Legend E' Card Operation Manual

Legend Industries, Ltd.
P.O. Box 112
2220 Scott Lake Road
Pontiac, MI 48054
(313) 674-0953

Legend License Agreement

Legend Industries, Ltd. (hereinafter referred to as Legend) does hereby grant to CUSTOMER a non-transferable and non-exclusive license to use the Software Program(s) LEGEND provides with the hardware described in the following manual (hereinafter singularly and/or collectively referred to as "Software") on the following terms and conditions.

Software is furnished to CUSTOMER for use on a single CPU only basis and may be modified, or copied (with the inclusion of Legend's copyright notice) only for use on such CPU. The CUSTOMER shall not provide or otherwise make available the Software or any portion thereof in any form to any third party without the prior approval of Legend. Title to the ownership of the Software shall at all times remain with Legend.

Read This:

Legend Industries, Ltd. does not copy protect the software sold by Legend. The expense of copy protection versus the efforts of people to break the protection scheme do not justify themselves. We will try to maintain the no protection policy as long as you help us by saying "NO" to your friend when he/she asks for a copy.

NOTICE

Legend Industries, Ltd. reserves the right to make improvements in this manual and the product described within this manual at any time and without notice.

UPDATE POLICY

Improved or Updated versions of the Software described in this manual will be made available to the original purchaser for the difference in retail price of the new Software, if any, or a minimum $10.00 charge to cover the shipping and handling expenses. Please send your original diskette and payment when requesting a software update to Legend Industries whose address appears on the title page. Your warranty registration must be filled out for Legend to update your diskettes.

CHECK BOTH SIDES OF THE DISKETTE

DISCLAIMER

Legend Industries, Ltd. makes no warranties, either expressed or implied, with respect to this manual or with respect to the software described in this manual, its quality, performance, merchantability or fitness for any particular purpose. Legend Industries, Ltd. software is sold or licensed "as is". The entire risk as to its quality and performance is with the buyer. Should the programs prove defective following their purchase, the buyer and not Legend Industries, Ltd. (or its distributor or retailer) assumes the entire cost of all necessary servicing, repair or correction and any incidental or consequential damages. In no event will Legend Industries, Ltd. be liable for direct, indirect, incidental or consequential damages resulting from any defect in the software, even if Legend Industries, Ltd. has been advised of the possibility of such damages. Some states do not allow the exclusion or limitation of implied warranties or liability for incidental or consequential damages so the above limitation or exclusion may not apply to you.

COPYRIGHT NOTICE

* E'Card, S'Card and Slot 8 are products of Legend Industries, Ltd.
* Apple][, Apple ///, DOS 3.3, Apple Pascal, Apple FORTRAN and Apple Language Card are products of Apple Computer Inc.
* CP/M is a product of Digital Research, Inc.
* Disk Emulator and Super Emulator are Patent Pending.
* FlashCalc is a trademark of VisiCorp.

Table of Contents

Table of Contents (cont.)

Table of Figures

Table of Illustrations

Table of Tables

Table of Examples

The Documentation

The documentation that comes with this peripheral explains how the Legend E' Card is installed and how it operates. We will assume that you have some working knowledge of the Apple and know how to 'BOOT' a diskette and 'RUN' a program. If you have any problem with these commands or are just starting out, you may wish to read the Apple manual that came with the computer. You should be able to complete the installation instructions without any problem at all.

As you read this manual, you may find terms used that are not familiar to you. We do not do this to make the manual hard to read, but it is necessary to give the correct information about the product and some terms are necessary for a more complete understanding of what is trying to be said. To assist you with some of the terms that are used, we have included a glossary in the back of this manual.

The documentation is very important to a peripheral and takes alot of time to compile. We ask that you take the time to read this manual so you can use the card to the fullest extent without any problems.

In this manual there are various items covered. Both hardware and software come with the E' Card package. Read the installation instructions first. You may wish to overview the other information in the manual after you have installed the card.

Features

There are some features found on this RAM card that you may want to take advantage of when you install this card.

Some of these features are active all the time and others are active when you set the proper switch. Refer to table 1 for a list of prominent features.

Table 1. Features

64K to 1 meg additional RAM memory

16 level gray video

RGB video output with switchable positive and negative sync

Before you install the E' Card into your machine. You should examine each of these features.

Here is a very brief description of the features listed before.

1. Memory, from 64K to 1 megabyte, can be put on the E' Card using 64K or 256K RAM.

2. A nice improvment in the video output is the 16 levels of gray in black and white from the composite video connector.

3. RGB video output for high resolution monitors with both positive and negative sync pulses.

Features

When you use the Legend E' Card for interfacing to a RGB monitor, the following video modes are supported.

1. 40 column text
2. 80 column text
3. 16 color LORES graphics
4. 8 colors in HIRES
5. 16 colors in Double HIRES

It should be pointed out that in LORES you have an option of mixing 40 or 80 column text with the graphics. The same applies to the HIRES. In the 8 colors of HIRES, you should only be able to display 6 of the 8 colors on the screen. Two (2) are detectable through software.

The Legend E' Card is designed to allow you to use the resident Apple //e 80 column firmware. This allows the Legend E' Card to be compatable with the software on the market that uses the Extended 80 column.

Getting Started

The E' Card is one peripheral that will;

1) Give you 64K to 1 Megabyte of additional RAM memory.

2) Give you RGB video output.

3) Give you a composite video output that has 16 gray levels in black and white.

4) Give you 80 column text display.

Additional features may come to mind as you read on.

The RAM on the E' Card is configured as multiple, individual 64K banks of Auxiliary RAM which look like several Apple extended 80 column cards in one machine.

The E' Card is intended to be installed in the auxiliary slot in the Apple //e computer. If you are attempting to install the E' Card into another slot or another computer, it probably will not fit without a hammer and chisel.

Installation is fairly easy and can be done in a short amount of time. Read the instructions and follow the steps to install the E' Card into your machine.

The E' Card is shipped in a blue anti-static bag that protects the card from static damage in transit and when it is not in use. Do not remove the card until installation.

Getting Started

Clear a large work area so you can move the computer around and attach the necessary cables for the RGB video and composite video.

The card is large enough that you will not be able to install the card backwards.

Disconnect the externally connected devices such as your disk drives from the computer. Move the computer to the work area.

Place the computer in front of you as if you were going to type on the keyboard. If the cover has not been removed, remove it now. This can be 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.

Illustration 1. Apple //e cover

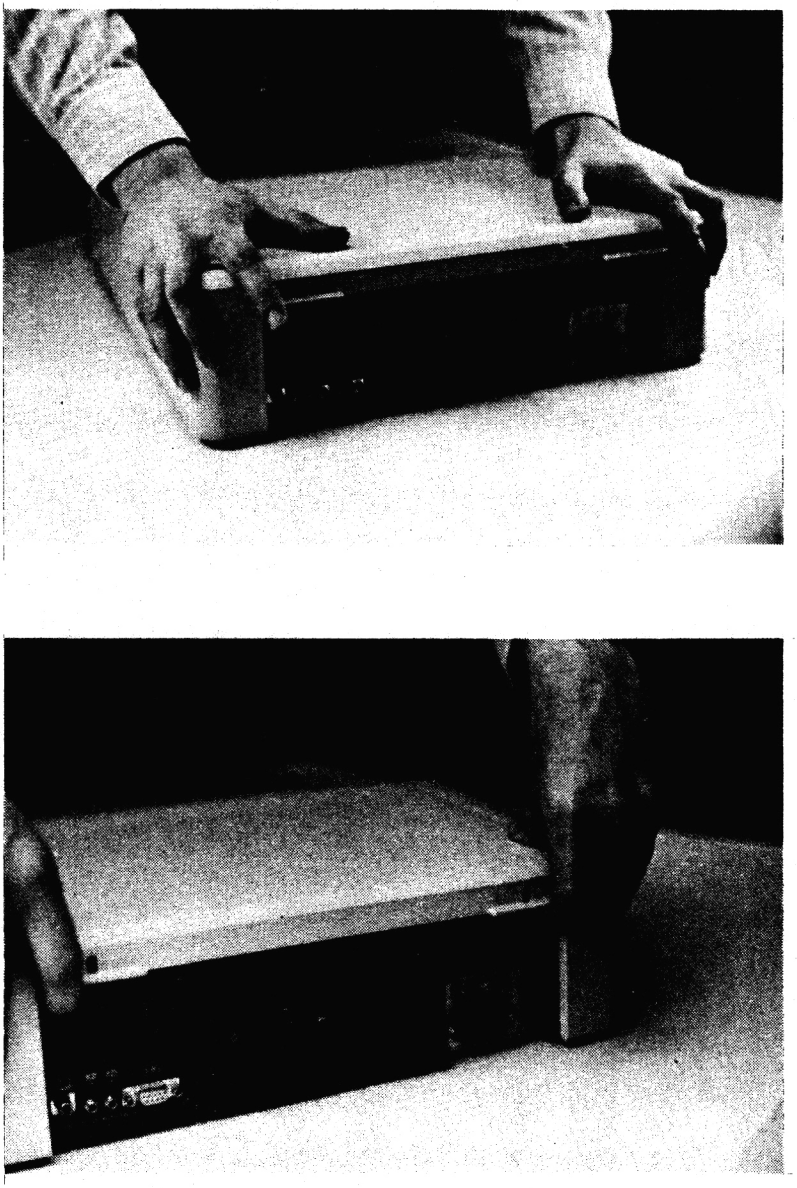
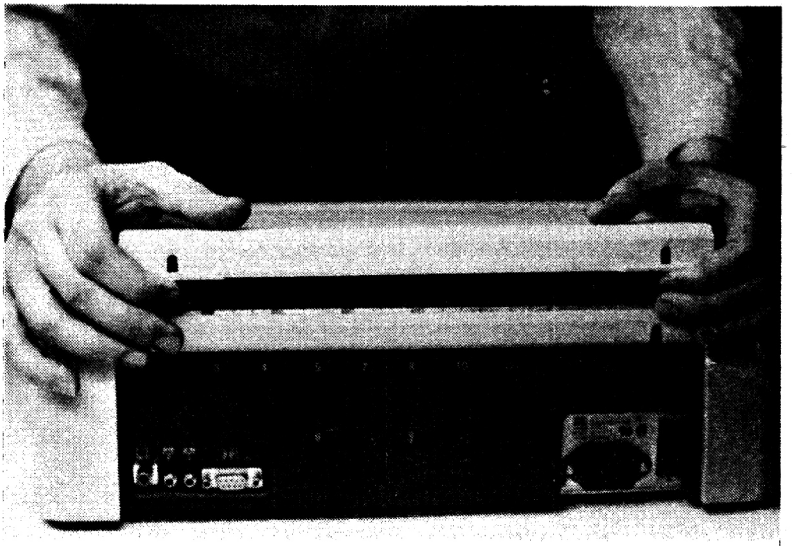
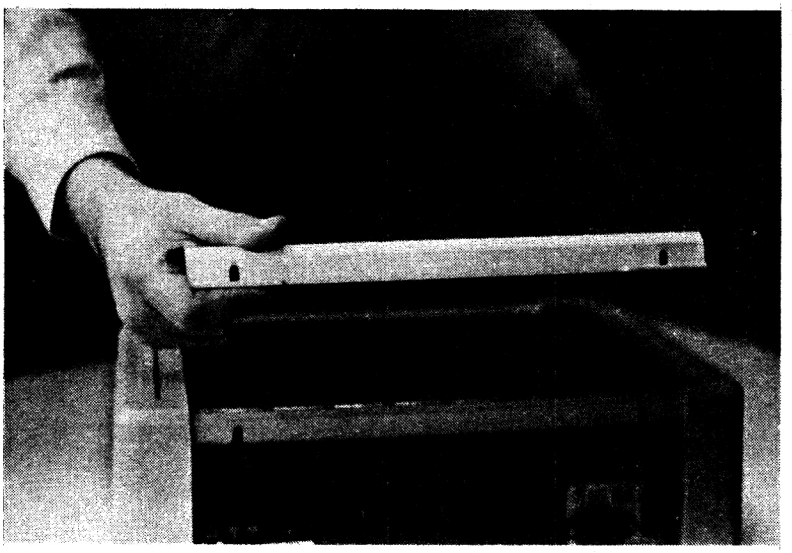


Illustration 1. Apple //e cover (cont.)

