TURNKEY.SE". Make sure you specify this as the program name in your "Hello" program. For example:

```
10 PRINT CHR$(4)"BRUN TURNKEY.SE"
```

Please note: If you change your system configuration (e.g. move around the RAM cards) the program will do strange things and may become full of worms. If you wish to change your system configuration, you will also have to change the configuration in the turnkey program. Just rerun the Super Emulator and set it up as before.

Firmware Selector

The Firmware Selector utility program was written especially for Apple][users that own either an Integer or Applesoft Firmware card as well as a Legend RAM card. At last! The power and flexibility of a RAM card in slot 0 for Pascal or CP/M and the convenience of a Firmware card in some other slot for Integer or Applesoft BASIC.

The Firmware Selector program may be used to modify the operating system on your DOS 3.3 diskettes to recognize a Firmware card installed in any slot inside the Apple. A DOS 3.3 diskette that has been modified using the Firmware Selector program will, when booted, recognize and control the selection and deselection of the Firmware card installed in the slot that you specified.

The Firmware Selector program is easy to use. Simply type RUN FIRMWARE SELECTOR with the Legend diskette in the drive. The program will prompt you to insert a standard DOS 3.3 diskette into the drive and then press <RETURN>. Be sure to remove any write protect tab on the diskette before inserting it into the drive.

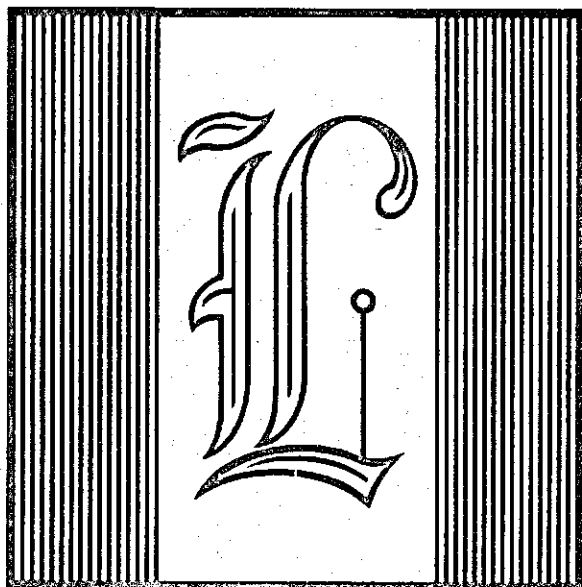
The program will read this diskette and display the present slot number the Firmware card will be utilized in.

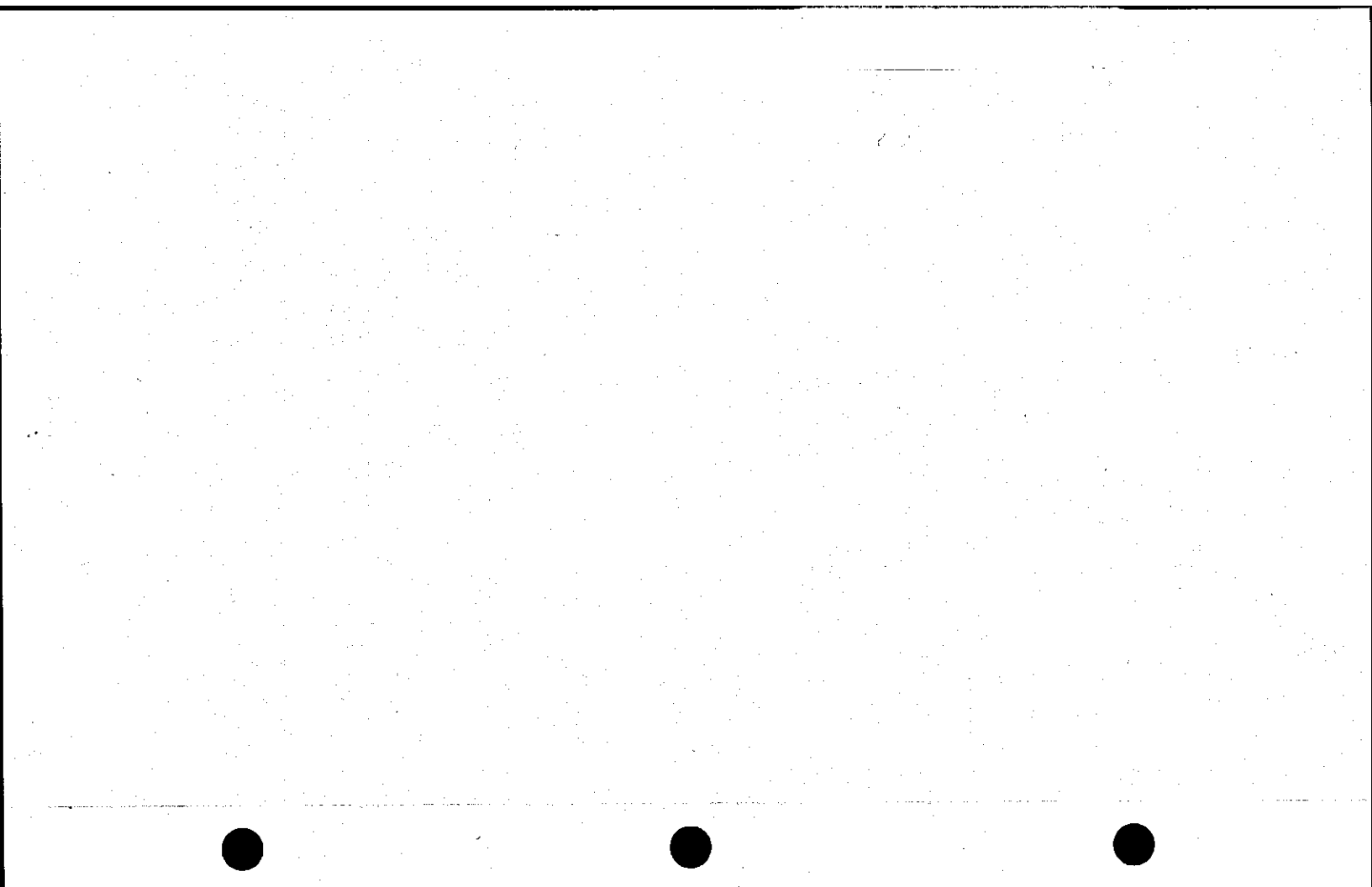
Firmware Selector

The program will now prompt you for a new slot number for the Firmware card. Type in a slot number (a number from 0 through 7) that corresponds to the new location of the Firmware card in your system (slot 4 is a good choice).

The program then modifies two bytes in the ROM switching routine within DOS on this disk.

That's all there is to it. The modified diskette, when booted, will automatically recognize your Firmware card installed in slot 4 or any other slot that you selected and your Pascal disks, when booted, will work fine with the Legend RAM card installed in slot 0. Remember: the switch on your Apple Firmware card should be in the down position for proper operation.





Legend Mailer

This program was written to enable you to use your Legend RAM card with the powerful Disk Emulator Software as a second disk drive in conjunction with a data-base program that is disk bound. It will allow you to save data to and from the RAM card and then save the information off to disk when the program is terminated. This makes the program appear to run very fast as true disk access is eliminated during file maintenance and record entry.

Before we go into using the program, we must have a discussion concerning the relationship between files, records and fields. A file is an entity (usually on your diskette) which contains information. We are not concerned here with files which contain programs or just one type of data (such as text for a word processor) but with files which contain several related items (such as names for a mailing list).

These files are made up of items called records. These records are description of the items contained within the files. The descriptions consist of one or more fields of data concerning a specific detail about that which the record describes.

Legend Mailer

For example: Suppose we have a list of people's names and phone numbers. The names and phone numbers are fields. The two fields taken as a whole make up a record. This record contains all of the information necessary to look up someone's phone number (providing you know their name). When you combine a bunch of different records, you have a file. Neat, huh?

Now lets get on with the program. The first thing to do is to set-up a system disk for running this program. This can be done by transferring certain files to a blank, initialized disk. Those files are:

```
LEGEND MAILER START
LEGEND MAILER
LEGEND MAILER PRINT
DISK EMULATOR 4.0
```

These files can be transferred by using the "FID" program on the Apple System Master. We will refer to this disk as the Program disk. You may wish to label it for future reference. This will not be an auto-boot disk. The creation of an auto-boot disk will be discussed later.

To run this program, type "RUN LEGEND MAILER START" and press <RETURN>. The introduction will appear on the screen; press any key to continue. You will now be given the following options:

Legend Mailer

- 1) CREATE NEW FILE
- 2) LOAD OLD FILE
- 3) RUN PRINT PROGRAM
- 4) INITIALIZE DATA DISK
- 5) QUIT

If you don't have a blank, initialized disk handy to put your data on please use the "INITIALIZE DATA DISK" option (number 4) at this time. Be sure to follow the instructions on the screen! If you don't, you may destroy the Program disk you have just created.

Now use the "CREATE NEW FILE" option (number 1). You will see a secondary menu like this:

- 1) MAIL LIST FORMAT
- 2) CREATE FORMAT

Select option 1 which is the MAIL LIST FORMAT. See Figure 11.

Regardless whether or not this layout is suitable for your application, we are using this just to familiarize you with the program so; press a key. You will now be prompted for a file name. If you press <RETURN> instead of a file name you will be returned to the start-up menu.

Legend Mailer

Figure 11. Mail List Format.

REFERENCE NUMBER	REF# 4
LAST NAME	LNAM 12
FIRST NAME	FNAM 12
TITLE	TITL 30
ADDRESS	ADR1 30
ADDRESS	ADR2 30
CITY	CITY 12
STATE	STAT 2
ZIP CODE	ZIP 5
AREA CODE	ACOD 3
PHONE NUMBER	PHN# 8
NOTES	NOTE 40

PRESS ANY KEY...RECORD LENGTH: 200

Create Format

This option is used to create your own format. If you don't like the Mail List format or it is not what you intended to use the Mailer for then this option is for you. As you are probably aware, this program is essentially a small data-base program. It is not dedicated to the mailing list purpose. It is therefore assumed that you may use this program for other purposes (e.g. recipes, parts lists, Christmas lists, Employee data, among others).

Legend Mailer

The format for other purposes can be generated by using this option. To enter this option type "2" when asked for the format you wish to use.

The program will always start with a reference number. This will have a field length of 4 and cannot be altered. The cursor will be in the position for you to enter field #2 (labelled CAT for some odd reason). You may use your imagination for the field titles from now on.

The ABBR entry is a 4 character abbreviation of the field name. You may choose any characters, but you should use a mnemonic for this field. The third entry for the field is the field length. This is used to tell the program how many characters you will be using to make up that field. Enter the maximum number of characters you think the field will take up (99 at the most).

At this point you should enter a filename to save this format under and press return. For now enter a file name of <TEST>. The screen will now appear as in Figure 12.

Legend Mailer

Figure 12. Mailer Hardware Setup

FILE: TEST

128KDE CARD SLOT 0

DISK DRIVE #1 SLOT: 6
 DRIVE: 1

DISK DRIVE #2 SLOT: 6
 DRIVE: 2

Although this program was written for the 128K RAM card, it will work with the S'Card if it has 128K (or more) RAM installed. When using the S'Card and asked this question, answer with the slot number of the S'Card.

There will be a flashing cursor asking for the slot number of the Legend card. If your card is in slot 0, press return. Otherwise, enter the slot # for your card. Do not press <RETURN>, the program will automatically go to the next line.

Follow this entry method for both drives. If you only have one drive enter a 1 for drive #2.

You will then be asked if this is correct. Check over your responses to the previous questions. If they are wrong, answer N and you may start over.

Legend Mailer

If Yes, you will be informed that the Disk Emulator is being installed. When this is finished you will be prompted to insert your data disk. After you have done so, press any key.

CAUTION: the disk will be completely overwritten!! Make sure that you are doing this with a blank, initialized disk, such as a data disk you have initialized earlier.

You will now be told that the format is being written to the disk, and then being loaded into the Disk Emulator. When prompted to, place the program disk back in the drive and press any key to continue. If you have two disk drives, disk swapping will not be necessary (the program disk will remain in drive 1 and the data disk will remain in drive 2).

The screen will now clear and the following submenu will appear at the bottom of the screen:

COMMANDS	0000	RECORDS	0000	ACTIVE
ADD	DELETE	SORT	LIST	
FIND	PRINT	CHANGE	QUIT	

ENTER OPTION:



Legend Mailer

DELETE

This option allows you to remove a record by the sequential record number. To use this option type D from the menu. The program will ask for the reference number of the record you wish to delete. Answer with that number.

If you answer with the wrong data, all is not lost. The program will not write to the diskette until you elect to quit, so it is possible to reboot the system and start over. If you select this option and remove a record, the altered file will be written to the diskette at the end of the session (See QUIT).

The delete command will destroy the data in the record specified. You may change this data in order to "undelete" the record. This will save space on the diskette (not necessary unless you have a full diskette). To do this, use the procedure under "CHANGE".

SORT

This option allows you to sort by any of the fields listed in the format you have elected to use. This option can be entered by typing S.

Legend Mailer

The program will now ask for the field to sort by, if you want to sort by State enter 8 (using the format supplied by Legend). Any of the fields listed may be used as the sort field. This allows you to sort alphabetically or numerically, allowing you to, for example, order all the records by State or Zip code.

When using this option, the program will appear to have "gone to lunch". This is normal due to Applesoft's garbage collection and the methodical way the program sorts. Do Not press RESET when this occurs, or you may loose all of your data.

LIST

When selected, this option asks for a reference number to start listing from. If you are looking for a record and don't know what its reference number is, start with #1.

The program will respond by listing (on the screen only) the record referenced. The left and right arrow keys are used to scroll between records. Pressing the <ESC> key will exit from this routine and return you to the menu.

This option can be selected after a sort to examine the file and display the information.

Legend Mailer

FIND

This option allows you to find a record by any of the fields you would use in the sort option. You may use the "FIND" option to look up an address or phone number or any of the fields used. This is done on a partial or full item match.

For example: If you wanted to find all the Smiths in the Data-Base, you would type F to enter the Find mode and then select either A for all or S for some. If you select A for all of the string data (this means to scan for Smith as the word "SMITH"), type the letter "A". You will be prompted for the string to search for. Enter the word SMITH. The program will scan for all of the Smiths in the data base and allow you to examine them on the screen.

You may select S, for some of the string data (this means to scan for Smith by way of some of the word, like "SM") and enter the field to scan under. If you scan for the last name, (field # 2), and then enter SM for the string (field data) to search for, you limit the scanning to two (2) characters. If you enter SMI, you limit the scan to three (3) characters. For example: If you enter SM you will get all the Smiths and the Smalls and Smzanskis and so on and so forth. However, if you select to scan for SMI then the only name selected in this example would be "Smith".

Legend Mailer

After entering the string to search for, you will be asked if you want the program to "WAIT FOR KEYPRESS (Y/N)". Answering Y to this option will tell the program to search for the first occurrence of the specified string and wait for you to press a key before continuing the search. This gives you a chance to review the data found before proceeding with the search. Answering N to this option will cause the program to rapidly search for the specified string. However, the search may go so fast that you wouldn't be able to read all the data displayed. This is useful if you are sure there is only one record that will be found or if you are just trying to find out if you have a particular piece of data on file.

The next entry required prior to starting the search is the record number to start the search at. The default for this is 1 (one). This is normally suitable for most applications. However, if you are certain that the record you are searching for is (for example) above 250 you would want to enter 250 as the record to start the search at because this would speed up the search. The last item required is the record to end the search at. This automatically defaults to the value of the last record. That is, if you have 500 active records the record number to end the search at would default to 500.

Legend Mailer

If you don't want to search the whole database, you would enter the range of records you would want to search through. To accept the default value(s) simply press <RETURN>.

PRINT

This option is used for dumping to the printer and is covered in the "PRINT LABELS" section of this manual.

CHANGE

This is the data edit routine. When selected you will be asked for the record number to change. The first item in that record will then be displayed. You now have the opportunity to enter new data for that field. If you wish to skip to the next field without altering the current data in the field, just press <RETURN>.

After entering new data for a field press <RETURN> and the process will repeat for the next field.

At the end of the record, the program will ask if you want to save the modified record. If the record looks correct, answer Y. The program then returns you to the sub-menu.

Legend Mailer

It should be noted that although you may have changed a record, the record is not recorded on the diskette until you elect to "QUIT" and write the new data to disk. The change option can be used if you made a small error in data entry and don't wish to retype the entire record. Do not "QUIT" every time you make a small change as it will take a long time to edit out every record. Do your editing and then, at the end, "QUIT".

PRINTING LABELS

This function is selected from the main program menu. When selected, you are asked to re-affirm your desire to run the print program (either a Y or N is expected).

The print program has its own separate menus as are described below.

PRINT PROGRAM MAIN MENU

- 1) PRINT
- 2) CREATE FORMAT
- 3) EDIT FORMAT
- 4) RETURN TO MAIN PROGRAM
- 5) QUIT

Legend Mailer

If this is your first time running the program, you will have to create a format for printing so select option number 2 (CREATE FORMAT).

The first thing you will be asked for is the number of lines in the format. This is the number of lines from the Top to the Bottom of the label and will be different with different labels. The most common setting for this is 5 (five) (this gives 5 lines of print for 1" {one inch} labels). The maximum that can be entered is 15 (this gives 15 lines of print).

The screen will clear and a blank format (see Figure 13) will appear along with a sub-menu near the bottom of the screen.

Figure 13. Label Printing Format.

```
LN#  1   2   3   4   5   6   7   8   9
```

```
1-  
2-  
3-  
4-  
5-  
6-
```

```
COMMAND      LINE 1  COL 1  
QUIT  ENTER  CHANGE  REVIEW
```

Lets go through these options one at a time.

Legend Mailer

QUIT

This option is used to save the created or edited format to the disk emulator and then return to the Print program's main menu. When this option is used, you are asked for a file name to save your format under. If you press return instead of entering a name, you are asked if you want to return to the menu without saving the current format. If this is done the current format is lost. If a file name is entered, the file is saved to the emulator and you are returned to the main menu.

ENTER

This option is used to set up the print format for your labels. When first selected you are asked for a FIELD #, and a PRINT LENGTH. When you enter the field number, such as State or last name, the default length for that field is displayed.

If you want the whole field to be printed enter a 0 (zero) for the length. Otherwise enter the length you want to have printed. If you want to print the first 10 characters printed of a field that has 30 characters in it, enter 10 for the print length.

Legend Mailer

The line and column that this information will be printed in is displayed in the inverse bar above the sub-menu. The location of the data on the label will be shown on the "FORMAT CHART" on the screen. The inverse number is the field number and the trailing number is the print length. Remember that a 0 (zero) represents the default print length for that item.

The following example explains the format for the first line.