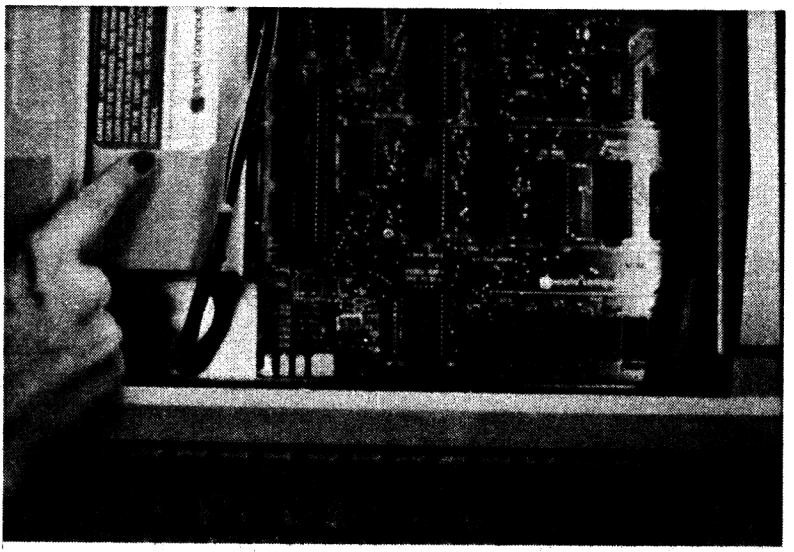




Getting Started

As you examine the inside of the Apple you will notice a gold or silver box to the left of the main circuit board. This is the power supply for the computer and the case is ground. Before we continue, we will want to eliminate any possibility of static damage to the E' Card. At this time put your hand on the power supply.

Illustration 2. Apple power supply

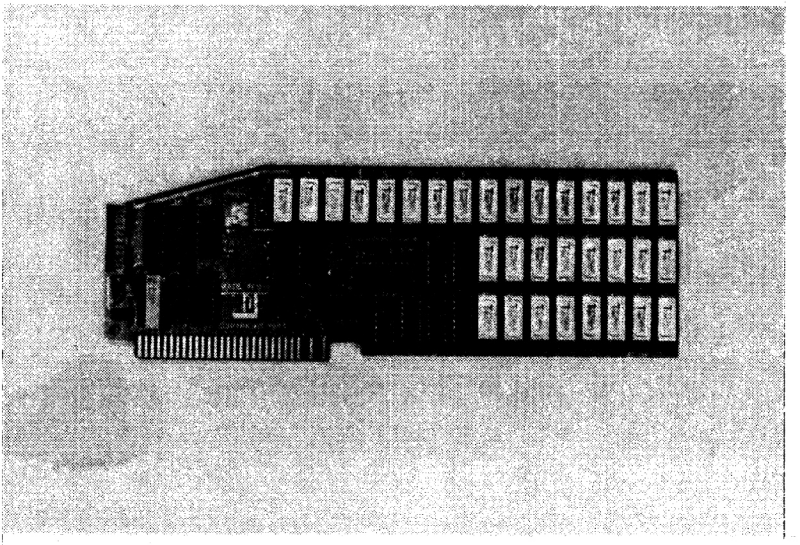


It should be pointed out that although the power cable is not plugged in, the power supply has the ability to dissipate a static charge through the ground plane in the computer.

Getting Started

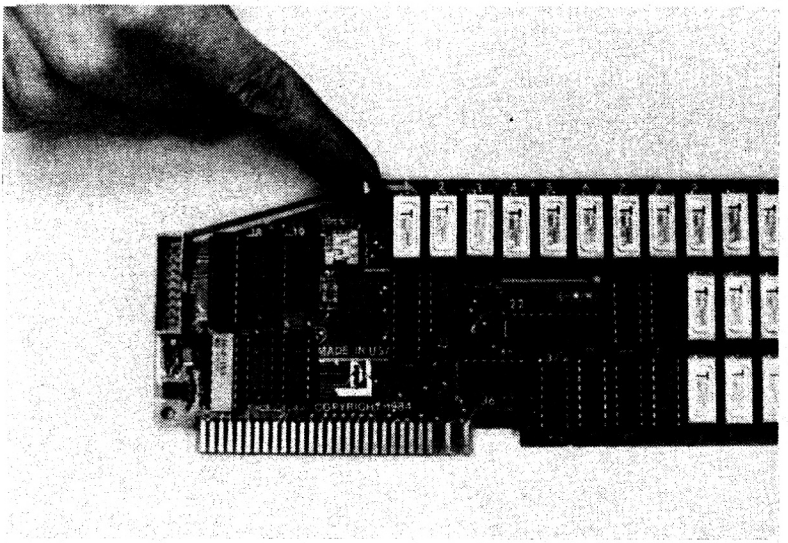
Open the anti-static bag the E' Card was shipped in and pull the card out of the bag. As you examine the card you will notice that there are up to four (4) rows of RAM. Each row is marked in the order of usage. Row A is used first and then row B and so forth.

Illustration 3. Rows of RAM

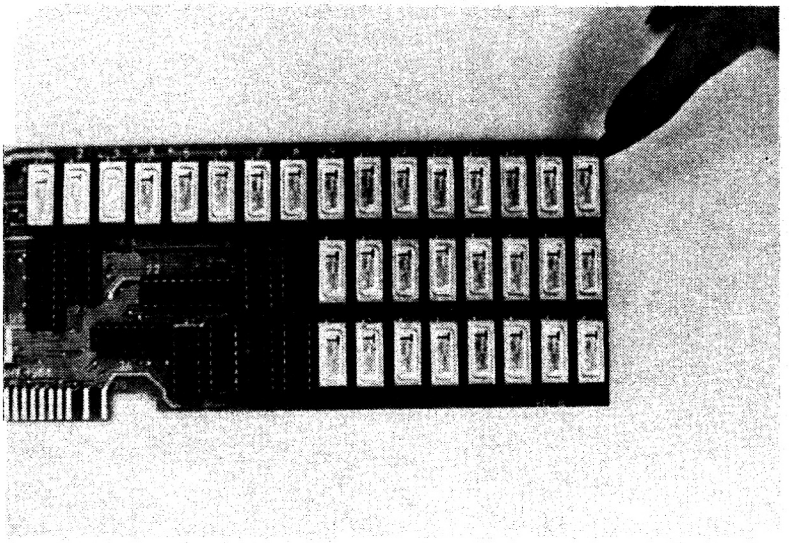


E' Card with 1 meg of RAM installed.

Illustration 3. Rows of RAM (CONT.)

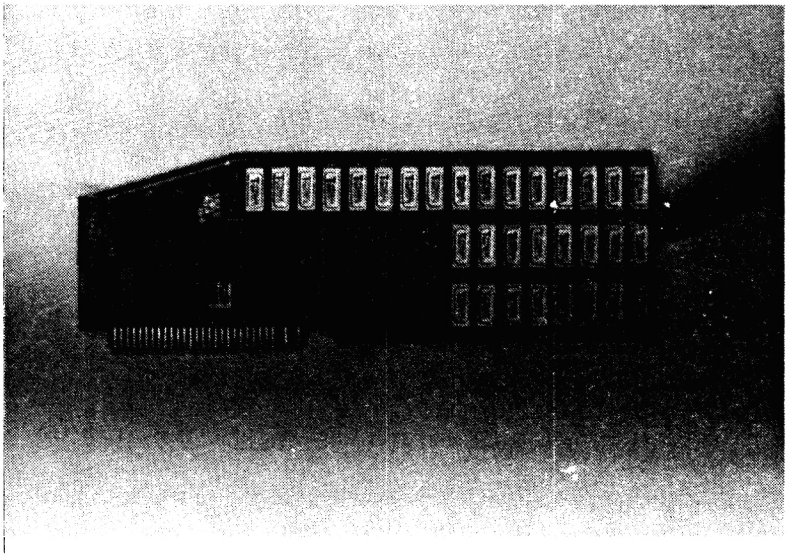


Row A

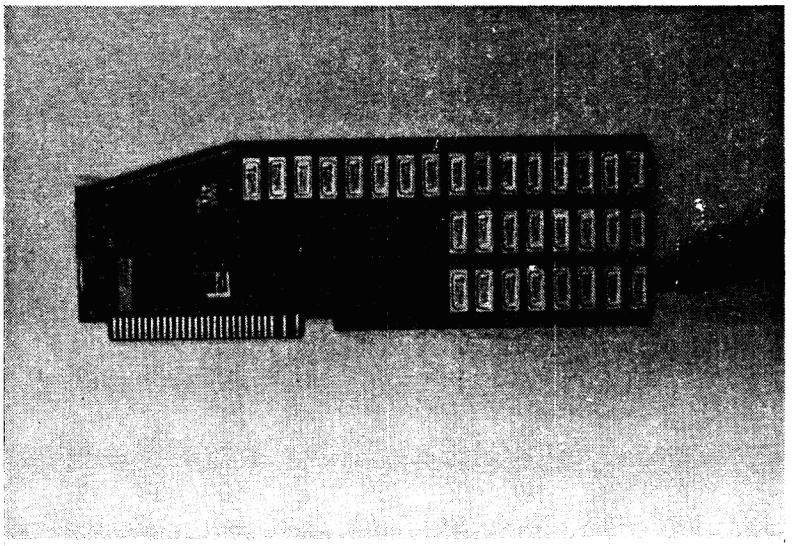


Row B

Illustration 3. Rows of RAM (CONT.)



Row C



Row D

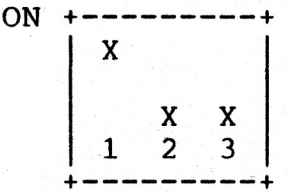
Getting Started

There will also be two (2) connectors by the edge connector that plugs into the Apple. One is the composite video connector and the other is the RGB video connector. There will also be two (2) cables that come with the card. Both of these cables mate with the two (2) connectors on the card.