1- 30 20 0

Lets take the first character, the number 1-, this is the line number. Next is the number 3, this is the field number, which would be for the first name using the Legend default format and will be shown in inverse video. Then the 0 (zero), which means the default field length or 12 characters in this case. The 2 is the next field number, which is the last name, again in inverse video. Then the number 0 (zero) which defaults the field length to 12. Now by entering the next number as 0 (zero) you indicate that you wish to go on to the next line. So, if you enter 0 (zero) for the field number and press <RETURN>, the program will go to the next line. Using this format you can leave a line blank by entering a 0 (zero) and pressing <RETURN>.

Legend Mailer

CHANGE

This is used to change one format block at a time. You are prompted for the line # and col that you want to change, and then asked for the new field # and print length.

REVIEW

This will display all the field names, field numbers, and default print lengths. Pressing any key will return you to the menu.

EDIT FORMAT

This option allows you to modify an existing print format. When selected you will be prompted for the name of the format file to be edited. The requested file will be loaded and then you will be able to edit it as with the CHANGE command described above.

PRINT

This routine, when selected, will ask you for several parameters as described below:

- 1) FORMAT FILE NAME

Legend Mailer

This would be the name of the desired print format that you have previously set up and saved.

2) PRINT WIDTH

This is the number of horizontal spaces on a single label. In this case we are talking about one (1) label even though you may have more than one label across.

3) NUMBER OF RECORDS ACROSS

This would be set to the number of labels across that you have. (see NUMBER OF SPACES BETWEEN LABELS if this is more than 1 (one))

4) NUMBER OF LINES BETWEEN LABELS

For most applications this would be set to one. With some labels you may need more than 1 line from the last line printed to the top of next label so this option is included.

5) NUMBER OF SPACES BETWEEN LABELS

This option is not available if you set the NUMBER OF RECORDS ACROSS to 1. If you are printing more than one label across, this must be set so that the printer will be positioned to the first character position on the next label across. The value to be used will have to be found experimentally by the user as there are hundreds of different labels available.

Legend Mailer

You are now at the final PRINT menu. This is used to select the records that will be selected for printing, and looks like this:

- 1) PRINT ALL
- 2) PRINT RANGE
- 3) SEARCH AND PRINT W/RANGE

Lets go through these in order.

1) PRINT ALL

As it's name implies this routine will print labels from all the records in the file currently being worked with.

2) PRINT RANGE

This selection asks you for the starting and ending record numbers. It will print labels only from records within the specified range.

3) SEARCH AND PRINT W/RANGE

This allows you to search for a specific string in a specified field within a range of records. Now to repeat this in English, step by step. When selected you will be asked for several parameters as follows:

FIELD TO SEARCH

Enter the number of the field you wish to search by.

PHRASE TO SEARCH FOR

Legend Mailer

Enter the string" of characters that are common between all records that you wish to print.

STARTING RECORD

This is the first record that should be searched.

ENDING RECORD

This would be the last record to be searched.

Example 2

Lets say that you wanted to print all of the records in your file where the STATE was ALASKA, and they fell between record numbers 20 and 50. You would enter 7 (seven) for the FIELD TO SEARCH, ALASKA for the PHRASE TO SEARCH FOR, 20 for the STARTING RECORD, and 50 for the ENDING RECORD.

After selecting a print option, and entering any parameters required, you will be prompted to make sure that the printer is ready, and to press any key to start printing.

The program will now start printing the selected labels. You can abort printing by pressing the ESC key, or pause the printing by pressing the letter P.

Legend Mailer

At the end of printing your labels you will be returned to the "PRINT PROGRAM MAIN MENU".

HELLO

The "HELLO" program is usually the first program that is run when the system boots a diskette, and is usually initialized into the disk. To set-up an auto-boot Legend Mailer diskette, you need a blank disk and at least one (1) disk drive and the Legend System disk (the one that came with the card). Follow these instructions carefully:

- 1) Boot the Legend System disk and allow the menu to appear on the screen.
- 2) Now type NEW. This clears out the old program.
- 3) Now type LOAD LEGEND MAILER START and wait for the drive to load the program into the machine.
- 4) At this time the Applesoft prompt should be on the screen. Remove the Legend disk from the drive and insert the blank diskette.
- 5) Now type INIT HELLO, the drive will start to turn and should not be interrupted. The Applesoft prompt will appear again.

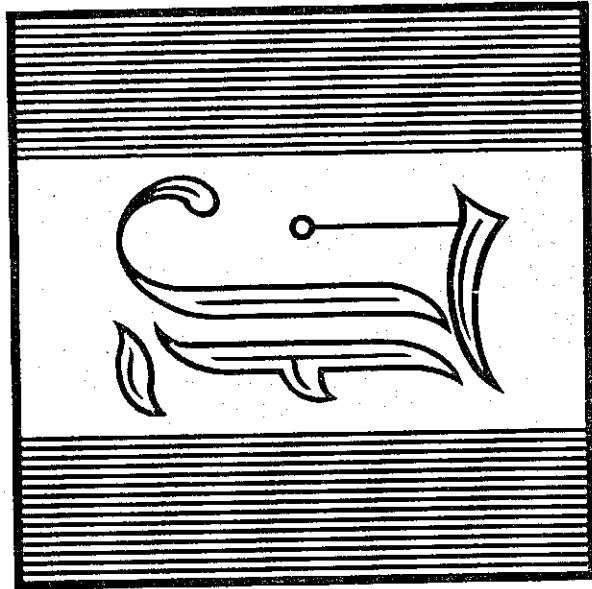
Legend Mailer

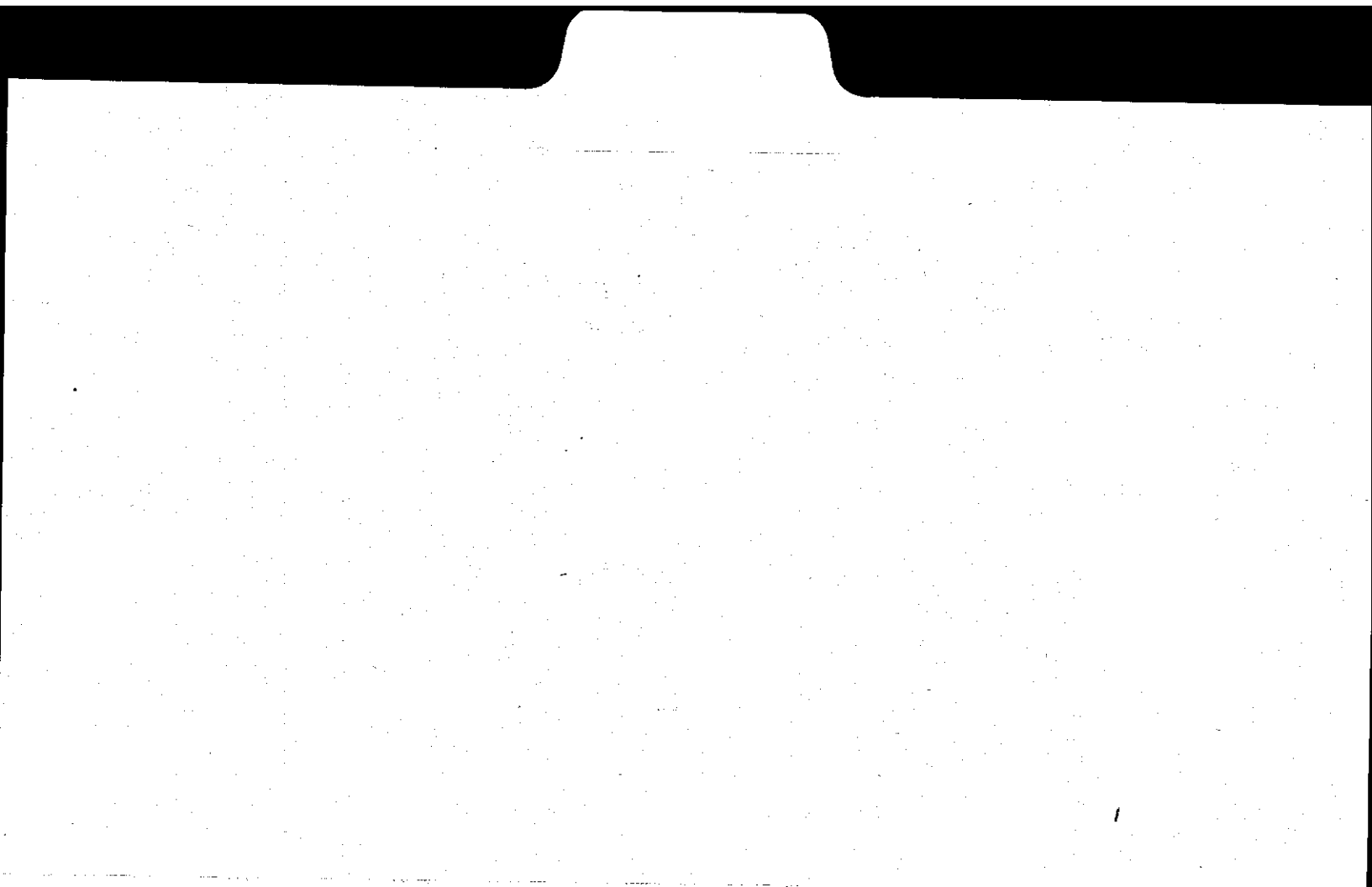
- 6) At this time you may wish to boot the new disk you just created. If you boot the disk, you can not run any of the programs as they are not on the disk yet.
- 7) Now boot the SYSTEM MASTER disk and type BRUN FID. The menu for FID will appear on the screen. We want to copy files from the Legend disk to the new disk (the one you just created).
- 8) The files to transfer are:

LEGEND MAILER
LEGEND MAILER PRINT
DISK EMULATOR 4.0

Now you should be able to boot the disk and have the starting menu come right up on the screen. At this time you may wish to back up your disk and put a write protect tab on the original.







Slide Select

The Slide Select program is designed to allow the user to retrieve several HiRes pictures very rapidly and display them in sequence on the screen. It is a combination of two pieces of software. It consists of an Applesoft program and machine language subroutines. You can call the machine language subroutines from your own BASIC program.

For the non-programmer, Legend Slide Select offers an easy way to display HiRes pictures. The result is the functional equivalent of a slide projector, allowing the user to flip forward or backward between the pictures.

Control of the displayed pictures is user selectable and can be controlled from the keyboard, game paddles or can be set to run automatically.

Up to 8 pictures can be stored in 64K of RAM, or 16 pictures in 128K of RAM.

This program assumes that you have an Apple][computer, a disk drive and at least one Legend card. Also, the program requires that you have the HiRes pictures you wish to display stored on a diskette.

Slide Select

Operation

Use of the Legend Slide Select program has been made as painless as possible for the non-programmer. You may move the Slide Select program onto another diskette. This encompasses moving all of the "Slide Select" files. The user should "boot" the system with the Legend diskette. To run the Slide Select program, type:

```
RUN SLIDE SELECT
```

The program will automatically scan for any RAM cards you may have in your machine and set itself up accordingly. The screen should then clear and the display will look like this:

```
MAXIMUM NUMBER OF PICTURES IS 24  
MEMORY AVAILABLE FOR 24 PICTURES  
NOW WE MUST TRANSFER THE PICTURE FROM  
DISK TO THE LEGEND CARDS  
PRESS <RETURN> WHEN ALL PICTURES HAVE  
BEEN LOADED. PRESS <ESC> FOR CATALOG  
ENTER THE FILENAME OF  
PICTURE #1
```

In this example, both a 128K and a 64K RAM card were used. No banks were locked out, so the Slide Select program can store a total of 24 pictures.

Slide Select

You should now type the filename of the first picture you wish to load. If the picture is on another diskette and it's necessary to change diskettes, you should do that before typing the filename. Several pictures are provided for the user to experiment with. All of the pictures have a filename that ends with a ".PIC" suffix. This practice is recommended to help document the contents of the files.

One of the pictures provided on the Demo side of the diskette has the filename DEMO TITLE. Let's load this picture first by typing DEMO TITLE <return>. The screen will then change to high resolution graphics mode, and the picture will begin to load. First the Apple will display whatever random "garbage" is in HiRes screen 1. Then, as the picture begins to load, the screen will begin to clear, and DEMO TITLE will be displayed. The screen will then revert to text, and you will be asked if the picture should be installed in the card or not. It should look like this:

```
MAXIMUM NUMBER OF PICTURES IS 24
MEMORY AVAILABLE FOR 24 PICTURES
NOW WE MUST TRANSFER THE PICTURE FROM
DISK TO THE LEGEND CARDS
PRESS <RETURN> WHEN ALL PICTURES HAVE
BEEN LOADED PRESS <ESC> FOR CATALOG
ENTER THE FILENAME OF
PICTURE #1 DEMO TITLE
INSTALL ?Y
```

Slide Select

If you wish to install that picture into the slide selection, then simply press "Y" or <RETURN>. If don't like that picture, then press "N". After each picture is installed, the second line of the display will change to reflect the amount of remaining memory in the Legend cards. In this example, the second line would look like this:

MEMORY AVAILABLE FOR 23 PICTURES

In this fashion, you can continue loading pictures from disk into the HiRes screen, and installing the HiRes images in the card. If you wish, you can press the escape key to view the catalog. If needed, you can type drive and slot extensions with the filename. For example: TEX.PIC,S6,D1 Will load the picture TEX.PIC from drive 1, slot 6. This feature is very handy with systems that have more than one drive.

If you have loaded all the pictures you wish, simply press <RETURN>. Then the program will continue to the next phase. If you load the maximum number of pictures (in our example, 24), this will happen automatically. The screen will clear, and the display appears as follows:

DO YOU WANT TO CONTROL THE SLIDE
SELECTION WITH:

GAME PADDLES (G)
KEYBOARD (K)
TIMED DISPLAY (T)

Slide Select

You should type either "G", "K", or "T", depending on your choice. The G option reads the push button switches on game controls #0 and #1. Push game control switch #1 to advance one picture, #0 to go one frame in the reverse direction. If you choose the K option, the arrow keys on the keyboard are used to advance or reverse the pictures. Finally, selecting the T option will direct the computer to change pictures automatically.

If you choose the timed display, you will be asked how many you wish each slide to show. The question will ask if the slide selection should repeat or stop after the last slide.

The following message should then appear on the screen:

```
PRESS <RETURN> TO BEGIN  
TYPE X TO EXIT PROGRAM
```

If the user presses the <RETURN> key, the slide select process begins and the first HiRes picture will appear. If the user types "X", the program will stop.

Regardless of the option chosen, if the "Q" key is pressed, the program will stop.

Slide Select

HELP!

If your system is not functioning properly, first check the hardware, then the software. Is your Legend card installed properly? Please refer to the Problem Determination Procedures section. Check the simple things such as the monitor being turned off.

NOTE: Using this software with other memory cards will lead to unpredictable results.

Slide Select Object

If you are a BASIC programmer, we provide the subroutines necessary to load pictures into the Legend cards. The programmer must first POKE the slot location and the picture number into the appropriate locations. Then he/she simply calls the desired entry point for either loading a HiRes picture into the card, or retrieving a picture from the card.

Slide Select

Figure 14. Slide Select Object.

Address	Function
\$9000 36864	Slot Index: must be slot x 16
\$9001 36865	Picture Index: must be picture # (picture # is 0-7 for 64K, 0-15 for 128K)
\$9002 36866	SAVE PIC entry point.
\$9005 36869	DISPLAY entry point.
\$9008 36872	Check machine setup

To use these routines, first you must BLOAD the object into memory. A typical way of doing this is:

BLOAD SLIDE SELECT.OBJ

The file loads at \$9000 (36864 decimal) and is \$1F1 (497) bytes long.

Some further notes about the routines: The SAVE PIC entry point loads the picture from HiRes page 1 into the card. The DISPLAY entry point retrieves the picture into either HiRes page 1 or 2. Even numbered pictures are displayed in page 1, odd numbered ones in page 2. After calling DISPLAY, the Picture Index is automatically updated to the next picture. Therefore, if you wish to DISPLAY the next picture, simply call DISPLAY again.

Slide Select

Example 3

```
500 REM -- RETRIEVING PICTURE #3
    FROM LEGEND CARD
510 RM -- IN SLOT 0
520 POKE 36864,0 : REM SLOT 0
530 POKE 36865,3 : REM PICTURE 3
540:
550 POKE - 16297,0: REM HIRES
560 POKE - 16302,0: REM FULL SCREEN
570 POKE - 16304,0:
    REM GRAPHICS MODE
580:
590 CALL 36869
600:
610 REM NOW RETRIEVE PIC #4
620 CALL 36869
```

You should note two things about this example. First, the Applesoft program must set the graphics mode (lines 550-570). Second, the Applesoft program doesn't have to worry about which page is being used. The DISPLAY entry point selects the proper page after moving the picture there.

Now that we know how to get a picture from the card, let's examine the process of putting it there. In the following example, we are again assuming the card is in slot 0.

Slide Select

Example 4

```
300 REM -- STORE PICTURE 0 INTO  
    LEGEND CARD  
310 REM  
320 POKE 36864,0 : REM SLOT #0  
330 POKE 36865,0 : REM PICTURE #0  
340 CALL 36866 : REM STORE PICTURE
```

Of course, the HiRes picture must already be in page 1 before this, or else we would store "garbage".

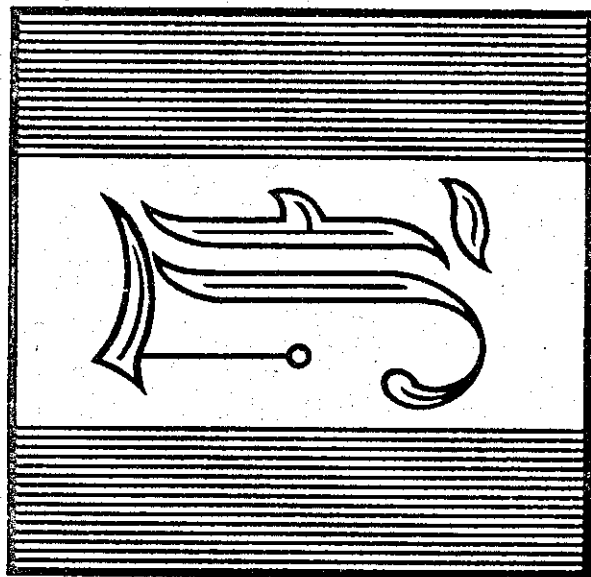
Now lets look at an example of retrieving pictures in rapid succession. In this case, we assume that a card having 128K of RAM is in slot 4, and we want to view 10 pictures, starting with picture 7. This means after viewing picture 15 we will wrap around to picture 0.

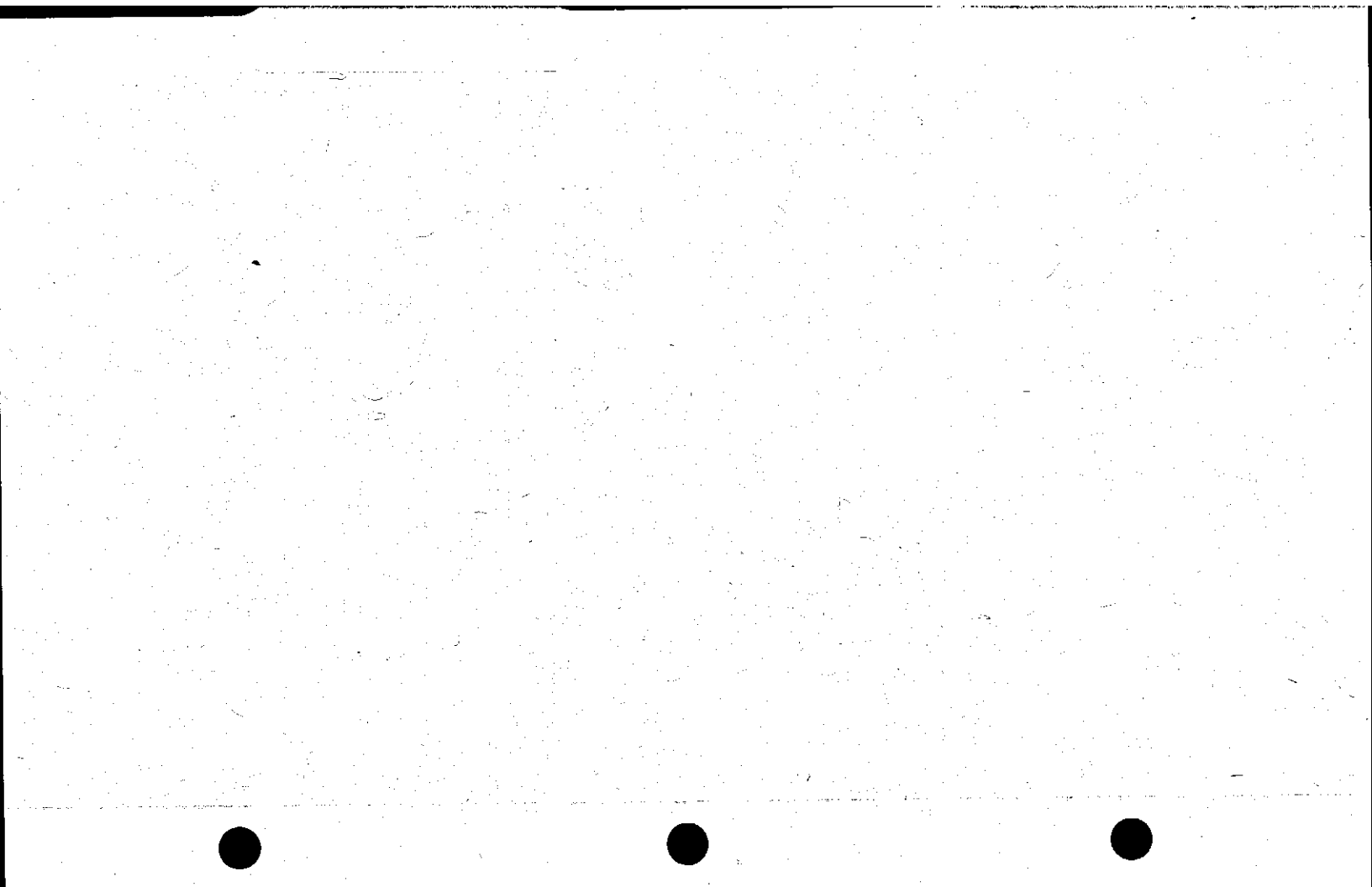
Example 5

```
1000 POKE 36864,4*16 :REM SLOT 4  
1010 POKE 36865,7 :REM PICTURE #7  
1020 :  
1030 POKE -16304,0 :REM GRAPHICS MODE  
1040 :  
1050 FOR I = 1 TO 10  
1060 CALL 36869 :REM DISPLAY PICTURE  
1070 NEXT I
```

This example assumes that full screen HiRes graphics has already been set.







VC Plus

This program enables VisiCalc to address more memory, giving the program more work space, and to allow you a choice of 40 or 80 columns on the video screen with a Videx Videoterm (an inverse character set is required). It is necessary to read this manual completely before using the Legend RAM card with this program. Please take the time now to do so.

This manual is not a tutorial and will not explain the internal operation of the program it supports. For information on the operation of the Legend card, please refer to the Theory of Operation section in the manual. For more information on VisiCalc, contact VisiCorp or Software Arts.

Configuration

In configuring the system, the only thing to remember is that the program, at this time, only works with up to 160K using any combination of Legend RAM cards. The cards can be put into any slot, except for slot 3. The program may recognize the Legend card as an 80-column card if it is in slot 3. When configuring your system, location is not a problem. Continue reading for further information on this subject. Decide on the configuration you want before implementing it.

VC Plus

Read the Legend manual completely before making a final decision on configuration. Programs such as Disk Emulator and Memory Master, or even Pascal Soft Disk may influence your decision as to where your Legend cards should go.

Installation

It is assumed that the user is familiar with the VisiCalc. This manual also assumes the user knows how to "Boot" a diskette and how to BRUN a program. If you are not knowledgeable in these areas, please consult the The DOS Manual for assistance on "Booting" a diskette.

To start the program you should first boot the Legend Utilities diskette. Then type: BRUN VC PLUS.

The program will come up and show you the machine configuration. If you have an 80 column board in your Apple, you will be asked:

DO YOU WISH TO YOUR 80 COLUMN CARD?

If you would like 80 columns, type 'Y' for Yes. If you would like 40 columns, type 'N' for No.

VC Plus

The program will then show you the final configuration it will use and ask you to insert the program diskette and press <RETURN>. Remove the disk from the drive and insert the VisiCalc disk. Press <RETURN>. The screen will go blank, and after about six (6) seconds the VisiCalc "Spreadsheet" will appear on the screen with 61K to 160K of memory.

You should be able to use VisiCalc in the same manner as if you were not using the VC-PLUS program, except you will have more memory and some operations may take more time. You should realize that bank switching is taking place during some of the time elapsed.

Notes

This program was written for Legend cards only and should not be used with other cards larger than 16K, cards larger than 16K will perform with unpredictable results.

This program only supports original copies of the VisiCalc program. Backup copies may not work.

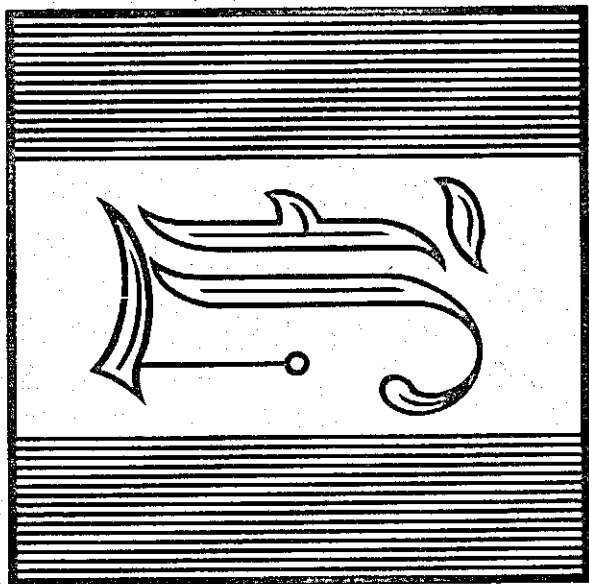
VC Plus

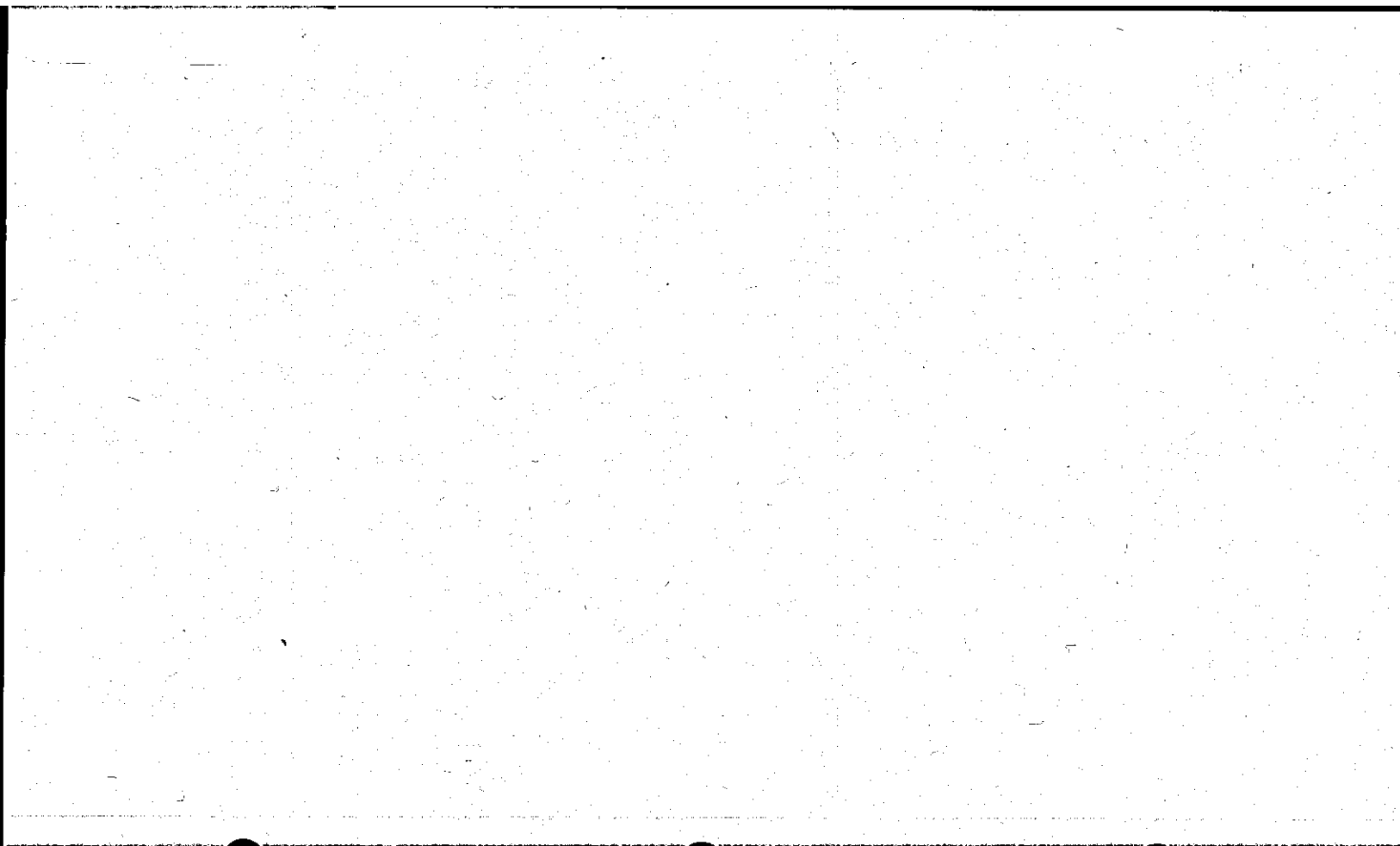
Hello

To make a diskette which will automatically run the VC Plus program when it is booted, follow these instructions:

- 1) Boot DOS.
- 2) Type NEW.
- 3) Type the following line:

```
10 PRINT CHR$(4);"BRUN VC PLUS"
```
- 4) Insert a blank diskette into the drive.
- 5) Type: INIT HELLO and wait for the diskette to be initialized.
- 6) Use a file transfer program, such as FID, to transfer the file VC PLUS to the new diskette you have just created.
- 7) You may now use the new diskette to automatically boot the VC Plus program.





Ampercard

Ampercard is an Applesoft utility that allows storage of variables (Strings, Integers and Reals) in the Legend RAM cards. This utility is intended for someone with knowledge of BASIC programming. Utilitizing a few simple Applesoft commands, the programmer may use the RAM card for storage, thereby freeing up the normal RAM space on the motherboard. There will be less disk access time and less garbage collection.

The way the variables are stored in the card is similar to the random access file of DOS. That is, any particular variable may be stored or retrieved depending on the indexing from BASIC. The following line is an example of writing a string to a RAM card where the 'SL' is the slot the RAM card is installed in, the 'BA' is the bank accessed in the RAM card, 'I' is the index, 'LS' is the maximum string length and 'ST\$' is the string.

```
2025 & WRITE,SL,BA,I,LS,ST$
```

To optimize the RAM usage, you declare the maximum string length that you wish to use, plus 1. Storage of integer numbers requires a declared length of 2 and real numbers require 5. Care must be taken so the product of the length and the index does not exceed 16383 ($LS * I > 16383$) which is the number of bytes in a RAM bank. with the proper programming, the user may mix any type of variable in the same portion of the RAM card.

Ampercard

In order for Ampercard to handle strings properly when reading from the RAM card, the input string must be declared in the beginning of the program before any strings are declared as in example 6.

Example 6

```
40 FOR I = 1 TO LS:ST$ + " ": NEXT  
   :X = FRE (0): POKE 115,  
   PEEK (111); POKE 116, PEEK (112)
```

The balance of line #40 must also be used so Applesoft does not foul it up. This has to be declared only once in the beginning of the program. If a read from the RAM card is done without the proper variables in the RAM card, very strange things can occur. If this happens with strings, your Apple will become full of worms.

The variable name used in the Ampersand may not exceed 2 characters, as in example 7.

Example 7

```
2050 & WRITE, SL, BA, I, LS, ST$  
6040 & READ, SL, BA, I, LI, T%
```

The number of banks relates to the amount of RAM on each card. Any variable name may be used.

Ampercard

The update and mount commands are a fast and efficient way of saving or retrieving variables as compared to DOS text files. It takes approximately 19 seconds to transfer the entire card.

The following lines show how.

```
9450 & .U0,D1
```

```
9650 & .M0,D1
```

The "&.U" is used for updating the disk and the "&.M" is used to mount the contents into the RAM card. The digit behind the command is the slot the RAM card is installed in. The ",D1" is optional for the drive to be used. The disk slot will default to the last drive accessed. Variable names may not be used in place of the RAM card slot or drive numbers when using update or mount.

***** CAUTION *****

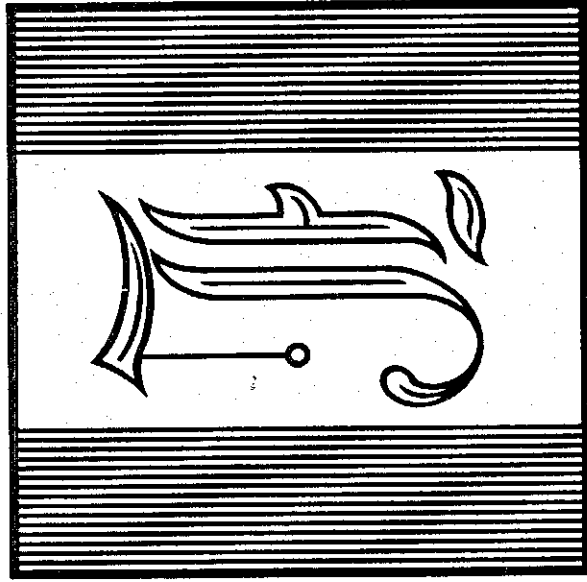
C A U T I O N must be used when using the update and mount commands as not to destroy what's in memory or on the disk. If you update, the data on the disk will be altered or destroyed, if you mount, the data in the RAM card will be altered or destroyed. Use these commands with care. A standard initialized disk must be used to update. The data transferred to the disk is in the same format as the Disk Emulator, tracks 3 through 34 are used.

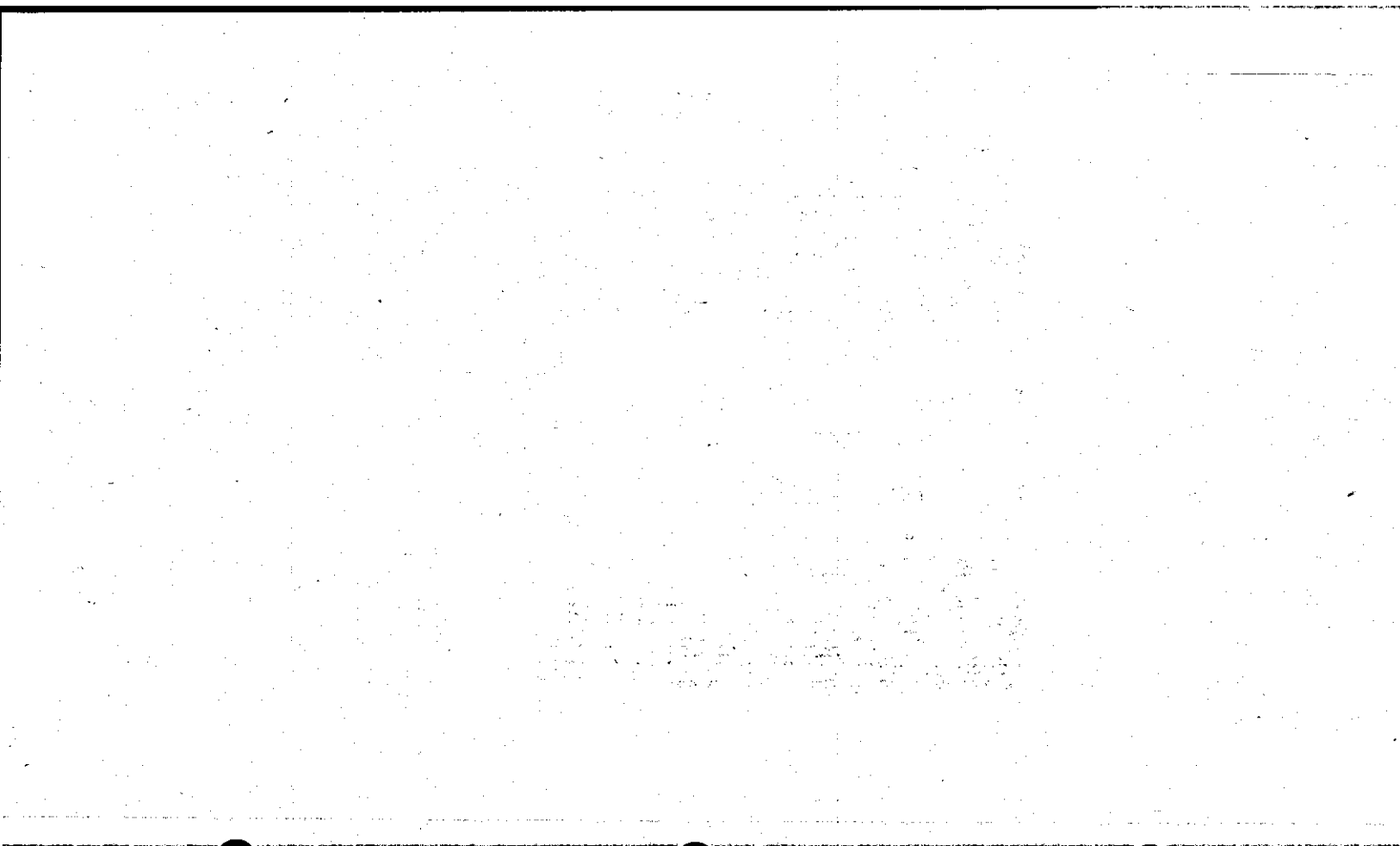
Ampercard

If you are using a larger drive and a larger emulator make sure the number of tracks of the emulated drive are equal to or less than the number of tracks on the larger drive. For example, an A-70 Micro-Sci drive would, at maximum, have tracks 0 through 69 designated in the setup.