The card will also have three (3) switches on it. Switch number 1 is used to replace the 'J1' jumper block you may have found on the Apple extended 80 column card (used to enable double high-res). This switch should be 'ON'. The next switch (number 2) is used to set positive or negative sync to the RGB video connector. This switch should be 'OFF'. The last switch is used to set the RAM type switching. This switch should be 'OFF' unless you are using 256K RAM chips.

For a better explanation of these switches, refer to the User Modifications section of this manual. Check the switches for proper settings.

Illustration 4. Switch settings



If these switch settings are not the same as the ones on the E' Card. Refer to the User Modiciations or Configuration section of this manual.

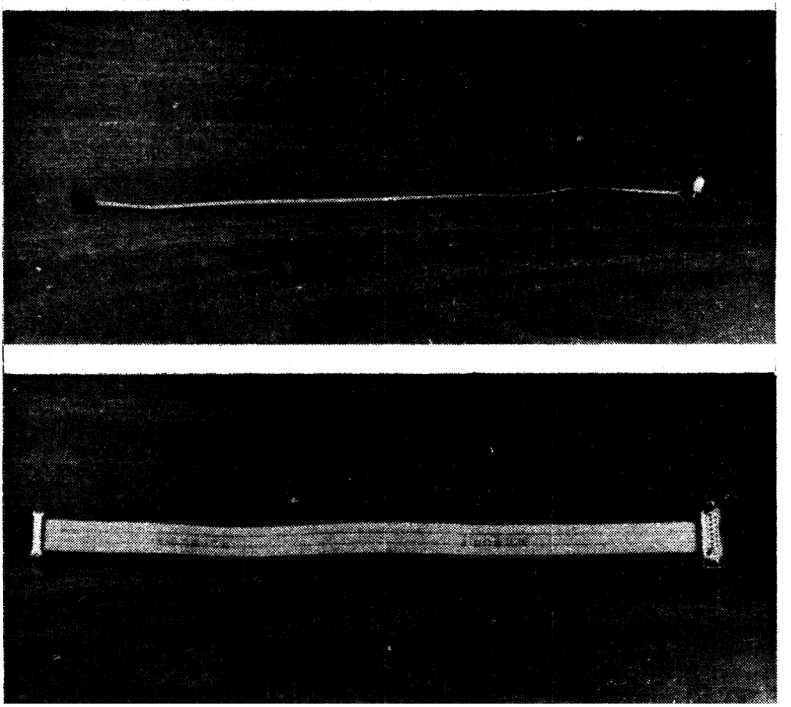
Getting Started

I will assume that you are going to install the E' Card with both cables and without changing the switch settings. If you do not want to do this, read the section called 'Configuration'.

Lay the card in front of you with the edge connector toward you as in Illustration 3. The video connectors are different enough that it would be hard to install the composite video connector on the RGB connector.

As stated before there should be two (2) cables that came with the card. One is a flat ribbon cable with a DB 15 connector on the end and the other has a RCA video jack on the end.

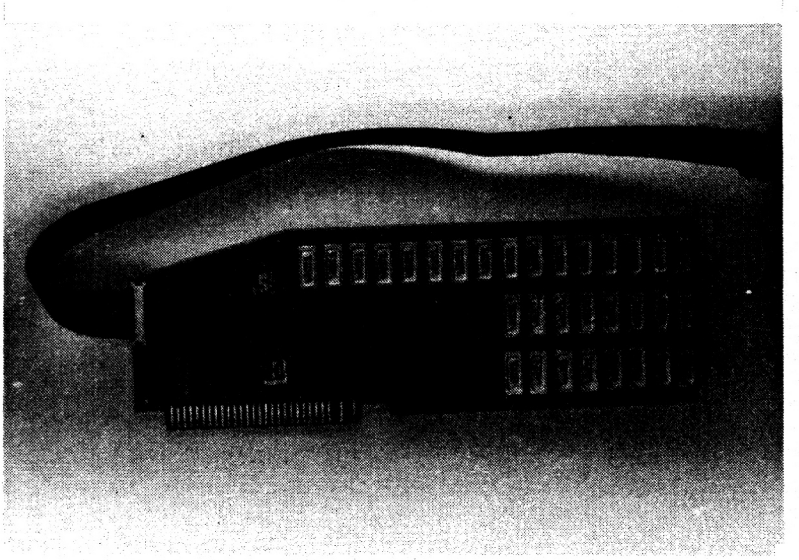
Illustration 5. E' Card cables



Both cables are polarized to prevent improper installation of the cables to the card.

Now install the RGB cable into the long connector as shown in Illustration 6.

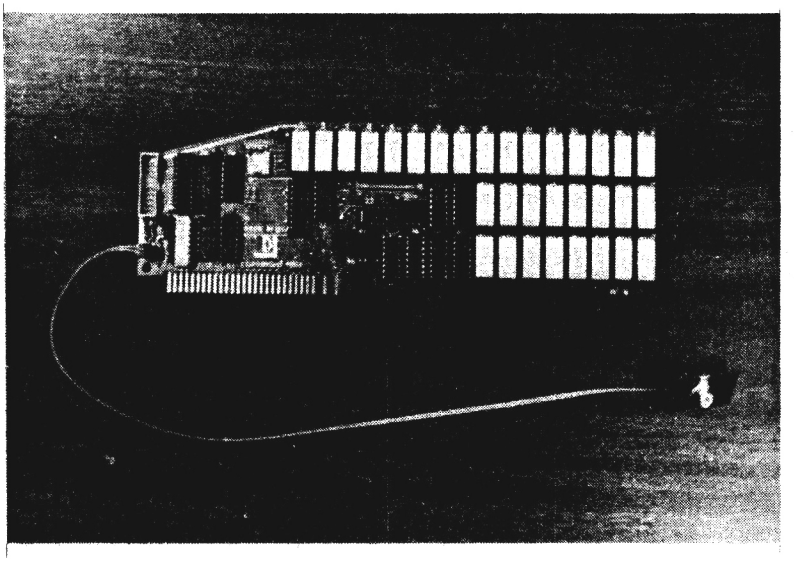
Illustration 6. RGB cable



The cable should exit to the left of the connector. This cable is long enough to reach the back plane of the //e and allow installation of the DB 15 connector at the rear of the computer.

The composite video connector is installed just below the RGB connector. This is shown in Illustration 7.

Illustration 7. Composite video



Getting Started

Now that both cables are connected to the card, it is time to install the card into the machine.

Grab the card with your right hand and match the edge connector of the card to the Auxiliary slot connector of the Apple //e. Push down on the card until it is well seated into the connector. Do not beat, hit, smash, pound or in other words force the card into the slot. If the card does not want to go into the slot, examine the connector for conflicting material such as a cable in the way.

Illustration 8. Cables installed

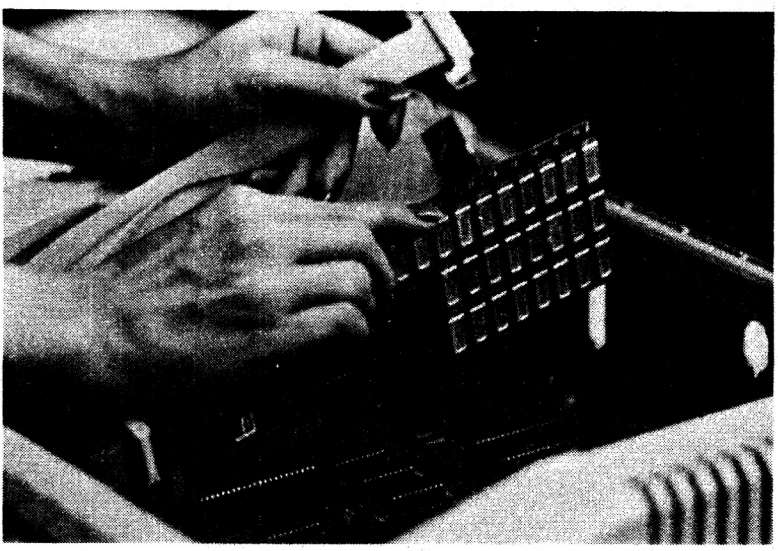
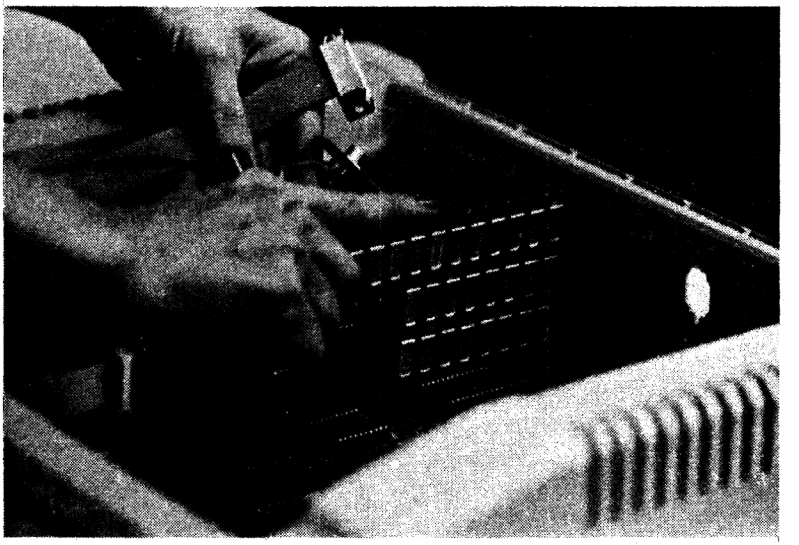


Illustration 8. Cables installed (CONT.)



Getting Started

After you have successfully installed the card into the slot, you will have to route the video cables to the rear of the machine.

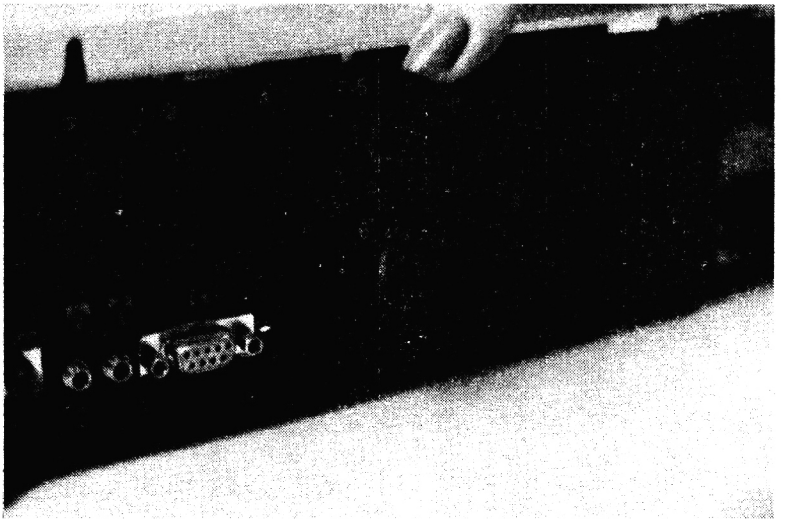
Both cables are designed to be installed into the cutouts at the rear of the //e. If you do not want to install the cables, just hang them over the back lip of the computer.