Ampercard is self-relocating. It can be used anywhere in memory, although it is best if it is "BRUN" just below the existing himem. Maxfiles should be set first and no strings declared. It will automatically reset to the proper himem and set the Ampersand hooks. The following line shows how to "BRUN" it into memory.

```
10 PRINT CHR$(4);"BRUN AMPERCARD,A";  
   PEEK (115) + PEEK (116) * 256 - 805
```



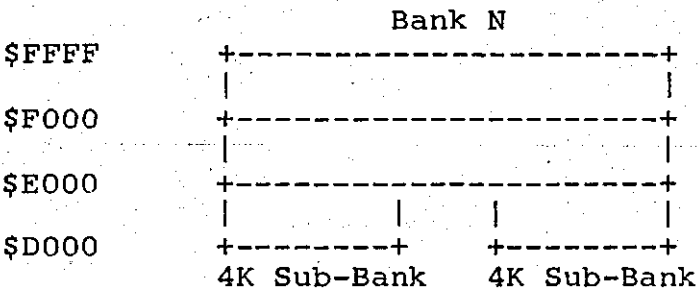


Theory of Operation

This chapter describes and details the operation of the Legend RAM card at the machine and hardware level. It is not intended to serve as a tutorial but as a reference guide for the user. Use the Apple Reference Manual as an additional information source.

The RAM in the card is configured as multiple, individual 16K banks of RAM which look like several language cards to the machine. This is located in the same address space used by the BASIC language contained in ROM (Read Only Memory) on the Apple motherboard. The \$D000 thru \$FFFF address space represents only 12K of addressable memory and consequently each 16K bank of RAM is further divided into two 4K Sub-Banks mapped into the lower 4K address space from \$D000 thru \$DFFF as shown in Figure 15. Please note that this is the same mapping convention used by the Apple Language Card and, in fact, the Legend RAM card is functionally identical multiple 16K Language Cards.

Figure 15. The Legend RAM card Memory Map (1 bank).



Theory of Operation

Memory Management is the term used to describe the selection of one Bank of memory, either ROM or RAM, to be active in the same address space at any one time. The Apple][has used memory management for years to select the BASIC ROM's on the motherboard or the BASIC ROM's on a firmware card in slot 0 to be mapped into the top 12K of address space in the Apple computer. This gives the user a choice of having either Integer or Applesoft BASIC active in the computer. The Apple Language Card is also mapped into this same address space. The Language Card contains 16K of RAM memory that can be loaded with BASIC and behave like a BASIC ROM card or it can be loaded with Pascal or some other operating system making it much more flexible than a ROM card.

Bank 0 on the Legend RAM card will always be recognized as a 16K Language Card when the card is installed in slot 0 and used with software designed to work with an Apple Language Card such as BASIC, Pascal, etc. The other banks available on the card will not be used and you may utilize each of these banks as you wish. If you 'boot' the Apple System Master, for example, it will load DOS 3.3 into the computer in the 48K of RAM on the motherboard and then the HELLO program will load Bank 0 on the Legend RAM card with the language that is missing in ROM on the motherboard.

Theory of Operation

Apple Pascal and other operating systems designed to work with a Language Card will utilize Bank 0 on the Legend RAM card when it is installed in slot 0.

The important thing to remember about managing the memory in the RAM card is that only one bank of memory may be active in the \$D000 thru \$FFFF address space at any one time.

When one of the 16K Banks of RAM is selected and the card is "on", the Inhibit line (pin 32 on the Apple I/O connector) is pulled low and the ROM on the motherboard is disabled. When the memory on the RAM card is deselected and the card is "off", the Inhibit line goes high and the ROM on the motherboard is re-activated.

If more than one RAM card is installed in the Apple Computer, then care must be taken to select only one of the cards at any one time. If more than one card is selected, the Inhibit lines on the cards will conflict with each other and hang the system.

Turning on and off the RAM on the Legend RAM card is relatively easy. The RAM card is controlled by accessing one of the 16 Device Select addresses assigned to its slot. Each peripheral slot in the Apple has a unique set of 16 slot-dependent Device Select addresses. These Device Select addresses were designed into the Apple for the purpose of controlling the hardware on a peripheral card.

Theory of Operation

Figure 16. Apple Device Select Addresses

Base Adr	Slot 0	1	2	3
\$C080	\$C080	\$C090	\$C0A0	\$C0B0
\$C081	\$C081	\$C091	\$C0A1	\$C0B1
\$C082	\$C082	\$C092	\$C0A2	\$C0B2
\$C083	\$C083	\$C093	\$C0A3	\$C0B3
\$C084	\$C084	\$C094	\$C0A4	\$C0B4
\$C085	\$C085	\$C095	\$C0A5	\$C0B5
\$C086	\$C086	\$C096	\$C0A6	\$C0B6
\$C087	\$C087	\$C097	\$C0A7	\$C0B7
\$C088	\$C088	\$C098	\$C0A8	\$C0B8
\$C089	\$C089	\$C099	\$C0A9	\$C0B9
\$C08A	\$C08A	\$C09A	\$C0AA	\$C0BA
\$C08B	\$C08B	\$C09B	\$C0AB	\$C0BB
\$C08C	\$C08C	\$C09C	\$C0AC	\$C0BC
\$C08D	\$C08D	\$C09D	\$C0AD	\$C0BD
\$C08E	\$C08E	\$C09E	\$C0AE	\$C0BE
\$C08F	\$C08F	\$C09F	\$C0AF	\$C0BF
	Slot 4	5	6	7
\$C080	\$C0C0	\$C0D0	\$C0E0	\$C0F0
\$C081	\$C0C1	\$C0D1	\$C0E1	\$C0F1
\$C082	\$C0C2	\$C0D2	\$C0E2	\$C0F2
\$C083	\$C0C3	\$C0D3	\$C0E3	\$C0F3
\$C084	\$C0C4	\$C0D4	\$C0E4	\$C0F4
\$C085	\$C0C5	\$C0D5	\$C0E5	\$C0F5
\$C086	\$C0C6	\$C0D6	\$C0E6	\$C0F6
\$C087	\$C0C7	\$C0D7	\$C0E7	\$C0F7
\$C088	\$C0C8	\$C0D8	\$C0E8	\$C0F8
\$C089	\$C0C9	\$C0D9	\$C0E9	\$C0F9
\$C08A	\$C0CA	\$C0DA	\$C0EA	\$C0FA
\$C08B	\$C0CB	\$C0DB	\$C0EB	\$C0FB
\$C08C	\$C0CC	\$C0DC	\$C0EC	\$C0FC
\$C08D	\$C0CD	\$C0DD	\$C0ED	\$C0FD
\$C08E	\$C0CE	\$C0DE	\$C0EE	\$C0FE
\$C08F	\$C0CF	\$C0DF	\$C0EF	\$C0FF

Theory of Operation

The Device Select addresses used to control the Legend RAM card conform to the same Device Select address conventions used by Apple Computer, Inc. for implementing the Language Card with the following exceptions:

- 1) Apple uses only 8 of the 16 Device Select addresses available at any peripheral slot. Address bit 2 of the Device Select address is ignored on the Apple Language Card and therefore the addresses \$C084-\$C087 and \$C08C-\$C08F provide the same control functions as the \$C080-\$C083 and \$C088-\$C08B addresses. The Legend RAM cards respond to the \$C080-\$C083 and the \$C088-\$C08B Device Select addresses only.
- 2) The Legend RAM cards provide a Bank Select address at location \$C084. This is a Write only address used to select banks 0 thru 63.

Any of the banks available can be selected by writing to the Bank Select address with a value from 0 to the maximum number of banks minus one (for a 128K of RAM, this will be 7). You can then use the other Device Select addresses to select ROM read, RAM read, write enable or write protect RAM in either the first or second 4K sub-bank. Using the Legend bank switching scheme, the maximum amount of RAM per slot will not exceed 4 Megabytes (we know of nobody who needs this much RAM in an Apple computer).

Theory of Operation

Refer to Figure 17 for the device select address conventions used by the Legend RAM card (addresses used are for slot 0).

Use the information in Figure 16 (you may wish to refer to the Apple][Reference Manual, pg. 82) to substitute the correct Device Select addresses when accessing the RAM card from some slot other than 0. For example, the Device Select addresses for slot four are \$C0C0 through \$C0CF.

Example 8. Using the RAM.

For the novice, the following is a very simplistic procedure to follow. For the advanced Apple user, you may either disregard the following or find it interesting to read. In the following discussion, the Legend card is assumed to be installed in slot 0. For other slot locations, please refer to Figure 16.

- 1) If you have a Disk Drive and/or an Auto-start ROM, do not insert any disks in your drives at this time.
- 2) Turn on your Apple and your TV/Monitor. If an auto-start ROM is installed, press RESET to stop the disk drive.

Theory of Operation

- 3) A prompt ("]" for Applesoft and ">" for Integer BASIC) should now be in the upper left hand corner of the screen. If you have an asterisk as a prompt, fear not, go on to the next step. If not, turn off the Apple and recheck Step 2.
- 4) Get into the monitor by typing CALL -151. The cursor should now be an asterisk ("*"). This is the cursor for the monitor.
- 5) At this point you have the option of doing one of several things:
 - a) You can select RAM read, and write protect RAM by typing C080. However if you read RAM with no information in RAM you will 'hang' the system.
 - b) You can select ROM read and if you type the ROM read address (\$C081) two (2) times, you write enable the Legend card. Write enable means you can write or put data into that (RAM) which is enabled.
 - c) You can select ROM read and write protect the RAM, by typing C082. This will turn "off" the card.

Theory of Operation

- d) You can select RAM read and if you type the RAM read address \$C083 two (2) times you write enable the card with \$C083. However if you read RAM and there is no information in RAM you will 'hang' the system.
 - e) You can bank select by typing C084, a write only instruction to select one of the RAM banks.
- 6) First you must move information (the monitor routine) into the Legend card. To do this you must write enable the card and still be reading ROM. Type: C081 C081 and press <RETURN>. This address is typed twice in order to write enable the card.
- 7) You are now able to write information to the Legend card. Type the following to move the Apple monitor routine that is stored in ROM up into the Legend card: F800<F800:FFFFM. If this is done correctly you will return to the monitor cursor.
- 8) You now have a copy of the Apple monitor in the Legend card. For an example type in the following:

```
300:A9 C1 20 ED FD 18 69 01
308:C9 DB D0 F6 60
```

Now if you type 300G, you should see the alphabet on the screen.

Theory of Operation

- 9) You may wish to select RAM read by typeing C080 (now you can without hanging the system) and see what you have. You should find a copy of the Apple monitor routines at \$F800. You can do this by typing in F800L <RETURN> to list the monitor's code.

Figure 17. RAM Card Device Select
Addresses for slot 0.

2nd Bank	1st Bank	Function
\$C080 -16256	\$C088 -16248	RAM Read and Write protect RAM
\$C081 -16255	\$C089 -16247	ROM Read (2 reads will write enable RAM)
\$C082 -16254	\$C08A -16246	ROM Read and Write protect RAM
\$C083 -16253	\$C08B -16245	RAM Read (2 reads will write enable RAM)
\$C084 -16252		Bank select (Write only)

The following pages provide a few simple assembly language examples to help clarify the use of the Device Select addresses for selecting and deselecting the RAM card.

Theory of Operation

It should be pointed out that although there are many LDA instructions used in these examples the data in the accumulator is not used, it is the address itself that is sensed by the RAM card. You could just as easily use the LDX or other instructions as long as it references the Device Select address. The only exception is the Bank Select address (\$C084) which is a 'Write only' address that requires that a bank value be written when the address is accessed (otherwise the bank number may change uncontrollably).

All of the following examples use the Device Select addresses for a RAM card installed in slot 0. The data values to enter in the monitor follow each of the listings in case you do not have an assembler.

Example 9

This example shows how to deselect or turn off and write protect the RAM on the Legend RAM card. Please note that the \$C08A address could also have been used to perform this particular function.

*

* ROM read and write protect RAM.

*

```
START    LDA $C082    ;Deselect RAM read
          RTS          ;Return to caller
          END
```

(monitor- 800:8D 82 C0 60)

Theory of Operation

Example 10

This example shows how to deselect, or turn off, the RAM on the card and enable the ROMs on the motherboard while still having the RAM card write enabled. This example routine also selects Bank 5 on the Legend RAM card with the 1st 4K sub-bank mapped into the \$D000-\$DFFF address space. While we have the ROM read enabled we are able to write data into RAM on the RAM card.

```
*
* Select ROM read & Write enable 1st
* sub-bank of Bank #5 with 2 consecutive
* reads.
*
BANKSEL EQU $C084
*
START   LDA #$05           ;Data for Bank #5
        STA BANKSEL       ;Select Bank no.5
        LDA $C089         ;Select ROM read.
        LDA $C089         ;Write enable RAM
        RTS               ;Return to caller
*
        END
```

```
(monitor- 800:A9 05 8D 84 C0 AD 89 C0
          808:AD 89 C0 60)
```

A copy of the Monitor could be installed in any one of the 16K banks in the RAM card using the routine in the next example. Simply change the operand in line 7 from #\$00 to the number of the bank you wish to select.

Theory of Operation

Example 11

This example shows how to turn off the Legend RAM card read and enable the ROMs on the motherboard. It also write enables Bank 0 on the RAM card with the 2nd 4K sub-bank active. While we have the ROMs read enabled, we are able to write data into the RAM on the RAM card. This example is expanded to show a very short routine called COPYMON which copies the Apple Monitor ROM on the motherboard into Bank 0 on the RAM card.

Notice that the routine uses only one set of zero page pointers, PTRL and PTRH. Of particular importance here is the fact that any load instruction will read the ROMs on the motherboard while any store instruction will write to the RAM card at the same address contained in PTRL and PTRH.

Theory of Operation

*
* Select ROM read & Write enable 2nd 4k
* sub-bank of Bank #0 with 2 consecutive
* reads.

*
BANKSEL EQU \$C084 ;addr for bank sel

*
START LDA #\$00 ;select Bank #0
STA BANKSEL
LDA \$C081 ;Select ROM read.
LDA \$C081 ;Write enable RAM

*
PTRL EPZ \$06 ;Zero Pg variable
PTRH EPZ \$07 ;Zero Pg variable

*
COPYMON LDA #0 ;set up pointer

STA PTRL
LDA #\$F8
STA PTRH
LDY #\$00 ;Y index = 0
COPYROM LDA (PTRL),Y ;Get byte fm ROM
STA (PTRL),Y ;Put byte in RAM
INY ;next byte
BNE COPYROM
INC PTRH ;next page
BNE COPYROM

*
LDA \$C082 ;write protect RAM
RTS ;Return to caller
END

(monitor- 800:A9 00 8D 84 C0 AD 81 C0
808:AD 81 C0 A9 00 85 06 A9
810:F8 85 07 A0 00 B1 06 91
818:06 C8 D0 F9 E6 07 D0 F5
820:AD 82 C0 60)

Theory of Operation

Example 12

One of the interesting aspects of having a language contained in RAM on the Legend RAM card is that it can be modified easily, something you can't do with Read Only Memory (ROM).

It just so happens that a copy of the Apple Auto-Start Monitor resides at address \$F800 to \$FFFF in Bank 0 on the card when it is loaded with a language by the DOS System Master Disk (the Auto-Start Monitor is listed in the Apple [[Reference Manual, pg.136).

Many users modify the Auto-Start Monitor to include custom functions. These custom Monitors can be copied into the RAM card and utilized when you switch to the language contained in RAM on the card (Integer or Applesoft).

This routine assumes that you have just BLOADED your own custom Monitor into memory at address \$1000 and that Bank 0 on the RAM card has already been loaded with a language. This routine will copy the custom Monitor into Bank 0 RAM.

```
(monitor- 800:A9 00 8D 84 C0 AD 81 C0
          808:AD 81 C0 A9 00 85 06 85
          810:08 A9 F8 85 07 A9 10 85
          818:09 A0 00 B1 08 91 06 C8
          820:D0 F9 E6 09 E6 07 D0 F3
          828:AD 82 C0 60)
```

Theory of Operation

*
* Select ROM read & Write enable 2nd 4k
* sub-bank of Bank #0 with 2 consecutive
* reads.
*

PTRL EPZ \$06
ADRL EPZ \$08
BANKSEL EQU \$C084
SOURCE EQU \$1000
TARGET EQU \$F800

*

START LDA #0 ;select Bank #0
STA BANKSEL
LDA \$C081 ;Select ROM read
LDA \$C081 ;Write enable RAM

*

COPYMON LDA #SOURCE ;setup addr ptr
STA PTRL
STA ADRL
LDA /TARGET
STA PTRL+1
LDA /SOURCE
STA ADRL+1

*

COPYROM LDY #0 ;init index
LDA (ADRL),Y ;move a byte
STA (PTRL),Y
INY ;next byte
BNE COPYROM
INC ADRL+1 ;next page
INC PTRL+1
BNE COPYROM

*

LDA \$C082 ;write protect RAM
RTS ;Return to caller

*

END

Theory of Operation

Example 13

Scanning for the Legend card

This last program is an example of how you would search for Legend RAM cards and set up a table of the amount of memory available in the machine. This program is great for cutting down on user error as there is no user supplied information used in setting up the table.

This program is part of the Legend Slide Select program and is used to assist in determining the amount of RAM in the machine.

To use this routine, BLOAD SLIDE SELECT.OBJ and execute a CALL 36872. The routine will return the RAM configuration of the machine in locations 768 through 776.

Locations 768 through 775 contain the number of banks location in each slot. Slot 0 is represented by location 768, slot 1 is 769 and so on. The location should be either a 1 or a multiple of 4. If it is a 1, there is a 16K RAM card in that slot. For each multiple of four, there is 64K of RAM in that slot (e.g. the number 8 represents 128K of RAM).

Location 776 will return the location of your Firmware card, if you have one installed in your machine.

Theory of Operation

Listing 13 contains the actual listing of the routine used to do the slot scan. You may incorporate this routine into your programs as long as you include the copyright notice.

You may use the Slide Select routines as a unit if you don't have an assembler.

Theory of Operation

Listing 13. Scanning for Legend Cards.

```

*
* Check machine configuration
* This is taken from SLIDE SELECT.OBJ
*
ADRL      EQU      6
PTRL      EQU      8

FOUND     EQU      $300      configuration found
ROMFLAG   EQU      $308      ROM card/A'soft in RAM card

RAMOFF    EQU      $C0B2     Deselect RAM read
RWRAM2    EQU      $C0B3     R/W RAM #2 bank
RAMON     EQU      $C0B3
BANKSEL   EQU      $C0B4     Bank select adr.
RWRAM1    EQU      $C0B8     R/W RAM #1 bank

LANGBYTE  EQU      $E000

          ORG      $9008     CALL 36872 from BASIC
          JMP      MACHCHK
          .
          .
MACHCHK   TXA                save X-reg
          PHA
          LDA      LANGBYTE   check RAM/ROM
          BIT      RAMOFF     turn off RAM card
          CMP      LANGBYTE
          BEQ      INROM
          LDA      #0         *in RAM
          BNE     ALLR       {branch always}
INROM     LDA      #2
ALLR     STA      ROMFLAG

MCL       LDX      #7         check all slots for
          JSR     BANKCHK     RAM cards
          TYA
          STA     FOUND,X
          DEX
          BPL     MCL

          LDX      ROMFLAG    restore language
          LDA     $C0B0,X     restore X-reg
          PLA
          TAX
          RTS

TIMES16   ASL      A
          ASL      A
          ASL      A
          ASL      A
          RTS

```


Theory of Operation

*
 * Check board in slot X for number of banks of RAM
 * returned in Y reg.
 *

BANKCHK	TXA PHA JSR TAX JSR LDA LDA JSR BNE JMP	TIMES16 BANK0 RAMON,X RAMON,X ISITRAM BC0 BANKEXIT	Save slot # Select bank 0 read from RAM and write too. Is it really RAM? yes..
*			
BC0	LDA STA JSR BNE LDA BNE	#1 BANKSEL,X ISITRAM BC1 #1 BANKEXIT	check card type switch to bank one 16K RAM card (branch always)
*			
BC1	SEC LDA TAY	#0	Legend card! save language bytes
BC6	TYA STA LDA STA INY CPY BCC	BANKSEL,X LANGBYTE TEMP,Y #64 BC6	
*			
BC01	LDA STA STA SBC BPL	#64 BANKSEL,X LANGBYTE #1 BC01	max number of banks select the bank store bank number in bank next bank
*			
BC2	LDY TYA STA CPY BNE INY CPY BCC	#0 BANKSEL,X LANGBYTE GOTBANK #64 BC2	now check for # of banks found max bank # {branch always}
*			
GOTBANK	TYA PHA LDA TAY		save RAM card size
BC4	TYA STA LDA STA	#0 BANKSEL,X TEMP,Y LANGBYTE	

Theory of Operation

	INY		
	CPY	#64	
	BCC	BC4	
	PLA		
	TAY		
	AND	#3	mask for card size
	BEQ	BC3	divisible by 4
	LDA	#1	One bank of RAM
	BNE	BANKEEXIT	
BANKEEXIT	TAY		save # of banks in Y
BC3	JSR	BANK0	Leave card at bank 0
	STA	LANGBYTE	and restore it
	STA	RAMOFF,X	turn off RAM card.
	PLA		retrieve slot #
	TAX		
	RTS		
*			
*	Select Bank 0 of Card indicated by		
*	X reg. A reg is zeroed, all others are preserved		
*			
BANK0	LDA	#0	
	STA	BANKSEL,X	
	RTS		
*			
*			
*	Test for RAM at \$E000		
*			
ISITRAM	LDA	LANGBYTE	
	CMP	LANGBYTE	is it the same?
	BNE	NORAM	
*			
	INC	LANGBYTE	
	CMP	LANGBYTE	
	BEQ	NORAM	
*			
	CLC		
	ADC	#1	
	CMP	LANGBYTE	
	BNE	NORAM	
	INC	LANGBYTE	
	CLC		
	ADC	#1	
	CMP	LANGBYTE	
	BNE	NORAM	
*			
	DEC	LANGBYTE	Since it's RAM,
	DEC	LANGBYTE	restore Lang ID byte
	LDA	#1	
	RTS		
*			
NORAM	LDA	#0	not RAM
	RTS		

Theory of Operation

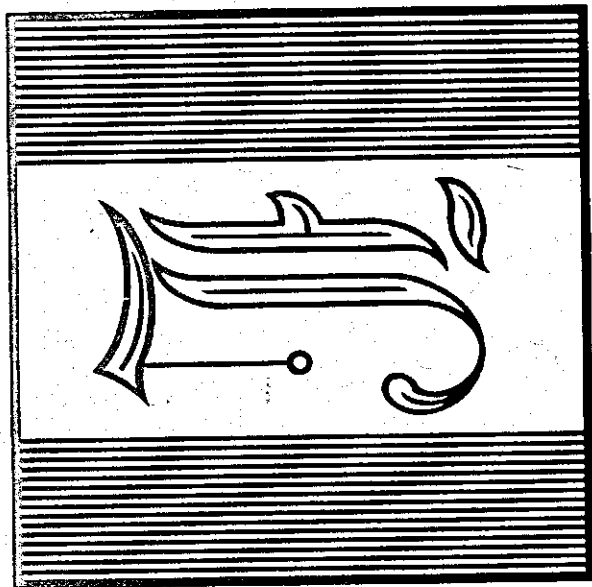
TEMP
TEMP2

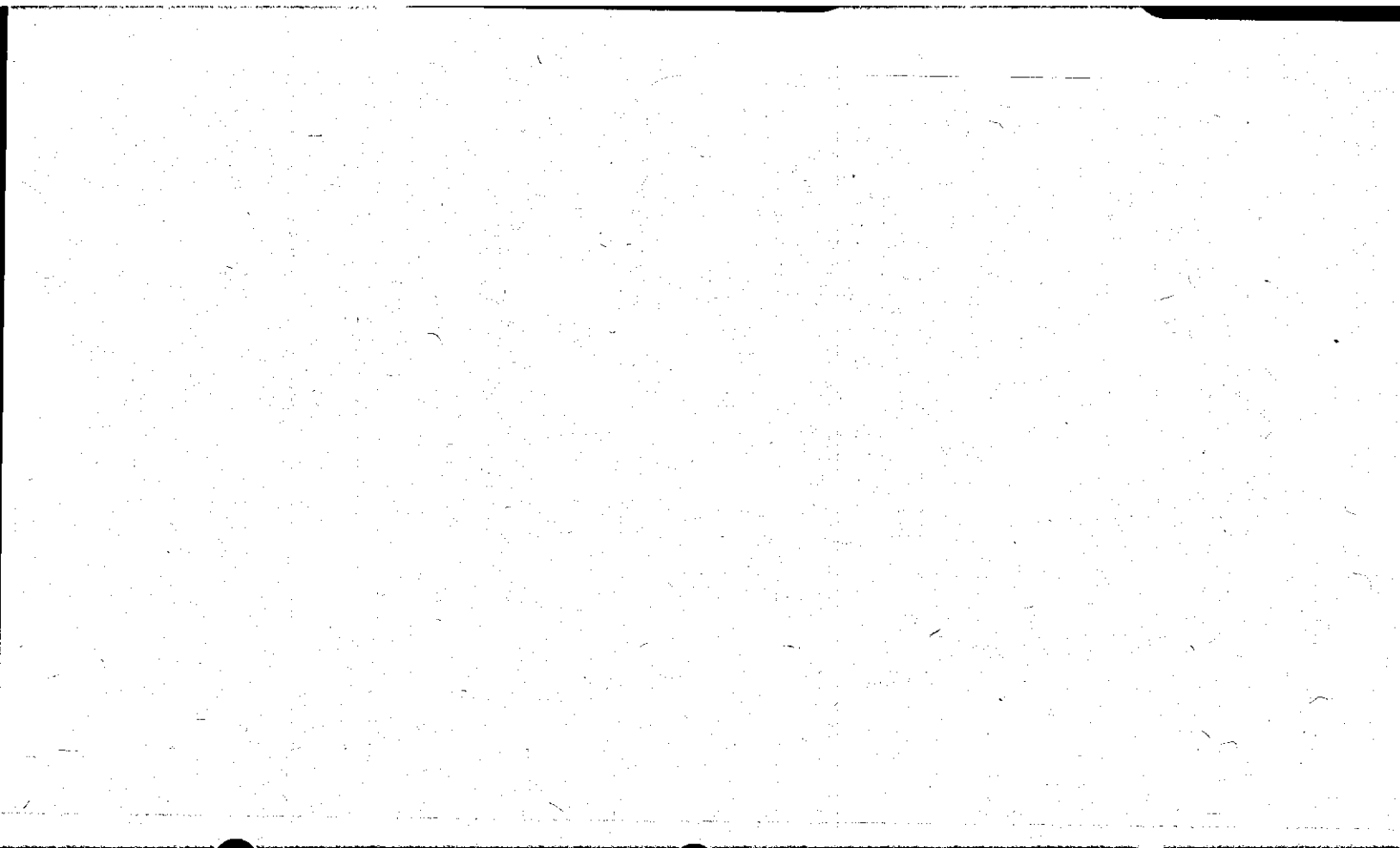
DS
DS
END

64
1

for saving language bytes







User Modifications

Adding RAMs to the S'Card

As you are aware, the S'Card is capable of allowing you to add RAM to the card as you require. If the card came with 64K on it, the next step is to add an additional 64K to the card and make it into a 128K RAM card. This can be done with 64K RAMs up to 256K.

The S'Card is designed to use both the 64K RAMs and the 256K RAMs. The S'Card may be configured with up to 4 rows of 64K or 256K RAMs. This gives you a maximum capacity of 1 Megabyte (with 256K RAMs). Because of this feature, the full S'Card can be very powerful. To accommodate the 256K RAMs it is necessary to make a small modification to the card. Refer to the paragraphs under 'Switching 64K and 256K RAMs' in this section for the modification.

using 64K RAMs

- 1) 64K - base configuration
- 2) 128K - Apple drive minus DOS
- 3) 192K - full Apple drive and relocated DOS
- 4) 256K - two Apple drives minus DOS

using 256K RAMs

- 1) 256K - same as 4) above
- 2) 512K - four 128K drives
- 3) 768K - four drives and relocated DOS
- 4) 1Meg - 4 large drives, relocated DOS, extra memory

User Modifications

If you look at the table above you may wonder what you may do with 1 Megabyte of RAM. To answer your question, you can emulate up to four large drives at 256K each or maybe one large drive at 1 Megabyte. The RAM card is addressable RAM and can be used as such.

Adding RAM to the card is very simple to do and requires almost nothing in the way of tools, but does require patience as you add chips to the card. If you rush into the operation without knowing exactly what you are doing you may encounter problems that can be avoided by taking the time to do the job properly.

You must add eight (8) RAM chips at a time. Since the chips are 64K by 1 bit or 256K by 1 bit, you must install eight (8) RAMs all at the same time in order to achieve a full byte-sized portion of that much more RAM.

The type of RAM chips used is fairly important. If you put 'game', or cheap, parts into the S'Card, it may not work properly and may even damage the other parts on the card. Please use the best parts that you can find (Legend Industries will sell you a RAM upgrade set for a modest price). A list of RAM manufacturers can be found in Figure 18. These are manufacturers that Legend has tested and found compatible with the card.

User Modifications

Figure 18. RAM Manufacturers.

- 1) Texas Instruments
- 2) OKI Semiconductor
- 3) Fujitsu Microelectronics
- 4) Mitsubishi Electric
- 5) Hitachi Electric

Each of the RAMs has 16 pins on them and a notch or some kind of indicator at one end to allow the person installing the chip to indentify pin one (1). When installing RAMs into the card, pin one is in the upper left hand corner. To install the chips simply guide the pins of the chip into the hole in the socket and press firmly (the word firmly does not mean hammer it in, if the chip refuses to go into the socket, check for bent pins on the chip or obstructions in the socket) until the chip slides into place.

Chips should be installed in the proper order; that is the first row of RAM is row A and the second is B and so on. If you put RAMs in row A and row C, most programs will not recognize the RAM in row C. The lettering on the S'Card tells you which row of RAM is which.

User Modifications

64K and 256K RAMs

The 64K and 256K RAMs are not completely compatible in the same memory board (refer to Figure 19 and 20 for a pinout). Because of this, it is necessary to remove the old 64K RAMs before inserting any 256K RAMs. There is also a jumper to be changed on the board so you may take advantage of the address space on the 256K chips.

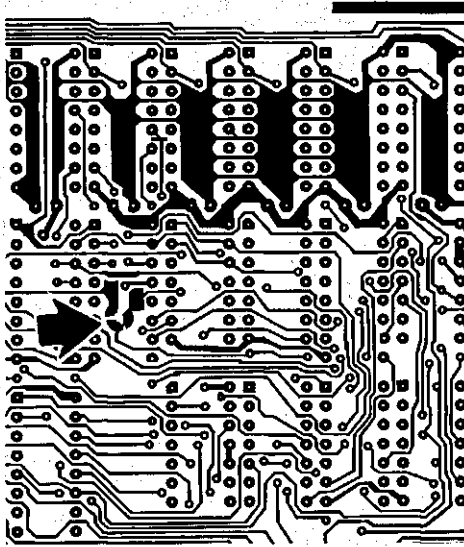
Before you remove the old RAMs from the board, we must take a few precautions. You must turn off your computer before removing the RAM card. You should be completely discharged of static electricity. You may do this by touching the power supply inside your computer or, better yet, go in the bathroom with the tile floor and do the rest of the procedure in there (remember to touch one of the metal faucets to discharge any static you may have left). The chips should be removed with an IC extractor or a small screwdriver, carefully prying the chips out of the sockets so you don't bend the pins.

To accept the 256K RAMs with all of the memory on them, you have to make one small modification to the RAM card. If you don't know how to use a soldering iron, or are a bit clumsy with it, we suggest taking the board to your dealer to have the modification done.

User Modifications

There is a set of three pads on the back of the PC board arranged in a triangular pattern. You must cut the small jumper between two of the pads and make a solder bridge between the middle pad and the one which wasn't already jumpered to it. When you make this change the 64K RAMs on the card must be removed and 256K RAMs put in.

Illustration 11. 256K Modification



User Modifications

You may now carefully insert the new 256K RAM chips (pin 1, the end of the chip with the small notch in it, should face the top of the board). The board is filled in a certain order to make the memory contiguous. The rows (8 chips each) should be filled in the order: A, B, C, D.

The reason the board needs to be modified is because the two RAM chips (64K and 256K) have different configurations. If you refer to Figures 19 and 20, you will see that there is only a one pin difference between the two RAM chips. This is the address line that expands the 64K RAMs to 256K (not available on the 64K RAMs). The modification to the board does more than allow the board to accept the higher density RAM part. It also changes the actual RAM addressing to function in 256K blocks instead of the 64K blocks necessary for the 64K RAM parts. If you don't change the jumper, the board will act just like it has only 64K parts in it. You will not be able to fully utilize the 256k RAMs. We suggest you test your board after you have completed this change.

User Modifications

Figure 19. 64K RAM pin outs

```

          ****   ****
          *     **   *
          ***
NC * 1          16 * GND
          ***
          *
          ***
D * 2          15 * /CAS
          ***
          *
          ***
/W * 3         14 * Q
          ***
          *
          ***
/RAS * 4       13 * A6
          ***   64K
          *     RAM
          ***
A0 * 5         12 * A3
          ***
          *
          ***
A2 * 6         11 * A4
          ***
          *
          ***
A1 * 7         10 * A5
          ***
          *
          ***
+5V * 8        9 * A7
          ***
          *
          ****

```

User Modifications

Figure 20. 256K RAM pinouts

```

          ****      ****
          *        **      *
          ***          ***
A8 * 1          16 * GND
          ***          ***
          *          *
          ***          ***
D * 2          15 * /CAS
          ***          ***
          *          *
          ***          ***
/W * 3          14 * Q
          ***          ***
          *          *
          ***          ***
/RAS * 4          13 * A6
          ***          ***
          *          *
          ***          ***
          256K
          RAM
A0 * 5          12 * A3
          ***          ***
          *          *
          ***          ***
A2 * 6          11 * A4
          ***          ***
          *          *
          ***          ***
A1 * 7          10 * A5
          ***          ***
          *          *
          ***          ***
+5V * 8          9 * A7
          ***          ***
          *          *
          ****

```

User Modifications

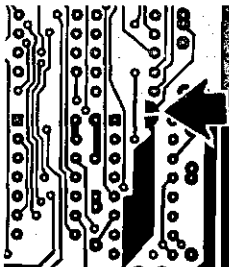
In short, the upgrading of your S'Card to 256K RAM parts is a relatively simple process. You must be careful when handling the parts so you don't accidentally destroy the RAMs and you must make the modification to the board to allow it to utilize the 256K parts. We hope you will enjoy the capacity which the higher density RAM parts have to offer.