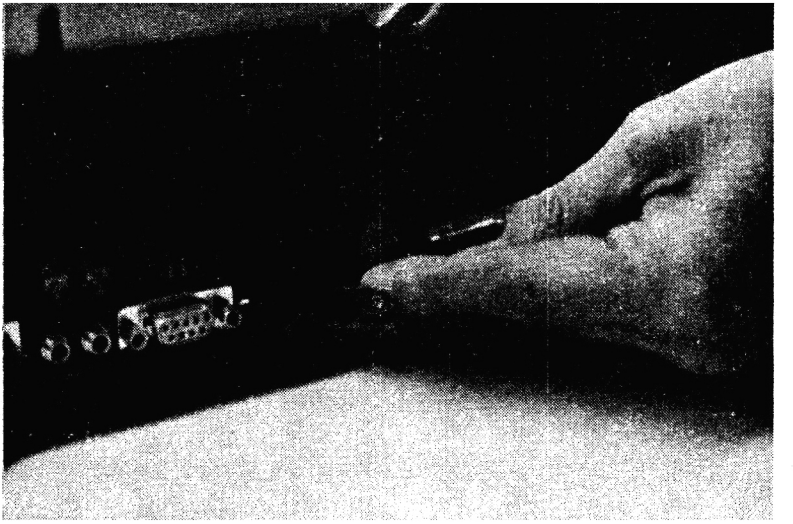
The RGB connector (DB 15) will fit into one of the four (4) cutouts back by slots five, six and seven (5,6,7).

Remove the plastic cover over the cutout of your choice by pushing the long tab down and out at the same time.

Illustration 9. Cover removal

Illustration 9. Cover removal (cont.)





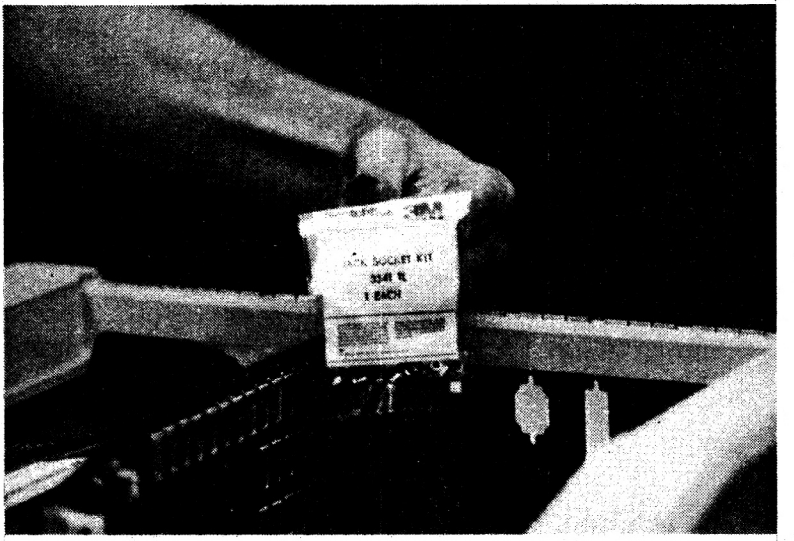
Getting Started

The cover should snap and then pop out. Do not force anything. If you can not get the cover to pop out, try another cover or seek assistance from the dealer.

The composite video connector is designed to be installed into one of the cutouts behind slots aux, three or five (0, 3 or 5) in the //e.

Both connectors are supplied with hardware that allows the connectors to be permanently mounted by inserting the supplied screws through the back of the Apple into the connector.

Illustration 10. Mounting connectors



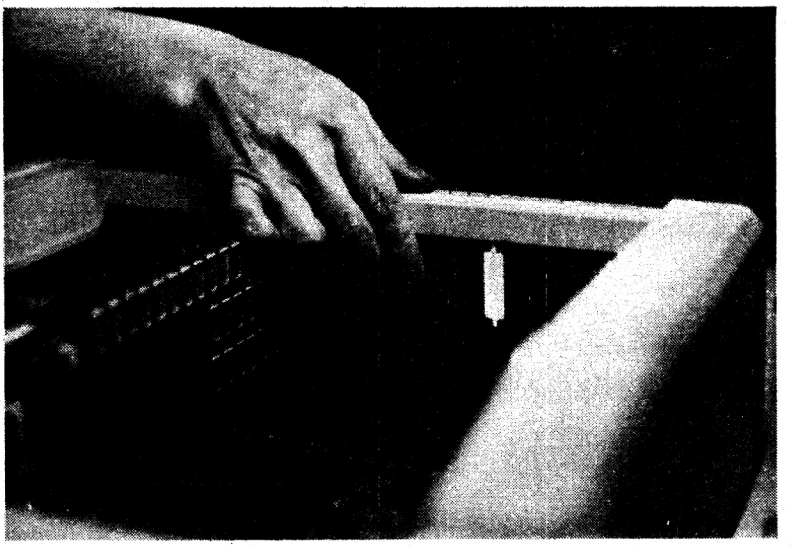
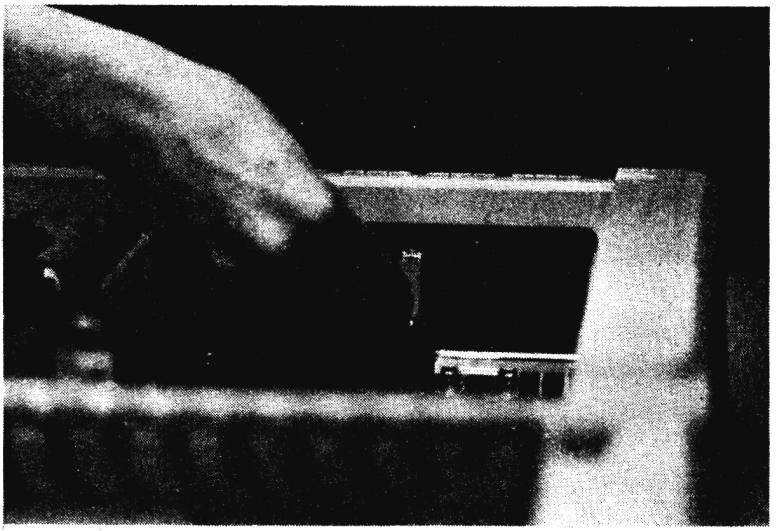


Illustration 10. Mounting connectors



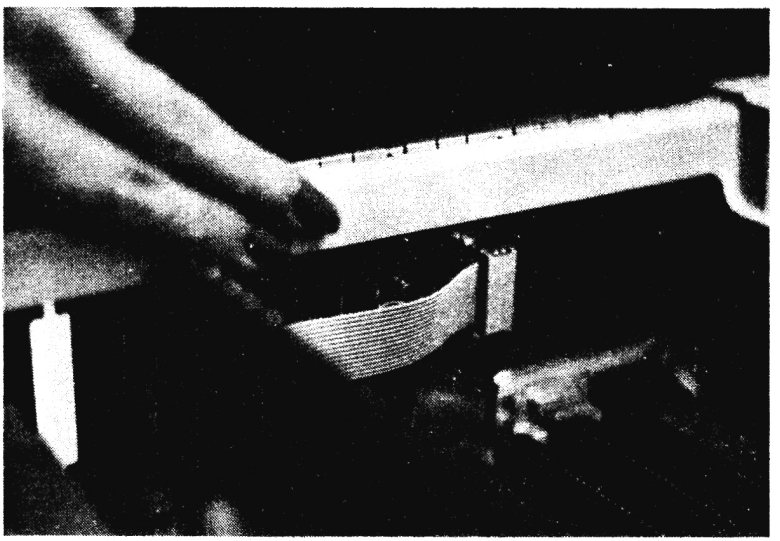
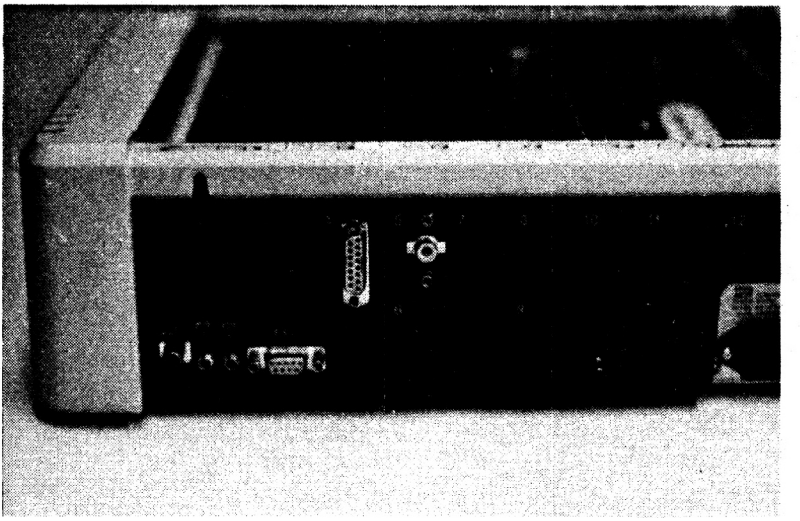


Illustration 10. Mounting connectors



Now that the card is installed into the machine and the cables are connected to the rear of the computer, you can now put your Apple back where you got it and reconnect the externally connected devices you disconnected at the beginning.

Before you completely seal up the computer and jump into another project, take the time to read the check-out procedures in the next section and try checking out the card.

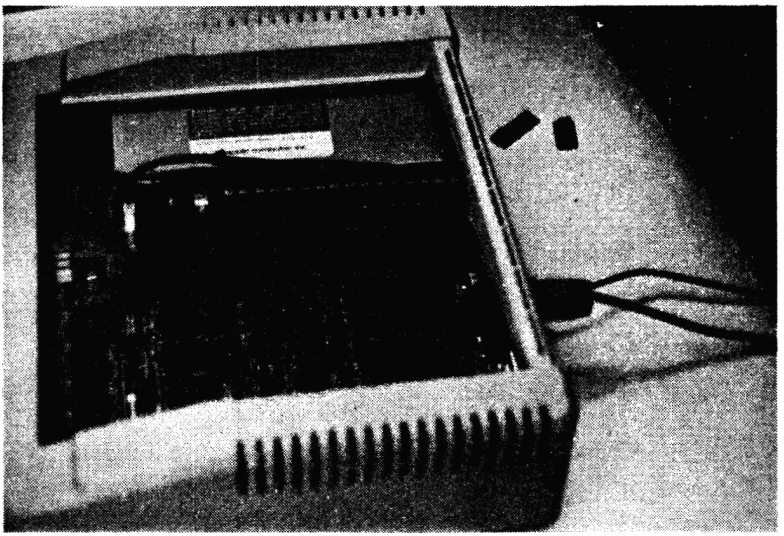
Getting Started

We at Legend Industries hope you enjoy using the E' Card as much as we do. The graphic capabilities and memory available make this card a very powerful peripheral for your machine. If you have problems with installation or any other part of this system, please feel free to call and ask questions.

(313) 674 0953

If you elected to install all of the cables and you followed the installation instructions completely, the card and computer should appear as in illustration 11.

Illustration 11. Finished installation



Checkout

Probably the easiest way to check out the card is to boot Pascal or CP/M. If you have either of these, the E' Card will be recognized as an eighty column card and in fact will display 80 columns. Pascal 1.2 will use the first row of RAM as program space.

Eighty column display is available from either the composite video output from the card or from the video output jack at the back of the computer. Both will give you 80 columns. If you have a RGB monitor connected to the RGB output, you will get 80 columns.

The card can also be used in BASIC following the instructions in example 1. The rest of the check out will be done in BASIC.

Example 1. BASIC 80

1. Turn on the Apple //e.
2. If you are booting a disk, boot DOS.
3. Make sure you are in "CAPS LOCK".
4. There will be the normal cursor.
5. Type "PR#3" to turn on the E' Card.
6. You should now have an eighty column display.

Checkout

You may wish to try typing on the keyboard or try cataloging a diskette before we continue.

To continue the check out, try switching the video connector from the video jack at the back of the computer and the composite video from the card. Both should have the same display.

After you have switched between both video outputs, try switching between 40 and 80 columns. This is done by pressing the ESC key and then 4 or 8. If you are in eighty columns, type 4 for forty columns and to switch back to eighty columns, press the ESC key again then 8.

You can completely turn off the E' Card by typing ESC CONTROL Q.

Turn the E' Card back on by typing PR#3.

If you have not loaded DOS yet, put the Legend disk into the drive and type ESC CONTROL Q and press RETURN. Now type PR#6 and boot the disk.

The menu will appear with one of the options being a memory test. The memory test is broken down into two (2) sections; one for video and the other for memory.

This is the test you will want to use to do the final test of the E' Card. Test both parts of the card, video and memory. As you use more memory the test will take longer to complete.

Memory Test

The memory test will display any errors found in the E' Card while testing. Errors are displayed as inverse 'B's. Error location as well as the error itself will be displayed at the bottom.

The memory test can be executed by typing either RUN HELLO TEST or BRUN TEST E MEMORY. The file, TEST E MEMORY, is the memory test program itself. HELLO TEST is the menu for both memory and video tests which will execute the TEST E MEMORY file on the diskette.

After the program is up and running, you will be asked a few questions to allow the program to know what is going on. The first question is relative to the amount of RAM in the E' Card. The question will ask you to select the number of banks of memory with seven (7) options available. Enter the number that corresponds to the amount of memory on the E' Card.

The next question asks if you want the test to stop if it finds an error or continue to find all the errors. Answer Y or N to this question.

Then the program will ask if you want to ring the bell if an error is found. This can be very irritating if a lot of errors are found. Answer Y or N to this question.

The program will then start to test the card. If there are no errors found, there will be a message at the bottom of the screen indicating completion.

Video Test

The video test is not as complicated as the memory test and can be executed by typing either RUN HELLO TEST or RUN TEST E VIDEO. As before, the HELLO TEST will display options for both memory and video. The TEST E VIDEO is the start of the video test itself. Video output should be taken from the composite video jack connected to the card or the RGB video output. The card will display three levels of test. One will test the 16 levels of gray, the other will test color bar and the last will test black and white resolution on a grade scale from black to white.

A complete test of the card should take about one (1) hour. If no errors are found, then you may elect to stop reading this manual now and start using the computer as you were before.

If any errors are detected, refer to the section known as PROBLEMS or call Legend direct.

(313) 674 0953

Configuration

The E' Card can be changed to accept different perameters in the machine. Those changes will be discussed in this section and will allow you to make simple changes to the card. This should not be confused with the User Modification section of this manual.

No Cables

The card can be installed without the cables supplied and used as just an extended eighty column text card. You will not have the 16 level gray video that is available from the composite video connector on the card. The card will allow eighty column display in Pascal, CP/M and BASIC.

Just RGB

The E' Card can be used as a RGB driver card for your high resolution monitor with or without the 16 Levels of gray and 80 columns. If you just want RGB output, connect just the RGB video cable to the connector on the card and plug the card in. Refer to the GETTING STARTED section for more complete installation instructions. If your RGB monitor is having problems holding horizontal or vertical sync (lines wiggling all over the screen), try switching the sync pulse. This is switch number 2.

Configuration

Cables for RGB

The cable that connects to the 16 pin connector on the Legend E' Card should be used all the time. The cable that connects the monitor to the computer must be a DB-15 connector. If the monitor you are using has a 9 pin connector (like the Amdex), then you will have to either make an adapter or get one from the maker of the monitor. Amdex provides a cable for this for a reasonable cost. The part number according to a person at Amdex, is AC-1100. Feel free to call us about this if you are having problems.

Double high-resolution graphics

By doubling the data rate that produces the 80 column display you can have 560 dots horizontally or in other words double high-res. There is a circuit that prevents the low-res graphics to crash and keeps the high-res at 280 dots. The circuit can be disabled by turning switch number 1 on. The card is shipped this way to allow you to use the double high-res graphics and the 16 levels of gray available. For more information read the section on the theory of operation.

Appleworks only

If you are using the E' Card for Appleworks without RGB. Install the card without anything attached and use the Executive Desk Top to modify a copy of the Appleworks disk.

Configuration

16 levels of gray or "Gray Video"

You can also use the Legend E' card for its graphics capabilities. The card will display 16 levels of gray from the composite video connector on the card. If you are going to use just the 16 levels, you need only to connect the composite video connector. Since the RGB connector does not have gray video capabilities, you can not use a RGB monitor with this video feature (unless a composite video input is available on the monitor also). Feel free to omit the RGB cable if all you need is the 16 levels of gray.

Appleworks

The E'Card will add memory to your Apple computer, therefore, it would only be logical to include a software program that would patch Appleworks for a greater desk top. You may have been sent a disk marked Executive Desk Top. If you want to expand the desk top of Appleworks, you need this program. If you don't have this program, then call your dealer or Legend.

The program is very easy to use and does not need a long explanation in order to use it.

It should be noted that the program you have may not use all of the RAM in the machine. This is possibly due to the programs usage of the RAM (with a 128K machine, you will only get 55K). The other reason may be due to the programer that is writing the interface routine for the extended memory found in the E' Card and the Appleworks program.

START

To start the program, boot the disk marked 'Executive Desk Top'. The screen will come up in 80 columns and give the necessary copyright notice. There will be a brief discription of what the program will do to your Appleworks startup disk. After you read the instructions on the screen, you will be prompted to put a COPY of your Appleworks startup disk into drive 1 and press return. Please remember to use only a copy of your Appleworks startup disk.

Appleworks

The program will modify the startup disk to allow you to use the additional memory on the E'Card.

All you have to do now is boot the modified Appleworks disk and you are off and running. There will be a larger amount of RAM (K) available for desk top usage.

It should be pointed out that there is no advantage in using the Executive Desk Top program with a 128K machine. That is to say, there is no point in using the Executive Desk Top program to give you the same 55K that you would get if you simply booted the Appleworks startup disk.

If you received the E'Card with 64K and already have an extended 80 column card with 64K on it (if you have a 128K machine from Apple), remove the 80 column card from the Auxiliary slot. Now remove the RAMs very carefully as you do not want to bend any of the pins of the RAMs. Please note the polarity of the RAMs (this is designated as either a notch or a dot at one end of the chip). All of the RAMs must be installed into the E'Card the same way. As you examine the E'Card, there will be empty sockets in the next usable row of memory. Insert the eight RAMs you removed from the extended 80 column card into the eight empty sockets designated as row 'B'.

Appleworks

Please note the polarity of the RAMs as you install them. The notch should match the notches of the other chips on the card. If this turns into a major mess, feel free to contact Legend for assistance.

This whole procedure is covered in the User Modifications section of this manual.

After you have installed the RAMs from the extended 80 column card into the E'Card, you can install the card into the machine. Refer to the installation instructions if you have problems installing the E'Card into the machine. Make sure you test the card with the memory test before you go on to use the card with Appleworks. Remember that now the card has 128K of memory on it and you now have a 192K machine.

If all is well with the memory test and you have booted the modified startup disk for Appleworks, you will have 100K (or thereabouts, some machines show 101K) of desk top.

The Appleworks program will be improved upon, and as it is improved, so will the 'Executive Desk Top'. Please call for more information on being updated.

(313) 674 0953

Theory of Operation

The E' Card has the ability to give the computer 64K to 1 Megabyte of RAM memory. On the E' Card, this is known as Auxiliary memory. It is equal to several extended eighty column cards on one card. Each one of the banks of memory is selected by use of a bank register and a common strobe ($C071).

The E' Card also has the ability to display black and white video with 16 levels of gray. The image enhancement is significant enough to produce near photo quality pictures from within Apple memory.

One other ability of the E' Card is the RGB video output. The video connector is intended to be used with a Taxan or Apple Hi-res monitor.

This section of the manual will be divided into smaller sections that allow you to read of one feature or another without reading the whole section.

A brief introduction

Memory management is a term used very often and is never explained. It is a term that describes the ability of a program/machine to control memory. In the //e the processor can only address 64K of RAM at any one time. To enable the computer to access more memory, bank switching is used to switch more memory in and out of the same address space. This is controlled by the Memory Management Unit in the computer.