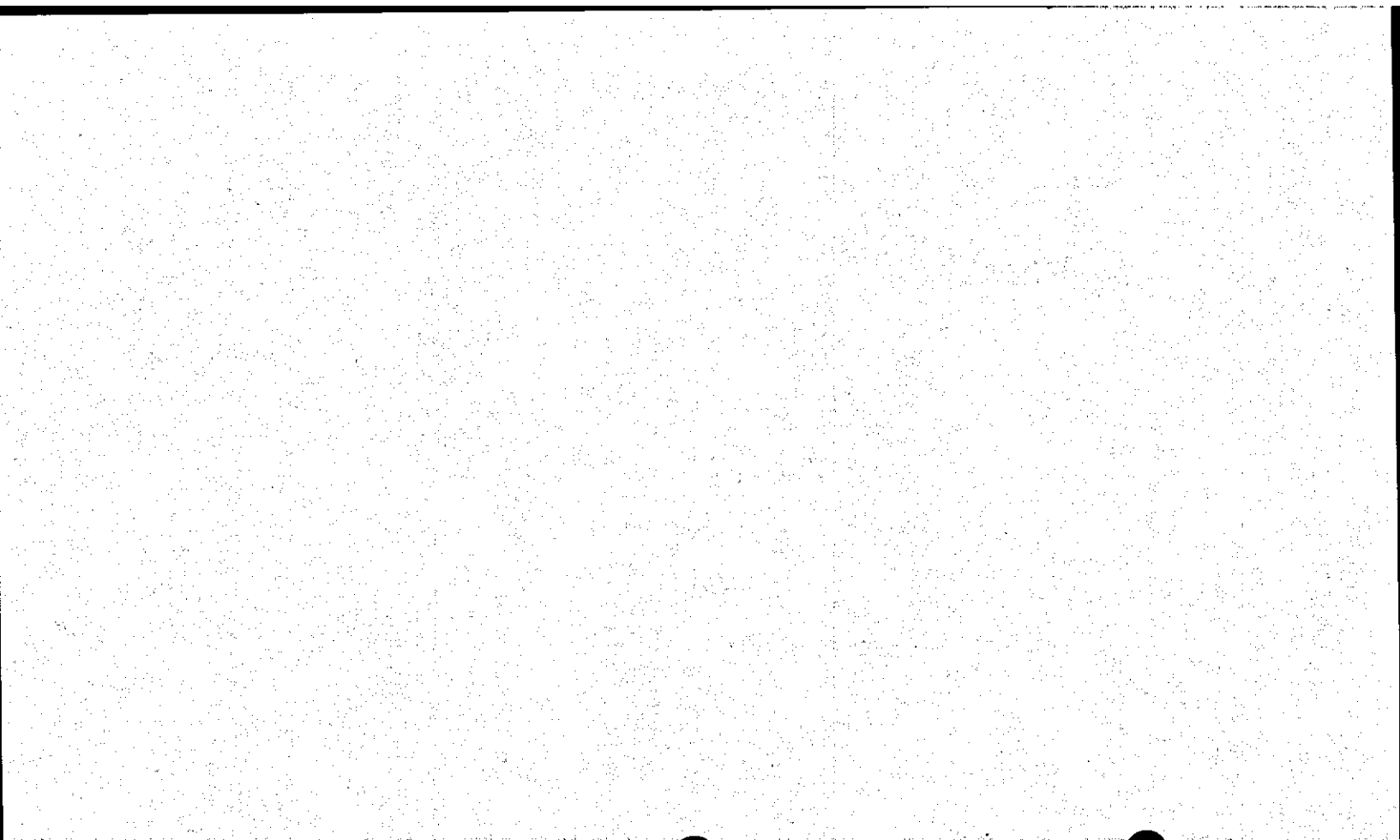
Resetting out of the card

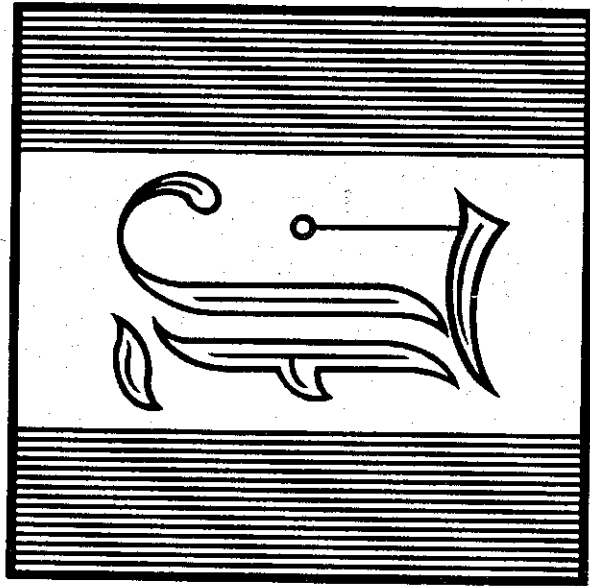
Legend has added a feature to the S'Card that may be of interest to you; the ability to reset out of the card. This is a simple feature to implement on the card, provided that you understand that any time reset is pressed the card will reset the bank to zero (0) and disable the card. After a reset it may be necessary to rerun the software that has attached itself to the S'Card.

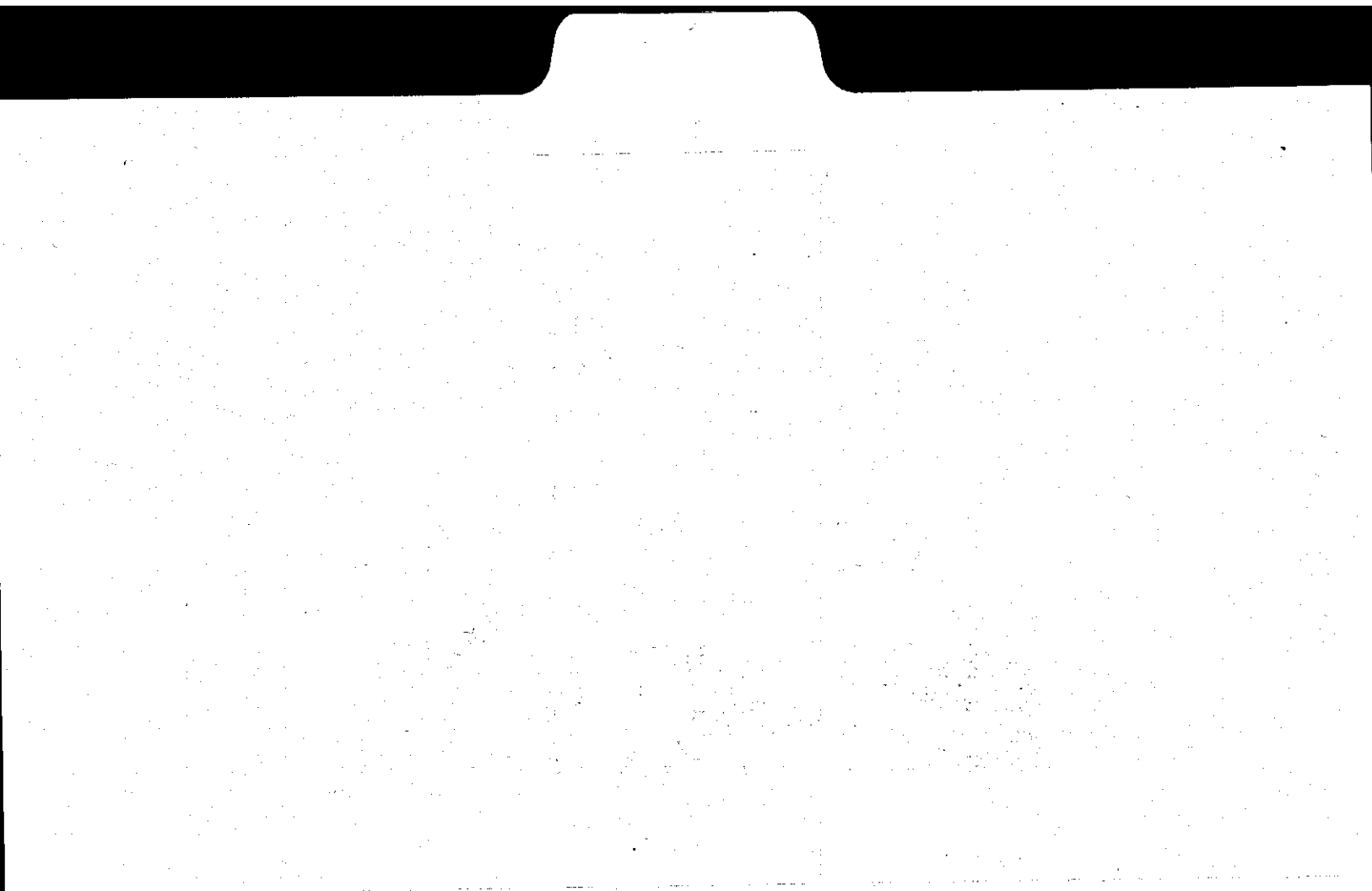
To implement the reset line feature you need only solder two pads together on the back of the card marked "RESET" and reinstall the card in your Apple.

Illustration 12. Reset connection.









Apple /// Usage

We wish to thank Serge of Hi-Tech Computing for his assistance in writing this section of the manual.

The operating system on which your Apple /// runs is known as SOS or Sophisticated Operating System. This operating system allows programs to use hardware devices through small interface programs known as drivers. It is necessary for you to have some knowledge of SOS to use the SOS driver available from Apple Computer or Legend Industries.

If you do not have the SOS driver, skip this section.

The SOS driver is provided by Legend Industries or Apple Computer. It may be necessary to pay a small fee to cover the diskette and labor to copy the program. If you have the SOS driver, back up this disk right away and store the original in a safe place.

Use of the SOS driver can make a substantial speed improvement in the operation of the Apple ///.

As mentioned before, SOS communicates to the devices connected to the computer through drivers. It will be necessary to connect the device driver, .RAM, to the operating system using the utilities programs provided with your Apple ///. There is an option on the utilities menu known as System Configuration Program (SCP).

Apple /// Usage

This program (SPC) is used to attach drivers to the operating system and allow SOS to communicate to the devices you attach.

If you are familiar with attaching device drivers to the Apple /// operating system, then you may find the following installation instructions boring. If you are a novice you may wish to refer to the Apple /// Owner's Guide, page 48, for more assistance on installing the .RAM driver within your system.

If you are just starting out, you will need a few things.

- 2 or more blank diskettes
- A copy of the Utilities disk
- A 256K Apple ///
- At least 1 Legend S'Card
- Patience

After getting all of these things in one central area, you may begin work.

Turn on the monitor and put the Utilities disk into drive 1 and boot the machine. At this time I will assume that you have installed the Legend card into the machine and are ready to attach the RAM driver to the system.

There will be 4 options to choose from. We want to select the Device handling commands or option 'D'. This will give you a submenu of various commands. We want to select the option 'F' or Format a volume.

Apple /// Usage

The disk drive will come on for a second and ask if you want to format the disk in drive 1 (this will appear as '.D1'). You will have to remove the Utilities disk from drive 1 and insert a blank disk. Press return.

The program will then ask for a new volume name. I like the volume name of "FAST". You can call the volume name just about any thing. If you do not care just press return and the program will call it BLANK.

The program will format the disk in the drive and return for more formatting. Insert the other diskette and format it also.

After formatting both of the diskettes, press ESCAPE to return to the submenu. The next option we want to use is 'C', Copy one volume onto another. If you have one drive this can be very boring and time consuming. The program will ask the volume and show '.D1'. If you are using one drive, press return. If you are using multiple drives enter the drive you wish to copy from. The program will then ask the volume you want to copy to. '.D1' will be showing. If you have one drive, press return. If you are using multiple drives, enter the drive you wish to copy to.

Make one copy of the SOS driver and one copy of the Utilities disk (our work disk).

Apple /// Usage

Press ESCAPE after you have made the copies. The submenu will appear again. If you want to do anything else now's the time to do it. If you are finished with this set of utilities, press ESCAPE.

Put the new Utilities disk into drive 1 and press 'S' for System Configuration Program (SCP). The disk will come on and then a submenu will appear on the screen with 6 options. Select option 'R' for Read a Driver File. The disk will come on for a second and a message will appear on the screen telling you that no drivers are loaded.

At the bottom of the screen there will be a request to read a driver and a default drive and driver, loaded into the machine. Press return and the disk drive will load the current SOS driver into the machine and display the contents to you. Remove the Utilities disk from drive 1 and insert the Ram card driver disk. You will have to read the driver for the ramcard into the machine and attach it to the operating system. Type '.D1/(up arrow)' the up arrow will appear as '='. In the upper right hand corner, a driver name will appear. You want to select "RAM.DRIVER" with the right arrow key and then press return. The disk will come on and .RAM will appear at the bottom of your list of drivers on the screen. Remove the Legend driver disk and insert the Utilities disk. Press ESCAPE. The submenu will appear on the screen with the 6 options.

Apple /// Usage

The option that we wish to select is 'C' for Change System Parameters. The disk will come on and the current configuration will appear on the screen. You will want to select number 2 or Change Peripheral Slot Assignments. The last device on the list will be .RAM which is what we are attaching to the operating system. Press the number that corresponds to the .RAM driver. In the case of this example I selected number 8. The driver name will be highlighted. Press return to accept this driver. The program will then ask for the slot assignment for that device. If your Legend card is in slot 3, then enter 3. In other words enter the slot the card is in. Press return to accept the slot you just entered.

The current driver configuration will appear on the screen with slot 3 assigned to .RAM. If this is to your liking, press ESCAPE to return to the submenu. If it is not to your liking edit it again until it is. If you have nothing else to change in the system parameters, then press ESCAPE to return to the main menu.

We are coming into the final stretch. One of the main menu options will be 'G' for Generate New System, which is what we want to do. Press 'G'. The disk will come on and validate the system and ask for the driver name to be written out to disk. The default is '.D1/SOS.DRIVER'. This is the system driver. If this is the name you want the new system saved under, press return.

Apple /// Usage

If not, enter the new name. The disk drive will come on again and tell you that the SOS.DRIVER already exists. Do not panic, the disk you created with the Legend driver on it has plenty of room on it. Remove the disk in drive 1 and insert the copy of the Legend disk.

The Utilities disk is just about packed and you may not be able to save the new system on it. You have the option of removing the present SOS.DRIVER from the Utilities disk and transferring the new SOS.DRIVER from the Legend driver copy to the Utilities disk copy.

To try out your new faster system, boot the disk that has the new system on it. It will be necessary for you to format the .RAM, so select 'D' from the main menu for Device handling commands. The submenu will appear with different options, choose the 'F' option. The program will tell you that the operation you are about to perform will destroy all the data on the disk. This is acceptable since we do not have any data on the ram card any way. The program will format .RAM and tell you the operation is complete. Press ESCAPE. The submenu will appear on the screen and give you a set of options. Select 'V' to verify the integrity of .RAM. If all is well the program will indicate 0 errors were found.

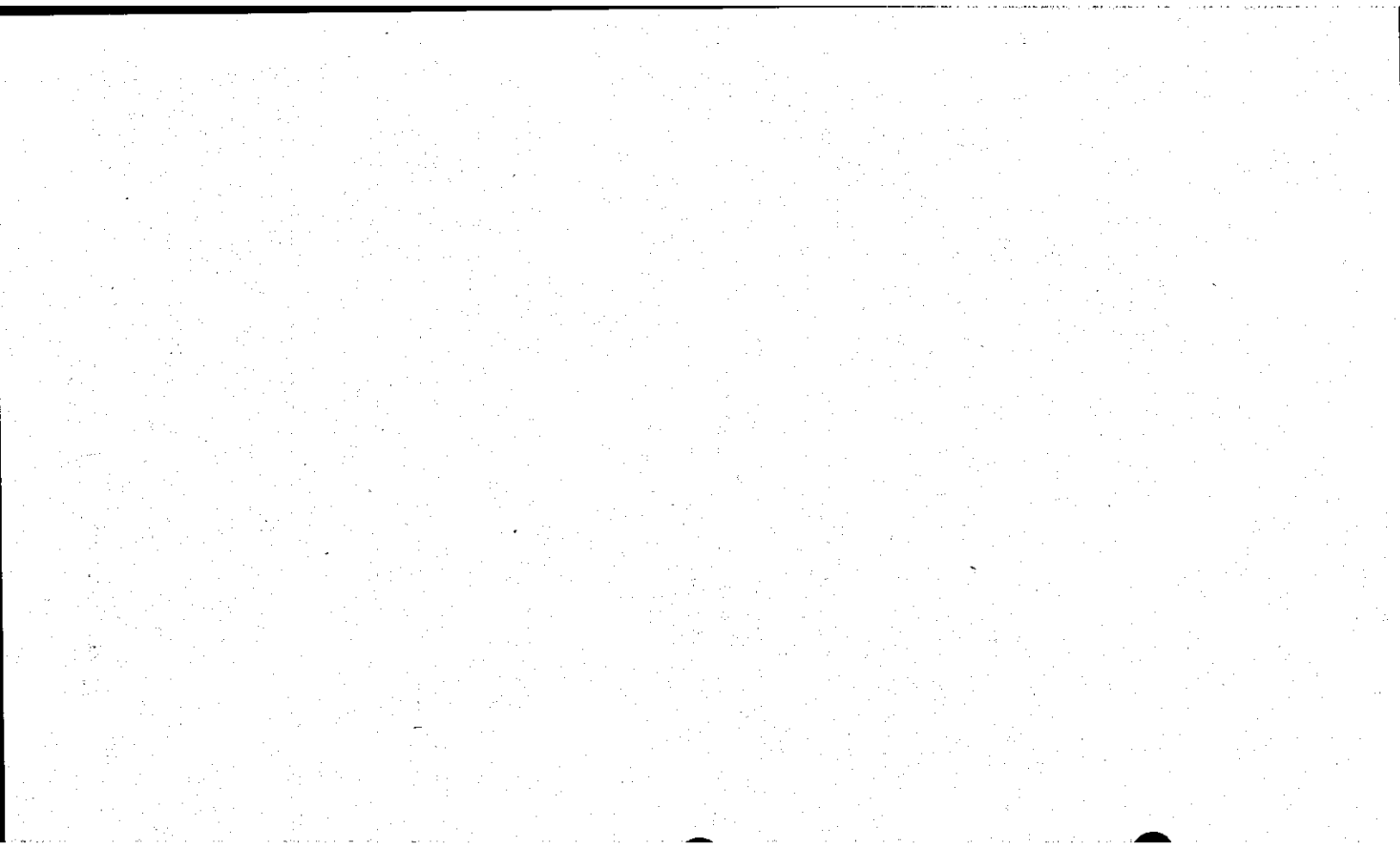
After all this you can transfer data/programs to and from the ramcard as you would between disk, but much faster.