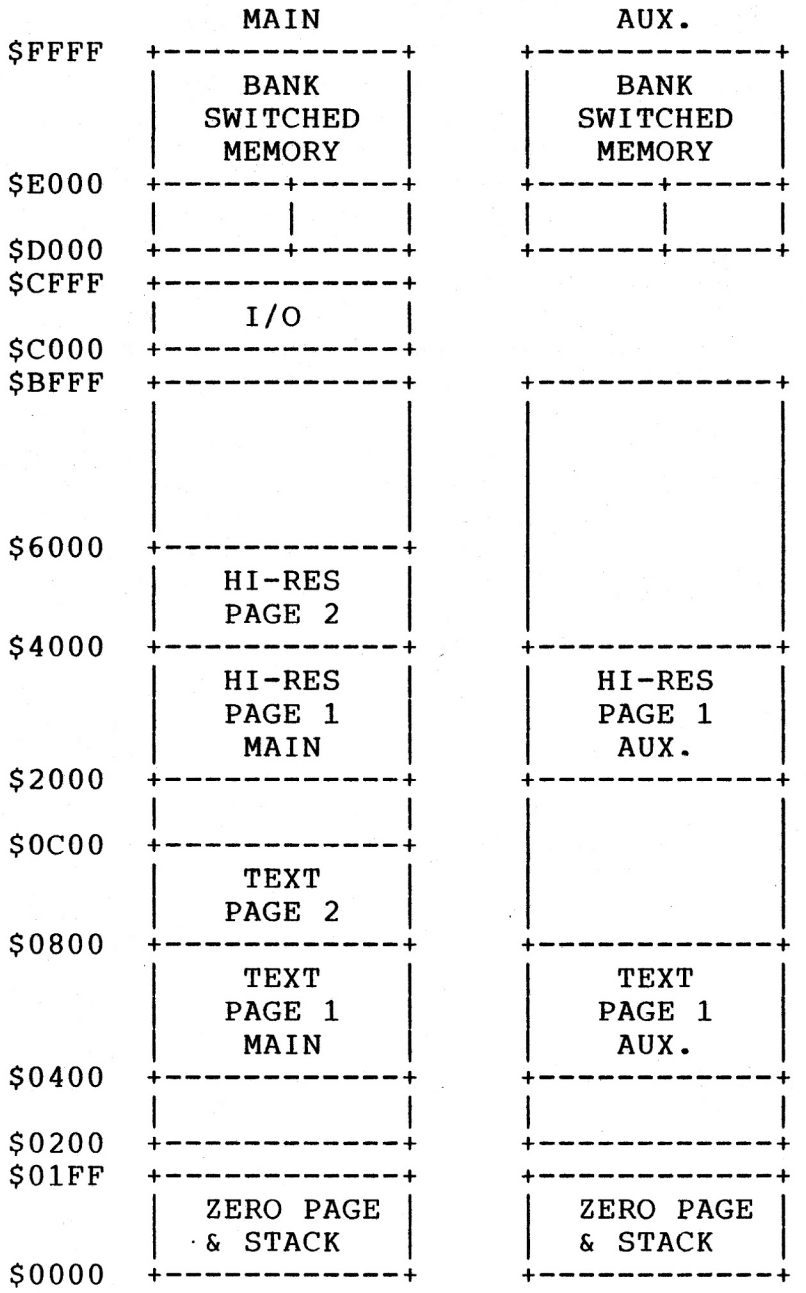
Theory of Operation

For the most part, the 6502 is designed for 64K operation and all of that 64K is taken up by the computer in its base form. The E' Card adds memory by making 64K chunks avaliable in a parallel address space. See figure 1 for a memory map.

The map shows the "48K" Apple and the added "16K LANGUAGE CARD" is paralleled almost completely with a few exceptions. Notice that there is no I/O space on the extended memory. There is only one (1) page of Hi-Res and Text in the Auxiliary memory. Normal memory pages are for the most part 256 bytes long. The exception is the Text pages (1024 bytes) and the Hi-Res pages (8192 bytes). In the double Hi-Res mode 16K of memory is being used.

Theory of Operation

Figure 1. Memory map

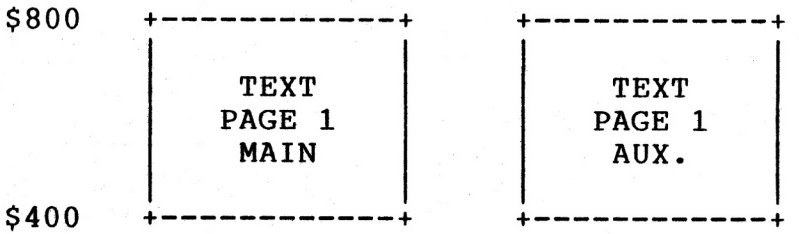


Theory of Operation

80 Columns

The eighty column display is generated by putting half of the charactors in the extended memory on the E' Card and the other half on main memory. Both reside in the $400 to $7FF address space (first text page). When the Apple is in 80 columns, the data from the display buffers is loaded onto the video display buss at alternating clock cycles. First we grab a byte from the Auxiliary memory buffer, then a byte from the main memory buffer. This comprises the 80 column display. All the charactors in the even columns on the screen are from the Auxiliary memory and all the charactors in the odd columns are from the main memory. Refer to the memory map in figure 2 for a comparison.

Figure 2. 80 Column memory



Theory of Operation

80 Column

There are two (2) pages of memory in the same memory address space that makes up the 80 column display. The 80 column display is controlled by soft switches that switch between the two (2) pages.

The 80 column display can be activated with the normal "PR#3" from within BASIC. The 80 column display also has some soft switches that allow you to do other things with the 80 column display. Soft switches are usually made up of three (3) memory locations that allow you to turn on, turn off and read the status of a given soft switch. Think of a soft switch as a light switch in your house, if the switch is on, the light is on. If the switch is off, the light is off and you can tell the status of the switch by looking at it. Thus, you have covered all three (3) possibilities of the switch. Refer to table 2 for soft switches that you can use from BASIC or from the keyboard. These are switches that require NO poking or peeking, but can be used from within BASIC.

Theory of Operation

80 Column

Table 2. 80 column soft switches

ESC CONTROL-Q	Deactivates 80 col.
ESC-4	Switches from 80 col. to 40 col.
ESC-8	Switches from 40 col. to 80 col. only after the card is active.
CONTROL-RESET	A drastic way of turning off the 80 column display.
ESC-R	Enables the uppercase restricted feature in the 80 col. display.
ESC-T	Turns off uppercase restricted
CONTROL-N	Sets display normal. Works only with the card active. Only works from within a program.
CONTROL-O	Sets display inverse. Works only with the card active and from within a program.
CONTROL-Q	Sets display to 40 col. only if the card is active. Only works from within a program.

Theory of Operation

80 Column

Table 2 (cont)

CONTROL-R	Sets display to 80 col. only if the card is active and from within a program.
CONTROL-U	Deactivates 80 col., homes and clears screen. Works only if the card is active and from within a program.

Some of these soft switches are setable only from within a program. In the case of these switches, you must supply the necessary ASCII code for the switch you are using. See example 2 for more help. You may wish to refer to the section called 'CODES' in this manual.

Example 2. ASCII code in program

```
10  PRINT CHR$(17):PRINT "THIS IS 40
    COLUMNS"

20 FOR I = 1 TO 1000: NEXT I

30  PRINT CHR$(18):PRINT "THIS IS 80
    COLUMNS"
```

80 Column

In example 2, CHR$(17) is the ASCII code for CONTROL-Q which turns off the 80 column display. Then we do a time loop in line 20 to pause for screens. The CHR$(18) is the ASCII code for CONTROL-R which will turn on the 80 column display.

The locations for the soft switches that control the modes of display and aux memory are shown in table 3. Unlike the soft switches described before, these locations can be addressed from within machine code or from within BASIC using POKES and PEEKS. Certain soft switches have to be accessed in a certain way to enable that function to be completed. For example, you must read $C01A (PEEK (49178) or PEEK (-16358)) to obtain the present status of the text or graphics mode soft switch. These soft switches cover text, graphics, and aux memory usage.

Table 3. More soft switches

RAMRD

$C003	49155	-16381	Write to this address location to turn on the 'READ AUX. 48K' switch.
$C002	49154	-16382	Write to this address location to turn off the 'READ AUX. 48K' switch and read main memory.

80 Column

RAMRD

$C013 49171 -16365 Read this address to tell the status of the RAMRD switch.

RAMWRT

$C005 49157 -16379 Write to this address location to 'WRITE ENABLE AUX. 48K'.

$C004 49156 -16380 Write to this address location to turn off the 'WRITE ENABLE AUX. 48K' and turn on main memory.

$C014 49172 -16354 Read this address to get the status of this switch.

ALTZP

$C009 49161 -16373 Write to this address location to turn on the aux. stack, zero page and language card memory.

$C008 49160 -16374 Write to this address location to turn off the aux. stack, zero page and language card memory and turn on main memory.

$C016 49174 -16352 Read this location to get the status of this soft switch.

Theory of Operation

80 Columns

80STORE

$C001 49153 -16383 Write to this address location to turn on the '80STORE' switch.

$C000 49152 -16384 Write to this address location to turn off the '80STORE' switch.

$C018 49176 -16360 Read this address to get the status of the '80STORE' switch.

80COL

$C00D 49165 -16371 Write to this address location to turn on the 80 column display.

$C00C 49164 -16372 Write to this address location to turn off the 80 column display and turn on the 40 column display.

$C01F 49183 -16353 Read this address to get the status of the '80COL' switch.

TEXT

$C051 49233 -16303 Write to this address location to turn on the text display.

Theory of Operation

80 Column

TEXT

$C050 49232 -16304 Write to this address location to turn off the text display and enable the graphics display.

$C01A 49178 -16358 Read this address to get the status of the 'TEXT' switch.

MIXED

$C053 49235 -16301 Write to this address location to allow you to mix text with graphics.

$C052 49234 -16302 Write to this address location to turn off the mixed mode and turn on the full graphics.

$C01B 49179 -16357 Read this address to get the status of the 'MIXED' switch.

PAGE2

$C055 49237 -16299 Write to this address location to turn off display page 1 and turn on display page 2.

Theory of Operation

The card is simple to use in the 80 column display mode and can be controlled from both the keyboard and from within a program. In table 4 there is a complete (as complete as we can tell) list of the CONTROL and ESC codes that work with the E' Card.

You may come to the conclusion that it may be possible to have two (2) or more programs resident in the computer at the same time. This is very possible considering the address range the memory covers. We have done this in BASIC. The problem arises when the BASIC interpreter tries to retrieve information from areas in main memory such as zero page or the processor stack.

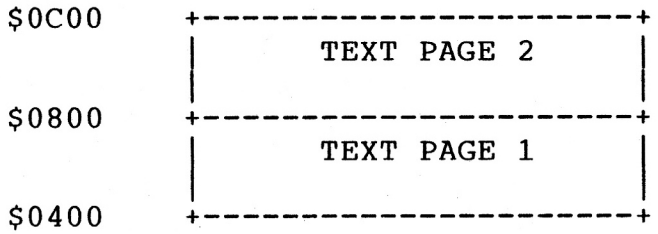
It should be pointed out that the E' Card will always go to bank zero (0) for video refresh. Every video refresh cycle (phase zero) the card is switched to bank zero (0). That means, if you are in bank four (4) and you output anything to the screen, you must go to bank zero (0) for proper screen output. Remember, this is for screen output only. If you do not need to change the information on the screen, you can stay in the bank that you are using.

Theory of Operation

40 Column

The data for the video display is stored at locations in memory known as display pages. The display pages reside at 1024-2047 ($400-$7FF) and 2048-3071 ($800-$BFF) in main memory. These pages are for 40 column display and Low-Res graphics. Refer to figure 3 for a memory map of the 40 column display.

Figure 3. 40 column map



Theory of Operation

16 Level Gray (Gray Video)

The E' Card can display 16 levels of black and white video (color possibly later this year) giving the Apple to display almost photographic quality images from within Apple memory.

Due to the manner in which the Apple //e handles serializing the data stream from the hires buffer, there is a minor hassle with bit slippage. This is due to Apple not clocking out the high bit of each byte from the buffer to the serial output found at the Aux connector. The pattern of slippage is shown in Table 5.