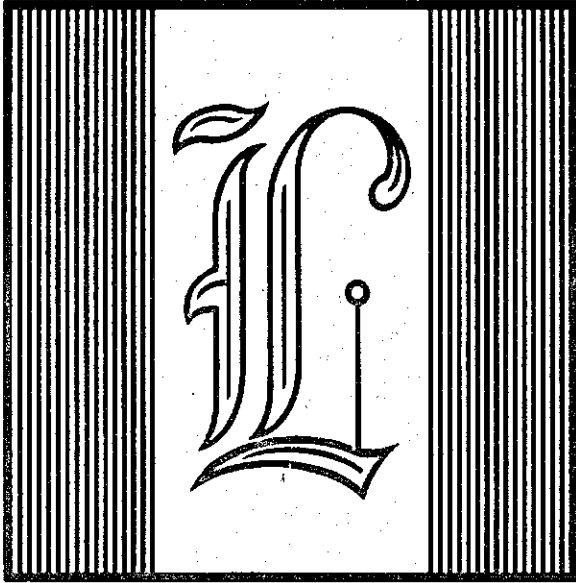
Apple /// Usage

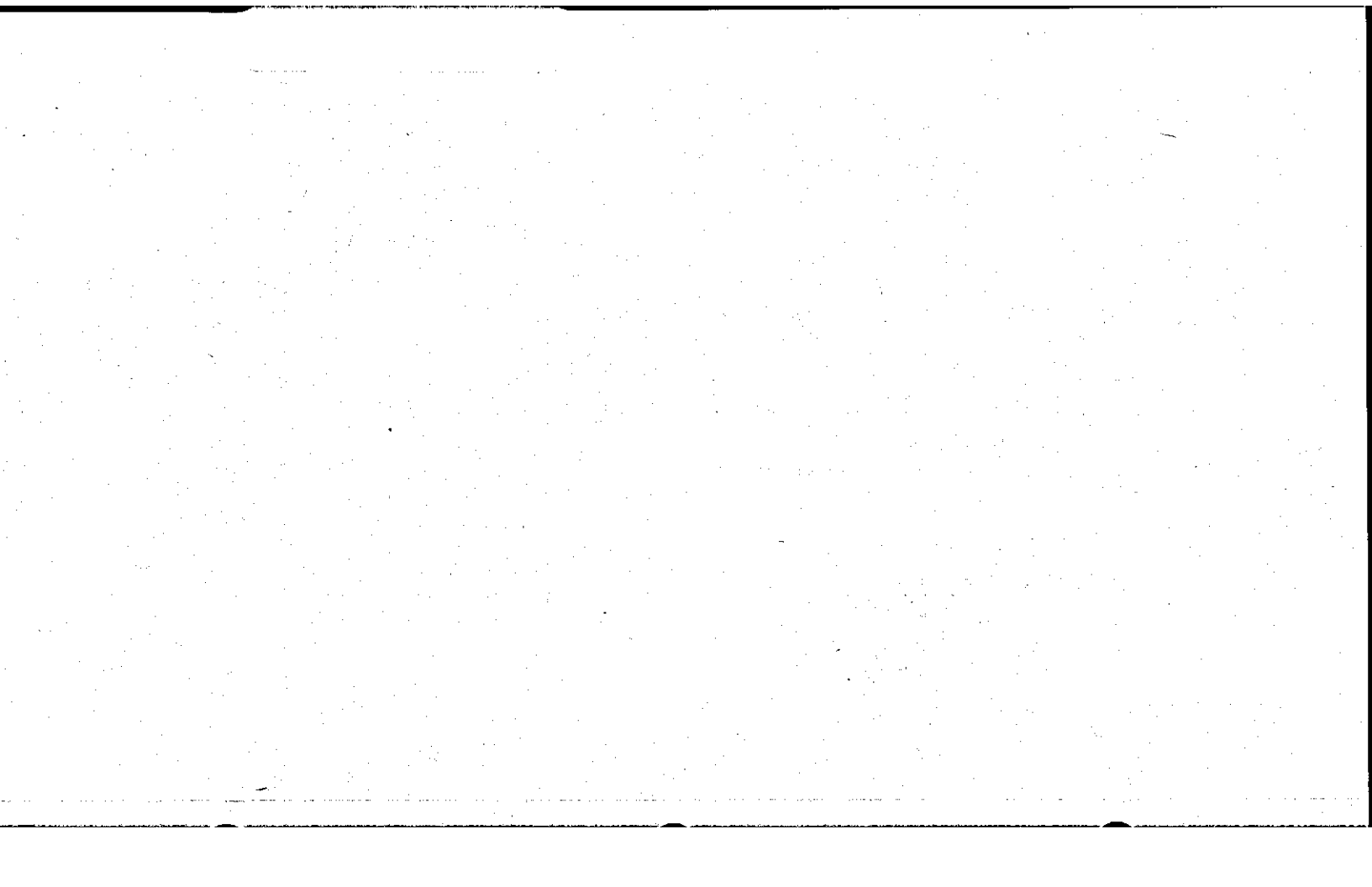
Using the Legend driver with the Apple /// and canned programs is a straight forward operation.

It will be necessary to boot the SOS system into the machine that you have attached the .RAM driver. After the machine is up and running, you can transfer the program you intend to run to the ramcard. Legend has been in contact with software programmers and has negotiated support for the ramcard in the /// environment. It is possible the program you are using is not directly compatible with the ramcard. This is usually due to protection of the software or conflicting memory usage.

You may feel free to contact Legend for assistance in using the Legend ramcard in your machine.







Problem Determination Procedures

This part of the manual has been written in order to assist you in determining the nature of a problem that may occur in using the card.

Legend Industries inspects every board completely before it leaves the factory. The possibility of having a malfunctioning board is low.

No power light

- 1) Check to see if the Apple is plugged in.
- 2) Check to make sure all cards are correctly seated.

System is Hung

The very first thing to check is if the system hangs with the card in the machine or not. Remove the card from the machine and try to boot a disk. If the system boots and everything seems to be working ok, try reinstalling the RAM card. Put the card into slot 4 or 5. If the system is hung, examine the inside of the Apple. If there is nothing touching the card and it is seated properly, assume it is the card and give us a call or return the card with an explanatory note.

Problem Determination Procedures

System won't "Boot"

If the card is installed in the Apple correctly and it still won't boot, turn off the power. Remove the card and turn the Apple on. If the Apple will now boot, check to see if you have installed one of the RAMs improperly. If you have installed the RAM improperly (upside down or one pin off) the RAM is probably dead. If the RAM is installed properly or you did not install any RAM and the system will not boot, you have the option of returning the card to Legend. If the Apple still won't Boot, the problem is with the Apple and not the Legend card. You should take the Apple to your dealer for repair.

System "Boots", but nothing happens

- 1) Check to see if there is a diskette in the disk drive.
- 2) Is the monitor on and connected?
- 3) Is the disk controller connected properly and well seated?

Problem Determination Procedures

- 4) If everything seems to be connected properly, examine the disk to see if it has been damaged. If the disk physically looks good, try reseating it in the disk drive. If this doesn't work, try another disk. One that uses the Apple language card should work. If a known good disk doesn't work, examine the card and make sure that any modifications you might have made to the card (i.e. adding memory) have been done correctly. If they have been done correctly, you have the option of returning the board to Legend.

“LANGUAGE NOT AVAILABLE”

- 1) Did you load a language into the card?
- 2) Boot the System Master and allow the menu to come up on the screen. Type FP, (INT if you have a Apple][+) to switch to the language in RAM. If you can switch between languages, then the card is working properly. If you can not switch between the languages, try re-booting the disk and/or reseating the card in the slot. Also check the installation of any memory you have added yourself.
- 3) Check to see if the card is installed in slot 0. It is not necessary to put the card in slot 0, however, if you are using it to hold the language missing in ROM on the motherboard, it should be installed in slot 0.

Problem Determination Procedures

- 4) If the message "LANGUAGE NOT AVAILABLE" still comes up, you have the option of returning the card to Legend.

INCORRECT DOS INSTALLED IN MACHINE

The only way this message can occur is if you have loaded a 32K or 16K DOS instead of a 48K DOS on the motherboard. If you have a 48K Apple][or an Apple //e, there is something wrong with either the DOS on your diskette or the RAM on your motherboard. Try running a RAM test program on your Apple (your dealer has one) in order to check the RAMs. If all checks out ok, give us a call for assistance.

"I/O ERROR"

- 1) Does the diskette you are Booting have information on it?
- 2) Does the diskette you are booting have DOS on it? If there is no DOS on the diskette (such as our 18SRC disk) it is possible to get an I/O ERROR.
- 3) Try a known good disk (perhaps you may wish to use your System Master from Apple). If an "I/O ERROR" is still present, try reseating the cards in the I/O slots.
- 4) Try reseating the diskette in the drive.

Problem Determination Procedures

- 5) Are you accessing the proper slot and drive?
- 6) Be sure your equipment is in good working order. Have your disk speed checked and the contacts on your disk controller cleaned periodically with a good cleaner or eraser. We recommend at least every 6 months.

Lines in Demo/Loss of information

- 1) There are several things that could cause this problem, many will not be discussed in this manual. Those that relate to the Legend card will be.
- 2) Check to make sure that any memory you have added to the card is installed correctly. Improper installation can destroy the improperly installed memory chips as well as causing other, more obvious, problems.
- 3) Check to see that the card is installed and seated properly.
- 4) Make sure you are addressing the same location that the information is stored in.

Problem Determination Procedures

- 5) If there has been more than 6 months between service calls on your computer, try removing all of the cards and cleaning the edge contacts on them. It may be a good idea to dust off the inside of your computer at this time. Fans are known to leave dust deposits inside of your machine.
- 6) Refer to "GARBAGE IN EMULATOR" section if this occurs with an Apple Language Card.
- 7) If you are still having problems losing information, and the Legend Memtest program shows bad RAM on the card, assume it is the card and return it to Legend.

Catalog or greeting garbled

- 1) Does your Apple have lower case? The Apple /// does not have lower case characters in Apple][emulation mode. The program to modify your Emulation Mode diskette to allow lower case characters in][mode is available from Legend or through your local dealer.

Problem Determination Procedures

- 2) Some of our greeting programs are written in lower case and if your Apple][doesn't have lower case some parts of the program will look garbled. Even though the Apple][is equipped with shift keys it does not have lower case capability. In the Apple][monitor ROM there is a routine called CAPTST, which converts lower case to upper case. That is why the greeting may appear garbled.

Garbage in Emulator

The Apple language card contains 16K of RAM and a monitor ROM. This ROM is active when the RAM on the Language card is not and takes over the \$F800-\$FFFF memory space on the Apple. A conflict may occur between the Language card and the Legend card over this address space. Almost all RAM boards conflict with the Language card over this space and don't know it, we at Legend try to assist you by telling you now. This will not harm the Apple but it may put garbage in the emulator.

You may alleviate this problem and still use your 16K Language Card by following this procedure.

- 1) With the Language card (not the Legend RAM card) in front of you, carefully remove the 74LS20 from the socket at location A5.

Problem Determination Procedures

- 2) Bend pin 5 of the chip straight out from the IC (if you don't know which pin is which, have a technician do this and the following step).
- 3) Ground pin 5 by connecting a small gauge wire (wirewrap wire works well) between pin 5 and pin 7.
- 4) Reinsert the IC back into its socket.

That's all there is to it! Now just reinsert the Language card into your Apple and you're all set. An enhanced version of this modification can be found in the December 1981 issue of Softalk magazine, page 184.

Many problems can be solved if you take the time to carefully check over the operation you are performing. Errors like loading a program over the language in bank 0, or assuming that the memory is directly addressable and forget to bank switch, can be avoided by reading this manual completely.

Problem Determination Procedures

Also, the RAM on the card is not directly addressible from BASIC. This means that you will need a machine language interface from BASIC to access the card. Some of these interfaces have been provided with the card (e.g. Disk Emulator, Ampercard and Memory Master) but you may wish to write your own. In order to do this you must have a working knowledge of 6502 machine language (the language of the microprocessor) if not a good assembler as well. If you are having problems writing your own routines, please call Legend for assistance.

Problem Determination Procedures

Legend Memtest

Legend Industries provides a memory test program for testing it's RAM cards. To use the memory test, run the program on the utility diskette by typing: BRUN LEGEND MEMTEST. The program is very easy to follow from there, it will step you through the test.

After telling the program which slot the RAM card is in, you are prompted to tell it how many banks you want tested. If you have 128K of memory on your card, enter 8. If you have 64K of memory, enter 4. Remember: Each set of 64K on the card is four (4) banks.

The program will now prompt you if you wish to stop on errors and if you wish to have the bell rung when the program encounters an error. If you think that you will have many errors, you should select to have neither of these options (answer 'N' to both). The program will now start to test the card.

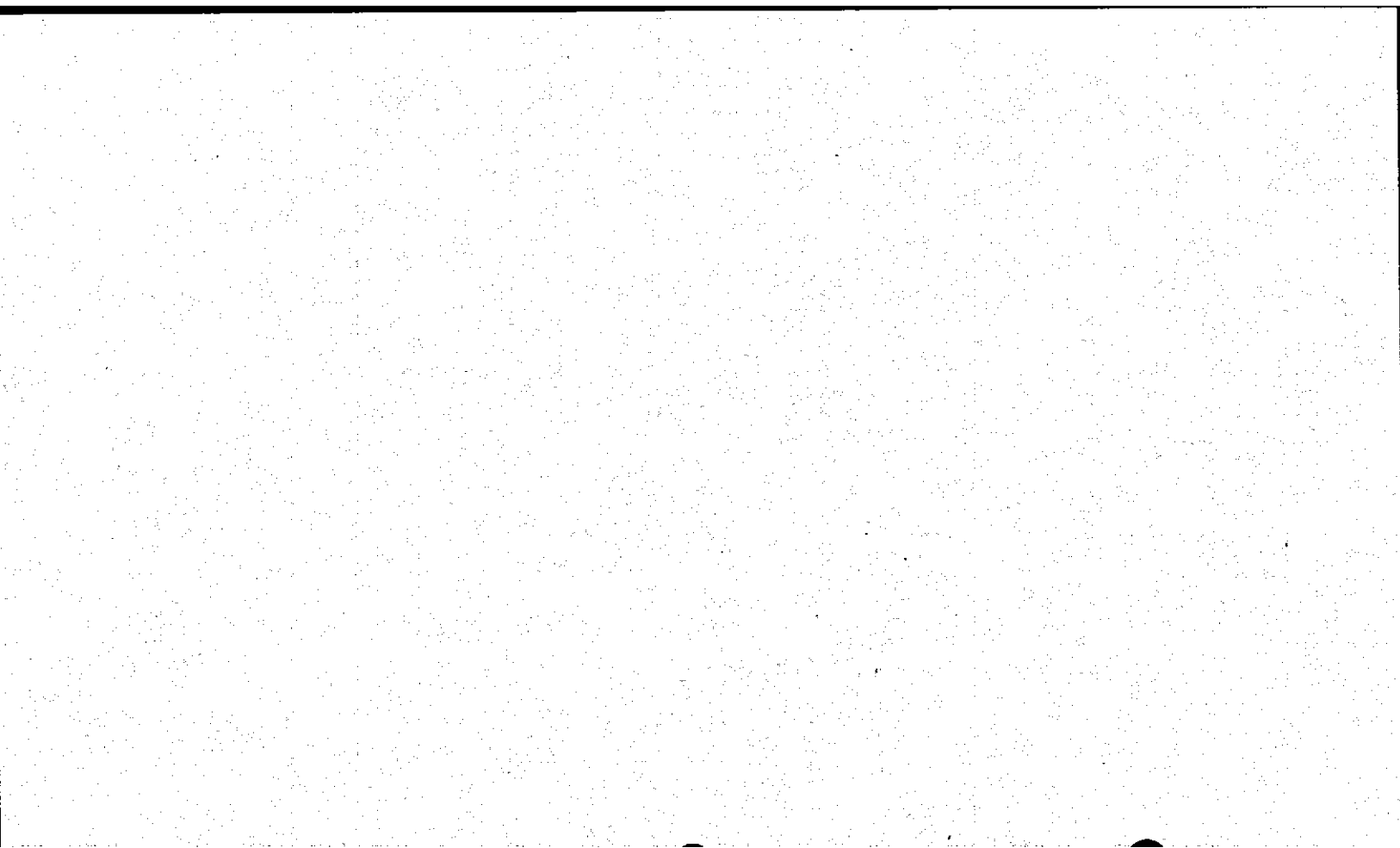
There are two parts to the Memtest program. The first section dynamically tests the RAM chips on the card. This is done by attempting to write a pattern of bits to the card and verifying that the pattern is correct by reading them back. This is used to check that the card is properly receiving data and not scrambling it so the rest of the tests will execute properly.

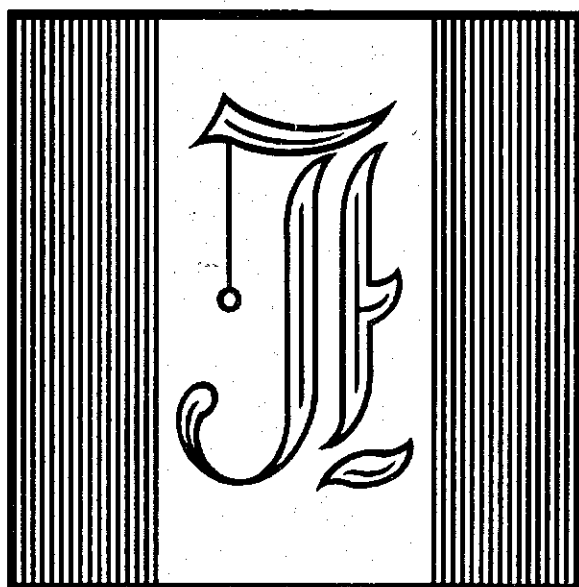
Problem Determination Procedures

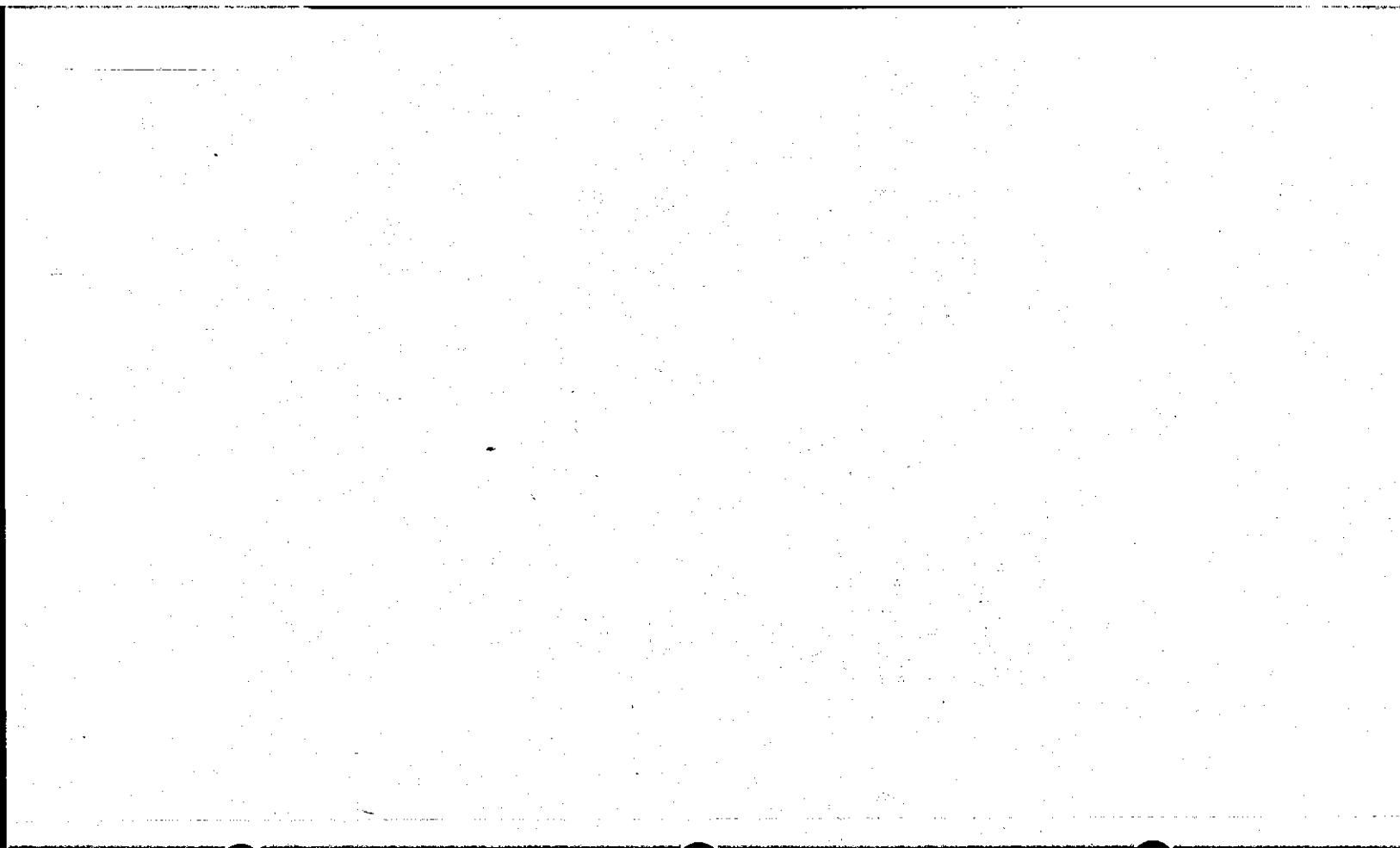
After the dynamic check is complete, the program will check the correctness of the address lines on your card. This is to insure the viability of the next part of the test.

The final part of the Memtest program will test the refresh timing of the RAMs (may be used to check for heat problems). This will show you whether or not the data is retained in the RAMs.

If at any time during testing the screen shows an inverse B, there is a problem with the card. Return it to Legend for repair.







Glossary

6502: The manufacturers name and part number of the microprocessor found in the Apple.

access: To gain entrance into the operating code of the program itself, usually for purposes of modification as contrasted to the entrance into a program which is operating. Also called access to source code.

address: A way of identifying a specific location in the computer's memory. On the Apple, an address is a number between 0 and 65535 (or \$0000 and \$FFFF hexadecimal).

Applesoft: see Floating Point BASIC.

application program: A software program designed to solve a specific problem or to do a specific job, e.g. accounts payable software. Also: applications software.

array: A group of related values the computer can manipulate as a unit. Value arrays may contain numbers and string arrays may contain letters.

ASCII: Stands for American Standard Code for Information Interchange. The standard computer code by which computers may interchange data or otherwise communicate with each other.

Glossary

Assembler: One who assembles electronic or mechanical equipment or a program which converts the mnemonics and symbols of assembly language into the opcodes and operands or machine language.

assembly language: A low level language based on the machine language computers can understand directly. This is formed from mnemonics based on the opcodes the computer executes. As opposed to higher level languages such as BASIC and Pascal which speak to the computer through an interpreter or intermediate code.

backup: An extra copy of the program or a particular version of the data. Backups may represent data bases at different points in time. Backups are kept should the original version be lost or damaged.

base: A number upon which a number system is based. Depending upon the design of a computer it may understand numbers in a base other than "tens" such as "base 2", also known as binary.

BASIC: Stands for Beginner's All-Purpose Symbolic Instruction Code. One of the most commonly used higher level languages. Often used because of the general acceptability and understanding of the language.

Glossary

binary: A number system with two digits, "0" and "1", with each digit in a binary number representing a power of two. Most computers use binary as a numbering system. A binary signal is easily expressed by the presence or absence of something, such as an electrical signal.

bit: A Binary digIT. The smallest amount of information which a computer can hold. Since there are only two choices within base 2, the digit will be either a zero or a one.

board: See peripherals.

boot: A term used to start up a computer by loading the initial instructions the computer will need to proceed in a normal manner. From "to pull one up by one's bootstraps." The process usually includes loading the operating system and either loading the higher level language or enabling its use if it is present in ROM.

buffer: An area of the computer's memory used to temporarily store information. The buffer is used to improve the efficiency of data transmissions by allowing pooling of data for rapid transmission to a faster device or as a waiting area for data going to a slower device. Data in a buffer is often lost during a break.

Glossary

bug: An error. A hardware bug is a physical or electrical malfunction or design error. A software bug is a slang term meaning an error in a program. The principle reason for program updates.

byte: A basic unit of measure of a computer's memory. This is usually 8 bits, so it may represent a value from 0 to 255. A byte is used to represent a single ASCII character.

card: Short for interface card. See peripheral.

carriage return: A term used with a printer to indicate that the print head returns to the "zero" position after printing a line. Also see RETURN key.

catalog: see directory.

character: A single letter or number stored or used within a computer.

chip: A generic term for an integrated circuit. A single piece of circuitry containing a number of different types of electronic devices in a related pattern designed to do a specific job.

clock: In a computer, a device which generates a constant frequency pulse designed to regulate the speed of all other chips within the computer.

Glossary

code: This is used as a synonym for a computer program, i.e. a programmer generates "code".

command: A character or word which causes the computer to undertake a certain specified action or operation.

computer: Any device which can receive and store a set of instructions, and then act upon those instructions in a predetermined and predictable fashion. The definition implies that both the instruction and the data upon which the instructions act can be changed. A device whose instructions cannot be changed is not a computer.

computer program: A series of commands put together for the purpose of executing a specific task.

control character: A character generated by using the control or CTRL key plus another letter. The characters have special meanings for programmers and, therefore, should only be used within an operating program when instructed. The characters are invisible on the screen but may still instruct the computer to perform a specific task.

copy: see backup.

Glossary

copyright: A legal term referring to the ownership or controlling rights of software or firmware. The copyright owner normally controls the distribution and rights of users of the copyrighted material.

CPU: Central Processing Unit. The heart of a micro computer which actually executes all calculations and controls all other devices within the computer.

CRT: Cathode-Ray Tube. A TV like display commonly used to view the output of the computer's work.

cursor: A position indicator on the CRT used to show the operator where the next screen operation will occur. On most small computers the cursor will take the form of a flashing or non-flashing box, block or line.

data: Information of any type which is entered, processed or output from a computer. It may take the form of number, letters or symbols.

data disk: a diskette which has been correctly formatted or initialized and prepared to receive data from an applications program. A diskette not designed for program storage.

Glossary

directory: A special file on a diskette which contains the names, filing locations and other data on all other files on the diskette. Diskettes without directories are not readable by the computer.

disk: A round piece of magnetically coated material used to store data. Can take the form of a floppy disk, a minifloppy disk or a hard disk.

diskette: Used to describe a floppy or minifloppy disk.

Disk Emulator: A combination of software and RAM used to simulate a real disk drive.

Disk Operating System: Also called DOS. See operating system.

display: A method of displaying information visually. Usually it takes the form of a CRT.

documentation: A written set of instructional material designed to aid the user in understanding the operation of a particular piece of hardware or software. Documentation may include internal instructions within the code of a program which assist the user in operating the hardware or software.

DOS: see Disk Operating System.

Glossary

Edge connector: A socket which mates with the edge of a printed circuit board in order to exchange electrical signals.

EPROM: Stands for Erasable Programmable Read Only Memory. ROMs which may be erased by ultraviolet light and reprogrammed.

ENTER key: see RETURN key

emulation: A mode of some computers in which they can act like a different type of computer. Emulation can be partial or total.

error message: A message to the user that an error has occurred. Sometimes the error messages are sent from the applications software and usually these messages indicate a remedy to the error. Error messages can also be sent from the operating system or high level language. These messages are usually explained in the hardware manuals along with remedies. Errors which repeat themselves every time a particular activity is attempted may be software related. Errors which occur intermittently may be hardware related.

Glossary

escaped characters: Special characters created by using the escape (or ESC) key plus another letter. The characters have special meanings to programmers and devices connected to the system. Care should be taken to avoid accidental use as they may enable some function not desired by an operating program.

execute: To carry out an instruction or series of instructions. Sometimes similar to running a program.

file: An organized group of sectors or tracks on a disk which contain data, programs, or other information the computer can bring into its memory for use by a system.

firmware: A term referring to software recorded permanently on a chip or in the form of Read Only Memory.

floppy disk: A disk storage system employing a flexible medium of storage. The normal sizes are 8" floppy disks, referred to as simply floppy disks and 5-1/4" floppy disks, sometimes referred to as minifloppy disks.

Floating Point BASIC: A type of BASIC which allows the entry, processing and output of decimal numbers. The form of BASIC most commonly used in business of scientific applications.

Glossary

formatting: A process which prepares blank data diskettes for use in storing data. The process marks the tracks and sectors with addresses which the operating system software later uses to store and locate specific information. Sometimes called initialization.

garbage: Meaningless information or data.

glitch: Also called a spike. An imperfection in the power supply from the commercial electric supplier. Can cause computers to act irradically or malfunction.

hard disk: A large capacity storage system similar to a floppy disk drive capable of high speed data storage.

hardware: A physical part of the computer as opposed to software which is compused solely of instructions to the hardware.

Hexadecimal: A number system which uses the ten digits 0 through 9 and the six letters A throught F to represent values in base 16. Each hexadecimal digit in a hexadecimal number represents a power of 16. In this manual, all hexadeciaml numbers are preceded by a dollar sign (\$).

initialization: see formatting.

Glossary

input: The transfer of data to the computer.

input/output: Called I/O for short. A general term used for equipment which allows the exchange of information between the computer and a peripheral.

instruction: A command to the computer telling it to do one specific thing.

Integer BASIC: A type of BASIC which is limited to the manipulation of integer numbers.

integrated circuit: A group of interrelated circuits in a single package.

interface: A piece of software or hardware which allows two devices to communicate with each other, e.g. peripheral cards, disk drive controllers, printers, communicating modems.

interrupt: A means of stopping computer operation in a way that allows operation to continue at a later time.

K: Stands for the Greek prefix Kilo, meaning one thousand. In common computer-related usage, K usually represents the quantity 1024 (2 to the tenth power).

Kilobyte: See K.

Glossary

Language: A computer language is a code which (hopefully!) both a programmer and his computer understand. The programmer expresses what he wants to do in this code, and the computer understands the code and performs the desired actions.

Load: To put data and/or programs into the memory of the computer.

location: A single specific place in the computer's memory where a specific piece of data or an instruction is stored.

machine language: The native language that a computer was designed to understand. Higher level languages output this language in order to cause execution of the program's instruction set.

memory: Circuitry designed to store or remember information on a controlled basis. The term is also sometimes used to describe outside devices such as diskettes which may be used to store information.

menu: A list of options displayed on the screen by an applications software package.

microprocessor: The Central Processing Unit (CPU) of a microcomputer.

op code: Also known as operation code. A specific instruction in machine language.

Glossary

operating system: The most basic form of software which manages messages between the CPU and other parts of the computer.

Pascal: A popular structured high level language.

peek: A BASIC command useful in examining the contents of a specific location of the computer's memory. Can be used by programmers to assist users in locating user errors.

peripherals: Hardware interconnected, but external, to the computer itself.

pinout: A description of the function of each pin on an IC, often presented in the form of a diagram.

poke: A BASIC command used to alter a value in a specific location in a computer's memory. Sometimes used by programmers to assist users in operating software under special conditions.

port (slot): A connection point on the hardware where a peripheral is connected. The port may require an interface of may allow the direct connection of the peripheral device.

printout: Hard copy from a printer.

Glossary

program: A set of instructions which tells the computer to do something specific.

program diskette: A diskette containing one or more applications programs designed to be booted and run in order to execute the application software contained on the diskette. Also see data disk.

programmable memory: A type of memory which can be changed from time to time as directed by the CPU.

programmer: A person who prepares software for a computer. This may include operating systems, assemblers, high level languages or applications software.

prompt: A special character used by a high level language to indicate that the user is at the command level of the language. Some prompts include the word "ready" or "OK" to additionally indicate the state of operation available.

RAM: Acronym for Random Access Memory. A type of randomly addressable programmable memory.

read: The act of obtaining information from a storage medium. Programs "read" data stored on disks.

record: A part of a file. Similar to a single address listing in a complete mailing list.

Glossary

register: A temporary memory location used by the CPU during its various operations.

reset: An operation which halts all operating programs and returns the computer to a predetermined state of operation. This operation may destroy system data, system programs, applications software or high level language currently operating depending upon "predetermined state" established during boot. Should be avoided when using applications software.

RETURN key: Also called the carriage return key or ENTER KEY. may be represented on keyboard by a left hooking arrow sign. The key is normally used by the operating software and applications software to end an input from the keyboard and "tell" the computer to act upon the information entered. The information entered may be data or a command for the computer to execute.

ROM: Acronym for Read Only Memory. A type of memory which retains its data after all power is removed from the system. Commonly used to store high level languages on the computer so that they are available immediately upon power up.

run: To start the operation of a program.

Glossary

sector: A section of a track on a disk.

slot: see port.

software: Programs or portions of programs. Coined to contrast with hardware which represents the physical equipment.

source code: The actual program written in the high level language as opposed to a form of the program furnished in a compiled or otherwise unmodifiable form.

string: A sequence of characters including letters, numbers, and symbols used in higher level languages. As opposed to numeric variables which can contain only numbers.

subroutine: A part of a program designed to serve a specific function. Usually set aside from the main program to make its repeated use more efficient.

system disk: A disk containing the necessary operating system needed to operate the applications software. Computers generally require a system disk either during boot or continuously during program operation. Data disks are usually not system disks.

track: A section of a disk.

Glossary

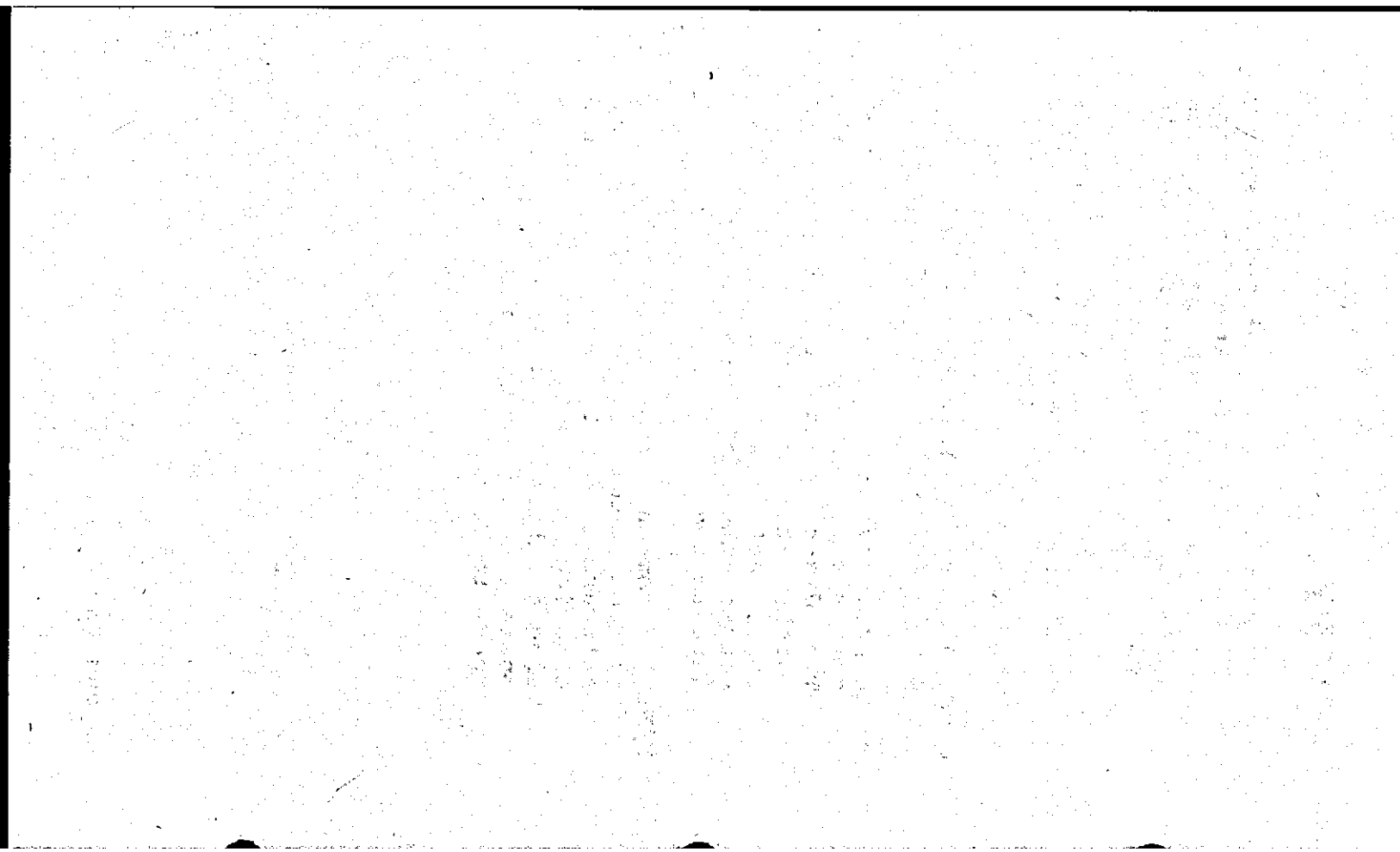
turnkey system: A packaged system designed for a specific task, including both the hardware and software needed to do the specific job.

volatile memory: The type of memory which requires power continuously to maintain its storage capability, e.g. RAM.

word: A group of characters which occupy one location in a computer's memory.

write protect: A function of most disk drives and their matching diskettes. The diskette has a slot on the side which, when covered by a piece of tape, acts as a lock. The drive senses the lock and will not write data to the diskette.

Y/N: A common form of verification request sent to the user by the software. Short for YES/NO thus allowing the user to answer with a single character whether a given operation is as it should be or needs to be changed.



Two-Year Warranty

Legend Industries, Ltd., "Legend", warrants the products it manufactures against defects in materials and workmanship for a period of two years from the date of purchase. Legend will repair (or at its option replace) at no charge, components that prove to be defective, provided the product is returned, shipping prepaid, to Legend Industries, Ltd.

This warranty does not apply if, in the opinion of Legend Industries, the product has been damaged by accident, misuse, misapplication, or as a result of service or modification by other than Legend Industries, Ltd.

No other warranties are expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Legend is not responsible for consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Return Policy

The Legend card may be returned for service or maintenance without any prior authorization. Make sure you have filled out the warranty card completely before returning any product to Legend. When returning product, be sure to include *Name, Address, City, State, Reg. No., Description of Problem and Phone Number.*

Special Notice

Before sending the warranty card read at least the first four pages of the Legend Manual.

Archived to PDF by DINO Manzella
ON 12-23-2022

VERBAL 8-25-86 3 YRS WARRANTY
FROM DATE OF MFR.

CARD SENT 8-25-86

REG. # N° 1158