Table 5. Bit Slippage

DOUBLE HIRES	STANDARD HIRES	GRAY VIDEO
0) Xyyy zzzz	Pxxx yyyy	Xyyy zzzz
1) Xyyy zzzz	Pyyy zzzz	Xyyz zzzy
2) Xyyy zzzz	Pyyy zzzz	Xyzz zzyy
3) Xyyy zzzz	Pyyy zzzz	Xzzz zyyy
4) Xyyy zzzz	Pyyy zzzz	Xzzz yyyy
5) Xyyy zzzz	Pyyy zzzz	Xzzy yyyz
6) Xyyy zzzz	Pyyy zzzz	Xzyy yyzz
7) Xyyy zzzz	Pyyy zzzz	Xyyy yzzz

In the Double Hires section of Table 5, the X represents the bit that is ignored by Apple.

In the Standard Hires section of Table 5, the P represents the bit that selects the color pair.

In the Gray Scaled section of Table 5, the X represents the bit that is NOT clocked out of the video stream.

The slipping bit is obvious in Table 5 and easily compensated for thru software.

Bank switching

The E' Card is several extended 80 column cards folded over each other. Since the card is addressed in blocks of 64K, it is necessary to switch a bank of memory out and switch another bank of memory in. This can be done in machine code by using the bank switch address of $C071 followed by the bank number.

For example, if you are in bank 1 and you want to go to bank 2, you will have to do a LDA # 2. Then you would have to STA $C071 to switch the banks. Now the E' card has bank 2 active or switch in for access.

There are some things to keep in mind as you bank switch. The whole 64K of address space is being switched out so there will be nothing in the zero page and in the 12K Language card space. Although you may be in a bank other than 0, the screen output (video refresh) is always revolving around bank zero (0). This means that in 80 col. video output, you must switch to bank zero for charactor output. Because it is possible to overlap banks, be careful when counting the number of banks found from within a program. Use a pattern or progression that will be detected if an overlap occures.

User Modification

Adding RAMs to the E'Card

As you are aware, the E'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. The RAMs on the extended 80 column card will work just fine for adding an additional 64K of memory. A total of 256K can be added with 64K RAM chips.

The E'Card is designed to use both the 64K RAMs and the 256K RAMs. The E'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 E'Card can be very powerful. To accomodate the 256K RAMs it is necessary to set a switch on the card (switch number 3). Refer to the paragraphs under 'Adding Memory' in this section for the modification.

Using 64K RAMs

1 row of RAM = 64K
2 rows of RAM = 128K
3 rows of RAM = 192K
4 rows of RAM = 256K

Using 256K RAMs

1 row of RAM = 256K
2 rows of RAM = 512K
3 rows of RAM = 768K
4 rows of RAM = 1Meg

User Modifications

Adding Memory

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 acheive 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 E'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 4. These are manufacturers that Legend has tested and found compatable with the card.

Figure 4. RAM Manufacturers.

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

User Modifications

Figure 4. RAM Manufacturers (cont.)

Typical Part numbers include;

256K	HM50256-15
64K	TMS4164-15
256K	D41256C-15
256K	41256-15

and most 150 ns RAMs

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 holes 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 E'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 5 and 6 for a pinout). Because of this, it is necessary to remove the old 64K RAMs before inserting any 256K RAMs. There is also a switch (switch number 3) that you must set 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, you 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 set switch 3 to the on or closed position. The switch can be set with a pencil or pen. If you do not set the switch to the proper setting for the type of RAM in the E'Card, you may end up with a card that is not usable at all. Please be careful.

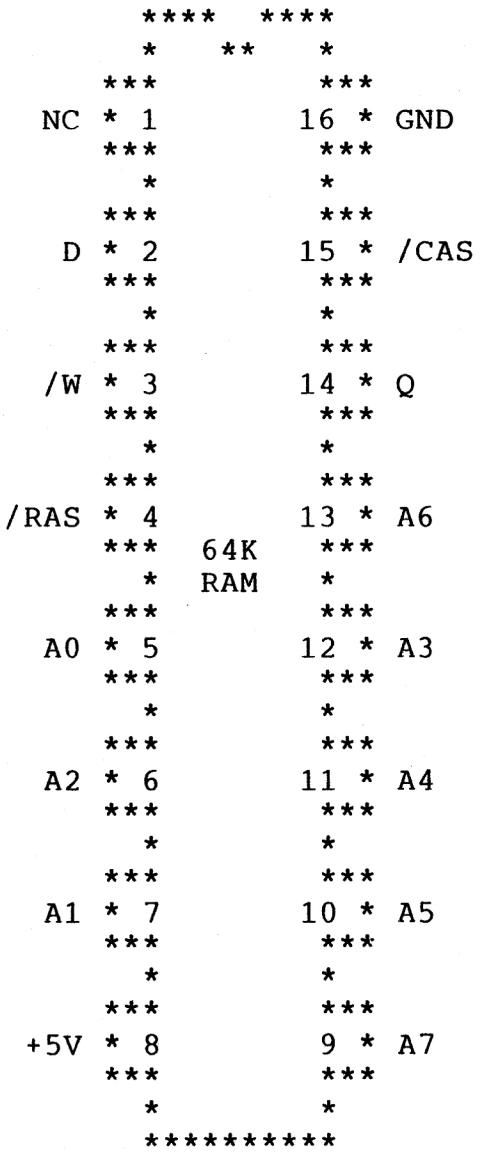
User Modifications

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 5 and 6, 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 funtion in 256K blocks instead of the 64K blocks necessary for the 64K RAM parts. If you don't change the switch, the board will act just like it has only 64K parts in it. The card will fail the memory test if the switch is set wrong. You will not be able to fully utilize the 256k RAMs. We suggest you test your board after you have completed this change.

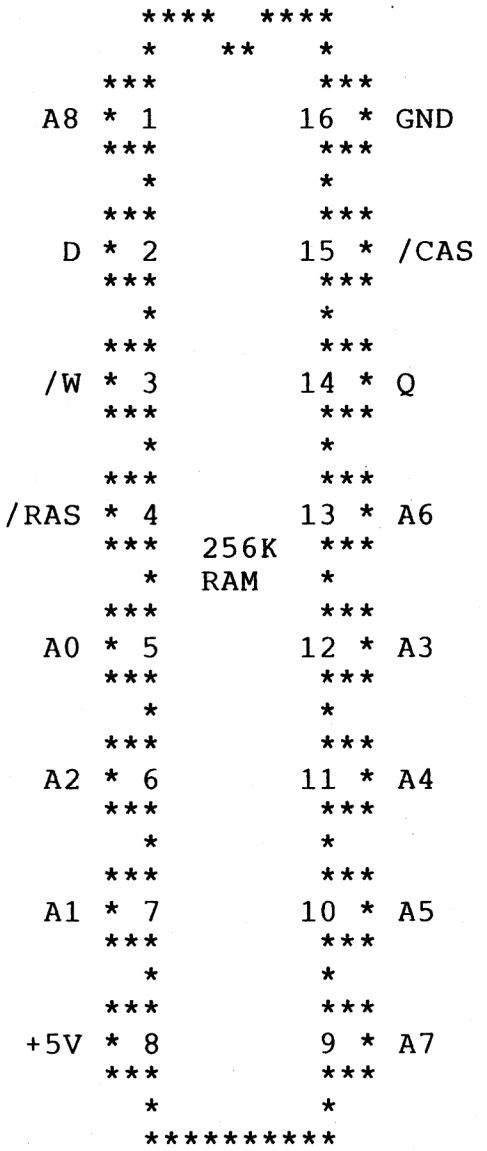
User Modifications

Figure 5. 64K RAM pin outs



User Modifications

Figure 6. 256K RAM pinouts



User Modifications

In short, the upgrading of your E'Card to 256K RAM parts is a relatively simple process. You must be careful when handling the parts so you don't accidently destroy the RAMs and you must make the modification to the board (set switch number 3) to allow it to utilize the 256K parts. We hope you will enjoy the capacity which the higher density RAM parts have to offer.

Monitor Sync

You may elect to use the RGB video interface on the E'Card with your high-res monitor. If you are doing this and are getting bad video (squiggly lines or scrambled images), try setting the sync on the E'Card. This can be done by setting switch 2 from one position to the other. If the switch is on or closed then the sync signal from the Apple is inverted (opposite of). If switching the sync does not improve the image on the screen, try adjusting the monitor.

Double Hires

By doubling the data rate that produces the 80 column display you can have 560 dots horizontally or in other words, double high-res. There is a circuit that prevents the low-res graphics from crashing and keeps the high-res at 280 dots horizontally. The circuit can be disabled by setting switch to the on or closed position. The 16 levels of gray, what we call gray video, requires the switch to be on or closed.

User Modifications

Apple Extended 80 Column Card

If you have the Apple extended 80 column card you can add the RAMs from the Apple card to the E'Card. This is a very simple process and can be carried out by almost anyone. The first thing to do is remove the Apple extended card from the machine with the power off. After the card is out of the machine, remove the RAMs from the card and install the chips into the E'Card. Please orientate the notch of the chips so they follow the same pin 1 convention as the rest of the chips on the card. Now install the E'Card into the machine. If you have problems with this, refer to the install section (Getting Started) of this manual.

User Codes

A brief explanation of this section is required. This section of the manual is used for programming or reference of facts relative to the Apple computer and the memory in it. Most tables have no indepth definition.

Table 6. ASCII Codes

Value	Char	Chr$	Hex	Notes
000	^@	0	$00	NUL
001	^A	1	$01	SOH
002	^B	2	$02	STX
003	^C	3	$03	ETX
004	^D	4	$04	EOT
005	^E	5	$05	ENQ
006	^F	6	$06	ACK
007	^G	7	$07	BEL
008	^H	8	$08	BS
009	^I	9	$09	HT
010	^J	10	$0A	LF
011	^K	11	$0B	VT
012	^L	12	$0C	FF
013	^M	13	$0D	CR
014	^N	14	$0E	SO
015	^O	15	$0F	SI
016	^P	16	$10	DLE
017	^Q	17	$11	DC1
018	^R	18	$12	DC2
019	^S	19	$13	DC3
020	^T	20	$14	DC4
021	^U	21	$15	NAK
022	^V	22	$16	SYN
023	^W	23	$17	ETB
024	^X	24	$18	CAN
025	^Y	25	$19	EM
026	^Z	26	$1A	SUB
027	^[	27	$1B	ESC
028	^\	28	$1C	FS

User Codes

Table 6. ASCII Codes (cont.)

Value	Char	Chr$	Hex	Notes
029	^]	29	$1D	GS
030	^^	30	$1E	RS
031	^_	31	$1F	US
032		32	$20	SPACE
033	!	33	$21	
034	"	34	$22	
035	#	35	$23	
036	$	36	$24	
037	%	37	$25	
038	&	38	$26	
039	`	39	$27	
040	(	40	$28	
041	)	41	$29	
042	*	42	$2A	
043	+	43	$2B	
044	,	44	$2C	
045	-	45	$2D	
046	.	46	$2E	
047	/	47	$2F	
048	0	48	$30	
049	1	49	$31	
050	2	50	$32	
051	3	51	$33	
052	4	52	$34	
053	5	53	$35	
054	6	54	$36	
055	7	55	$37	
056	8	56	$38	
057	9	57	$39	
058	:	58	$3A	
059	;	59	$3B	
060	<	60	$3C	
061	=	61	$3D	
062	>	62	$3E	
063	?	63	$3F	
064	@	64	$40	

Table 6. ASCII Codes (cont.)

Value	Char	Chr$	Hex	Notes
065	A	65	$41	
066	B	66	$42	
067	C	67	$43	
068	D	68	$44	
069	E	69	$45	
070	F	70	$46	
071	G	71	$47	
072	H	72	$48	
073	I	73	$49	
074	J	74	$4A	
075	K	75	$4B	
076	L	76	$4C	
077	M	77	$4D	
078	N	78	$4E	
079	O	79	$4F	
080	P	80	$50	
081	Q	81	$51	
082	R	82	$52	
083	S	83	$53	
084	T	84	$54	
085	U	85	$55	
086	V	86	$56	
087	W	87	$57	
088	X	88	$58	
089	Y	89	$59	
090	Z	90	$5A	
091	[	91	$5B	
092	\	92	$5C	
093	]	93	$5D	
094	^	94	$5E	
095		95	$5F	
096	`	96	$60	
097	a	97	$61	
098	b	98	$62	
099	c	99	$63	
100	d	100	$64	

User Codes

Table 6. ASCII Codes (cont.)

Value	Char	Chr$	Hex	Notes
101	e	101	$65	
102	f	102	$66	
103	g	103	$67	
104	h	104	$68	
105	i	105	$69	
106	j	106	$6A	
107	k	107	$6B	
108	l	108	$6C	
109	m	109	$6D	
110	n	110	$6E	
111	o	111	$6F	
112	p	112	$70	
113	q	113	$71	
114	r	114	$72	
115	s	115	$73	
116	t	116	$74	
117	u	117	$75	
118	v	118	$76	
119	w	119	$77	
120	x	120	$78	
121	y	121	$79	
122	z	122	$7A	
123	{	123	$7B	
124	|	124	$7C	
125	}	125	$7D	
126	~	126	$7E	
127		127	$7F	DEL

The ASCII codes from 128 to 255 are usually defined by the machine. In the table above, the STANDARD ASCII codes are given. These are not entirely the same in the Apple. In table 7 the ASCII codes for the Apple screen are given.

User Codes

Please note that although the ASCII codes appear the same, the hex values used are different and the SCREEN output will be different. For example; a CONTROL-M, which is a CARRIGE RETURN, is a CHR$(13) but is a $8D in hex. Remember this is how the Apple views the character.

Table 7. Apple Screen ASCII

Value	Char	Chr$	Hex	Notes
000	@		$00	INV
001	A		$01	INV
002	B		$02	INV
003	C		$03	INV
004	D		$04	INV
005	E		$05	INV
006	F		$06	INV
007	G		$07	INV
008	H		$08	INV
009	I		$09	INV
010	J		$0A	INV
011	K		$0B	INV
012	L		$0C	INV
013	M		$0D	INV
014	N		$0E	INV
015	O		$0F	INV
016	P		$10	INV
017	Q		$11	INV
018	R		$12	INV
019	S		$13	INV
020	T		$14	INV
021	U		$15	INV
022	V		$16	INV
023	W		$17	INV
024	X		$18	INV
025	Y		$19	INV
026	Z		$1A	INV

User Codes

Table 7. Apple Screen ASCII (cont.)

value	Char	Chr$	Hex	Notes
027	[		$1B	INV
028	\		$1C	INV
029	]		$1D	INV
030	^		$1E	INV
031	_		$1F	INV
032			$20	INV
033	!		$21	INV
034	"		$22	INV
035	#		$23	INV
036	$		$24	INV
037	%		$25	INV
038	&		$26	INV
039	`		$27	INV
040	(		$28	INV
041	)		$29	INV
042	*		$2A	INV
043	+		$2B	INV
044	,		$2C	INV
045	-		$2D	INV
046	.		$2E	INV
047	/		$2F	INV
048	0		$30	INV
049	1		$31	INV
050	2		$32	INV
051	3		$33	INV
052	4		$34	INV
053	5		$35	INV
054	6		$36	INV
055	7		$37	INV
056	8		$38	INV
057	9		$39	INV
058	:		$3A	INV
059	;		$3B	INV
060	<		$3C	INV
061	=		$3D	INV

User Codes

Table 7. Apple Screen ASCII (cont.)

Value	Char	Chr$	Hex	Notes
062	>		$3E	INV
063	?		$3F	INV
064	@		$40	FLASH
065	A		$41	FLASH
066	B		$42	FLASH
067	C		$43	FLASH
068	D		$44	FLASH
069	E		$45	FLASH
070	F		$46	FLASH
071	G		$47	FLASH
072	H		$48	FLASH
073	I		$49	FLASH
074	J		$4A	FLASH
075	K		$4B	FLASH
076	L		$4C	FLASH
077	M		$4D	FLASH
078	N		$4E	FLASH
079	O		$4F	FLASH
080	P		$50	FLASH
081	Q		$51	FLASH
082	R		$52	FLASH
083	S		$53	FLASH
084	T		$54	FLASH
085	U		$55	FLASH
086	V		$56	FLASH
087	W		$57	FLASH
088	X		$58	FLASH
089	Y		$59	FLASH
090	Z		$5A	FLASH
091	[		$5B	FLASH
092	\		$5C	FLASH
093	]		$5D	FLASH
094	^		$5E	FLASH
095			$5F	FLASH
096	`		$60	FLASH
097	a		$61	

Table 7. Apple Screen ASCII (cont.)

Value	Char	Chr$	Hex	Notes
098	b		$62	
099	c		$63	
100	d		$64	
101	e		$65	
102	f		$66	
103	g		$67	
104	h		$68	
105	i		$69	
106	j		$6A	
107	k		$6B	
108	l		$6C	
109	m		$6D	
110	n		$6E	
111	o		$6F	
112	p		$70	
113	q		$71	
114	r		$72	
115	s		$73	
116	t		$74	
117	u		$75	
118	v		$76	
119	w		$77	
120	x		$78	
121	y		$79	
122	z		$7A	
123	{		$7B	
124	|		$7C	
125	}		$7D	
126	~		$7E	
127			$7F	

The following program can be entered to print the entire list of characters generated by the CHR$ function.

User Codes

Example 3. CHR$ function

```
5 PRINT CHR$(4);"PR#3"
10 FOR X = 0 TO 255
15 A$ = CHR$(X)
17 B$ = "CHR$("+ STR$ (X) + ") = " +
   A$
18 Y  = PEEK (36) + 12:  IF Y >  30
   THEN Y = 0
19 GOSUB 50
20 POKE 36,Y
21 IF Y = 0 THEN PRINT
22 IF X = 31 OR X = 159 OR X =  127
   THEN PRINT
30 NEXT
31 END
50 IF X > 31 AND X < 128 OR X >  159
   THEN W = 0 : GOTO 61
60 B$  = "CHR$(" + STR$ (X)  +")  =
   CTRL " + CHR$ (X + 64)
61 Z = Z + 1: IF Z > 4 THEN Z = 1
62 IF Z = 1 THEN Y = 20
63 IF Z = 2 THEN Y = 40
64 IF Z = 3 THEN Y = 60
65 IF Z = 4 THEN Y = 0
70 PRINT B$;: RETURN
```

As you run this program, you will notice that the characters generated are not in inverse or flashing and repeat them selves. This the Keyboard ASCII. NOT the Apple display screen ASCII.

User Codes

The following codes are called ESC (escape) codes and are used in conjuction with the features found in the Apple //e firmware.

Table 8. Escape codes

	ESC-@	Clears the video display and moves the cursor to HOME.
	ESC-A	Moves the cursor up one line.
	ESC-B	Moves the cursor to the right one space.
	ESC-C	Moves the cursor to the left one space.
	ESC-D	Moves the cursor down one line.
	ESC-E	Clears to the end of the line.
	ESC-F	Clears to the bottom of the window.
*	ESC-I	Moves the cursor up one line and turns on the Escape mode.
*	ESC-J	Moves the cursor to the left one space and turns on the Escape mode.

User Codes

Table 8. Escape codes (cont.)

*	ESC-K	Moves the cursor to the right one space and turns on the Escape mode.
*	ESC-M	Moves the cursor down one line and turns on the Escape mode.
**	ESC-R	Turns on the uppercase restricted mode.
**	ESC-T	Turns off the uppercase restricted mode.
**	ESC-4	Switches the 80 column screen to 40 columns.
**	ESC-8	Switches the 40 column screen to 80 columns.
**	ESC-CONTROL-Q	Deactivates the 80 column card.

Some of these Escape codes are only active from within other modes. The codes marked with a single * are codes that require you to press Escape only once. The codes that have ** are only active when the 80 column card is active. The other codes require you to press Escape every time you want to do that function.

User Codes

The next table is for Control codes and can be used from within Applesoft by using the CHR$ function. Some of these Control codes only work in when other swithes are set. Those codes that have * are only useable from within Applesoft. The codes that have ** are usable only when the 80 column card is active. Codes that have *** have both conditions set upon them. Other codes will be discussed at the end of the list.

Table 9. Control codes

	CONTROL-G	7	Produces a 1000hz beep
	CONTROL-H	8	Moves the cursor one space to the left.
	CONTROL-J	10	Moves the cursor down one line and will scroll if necessary.
**	CONTROL-K	11	Clears from cursor possition to end of window.
**	CONTROL-L	12	Moves the cursor to the upper left of the window and clears the window.
	CONTROL-M	13	Moves the cursor to the end of line and generates a carriage return.
***	CONTROL-N	14	Sets display to normal.
***	CONTROL-O	15	Sets display to inverse.

User Codes

Table 9. Control codes (cont.)

***	CONTROL-Q	17	Sets display to 40 columns.
***	CONTROL-R	18	Sets display to 80 columns.
	CONTROL-S	19	Stops display listing
***	CONTROL-U	21	Deactivates the 80 column card.
**	CONTROL-V	22	Scrolls the display down.
**	CONTROL-W	23	Scrolls the display up.
**	CONTROL-Z	26	Clears the line the cursor is on.
**	CONTROL-Y	25	Moves the cursor to the upper left hand corner of the screen.
**	CONTROL-\	28	Moves the cursor one space to the right.
**	CONTROL-]	29	Moves the cursor all the way to the right.
**	CONTROL-^	30	SEE TEXT

User Codes

The last Control code is for cursor positioning. Using the next 2 characters, minus 32, as one-byte X and Y values, moves the cursor to CH=X, CV=Y. This function is not supported under BASIC, but is supported under Pascal. Please refer to the Apple Pascal Operating System Manual for more information relating to this function.

Control S is used in both 40 and 80 column displays to stop the scrolling of the screen.

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 of 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. Disdettes 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.

documemtation: 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 of 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 our an instruction or series of instructions. Sometimes similar to running a program.

file: An orgranized 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 to referring 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 located specific information. Sometimes called initialization.

garbage: Meaningless information or data.

glich: 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 represend 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 ramdomly 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.