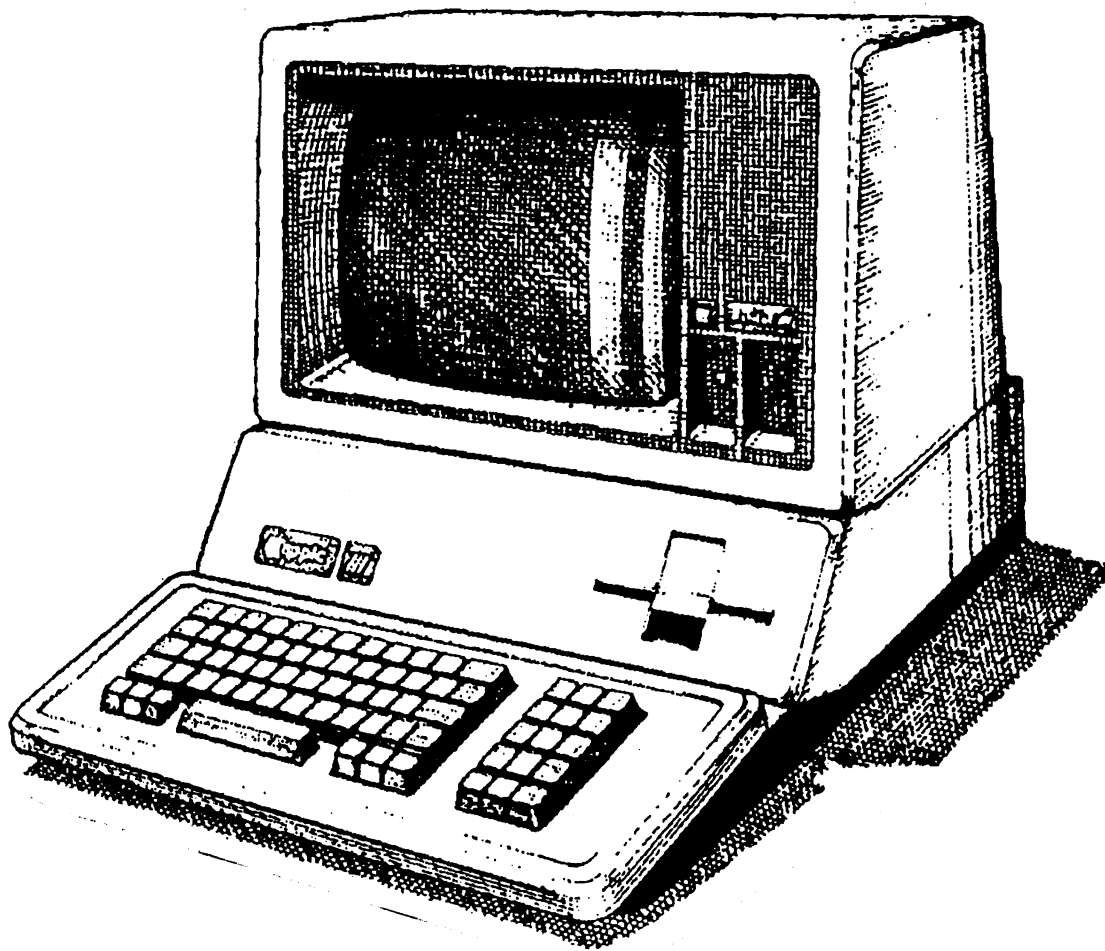




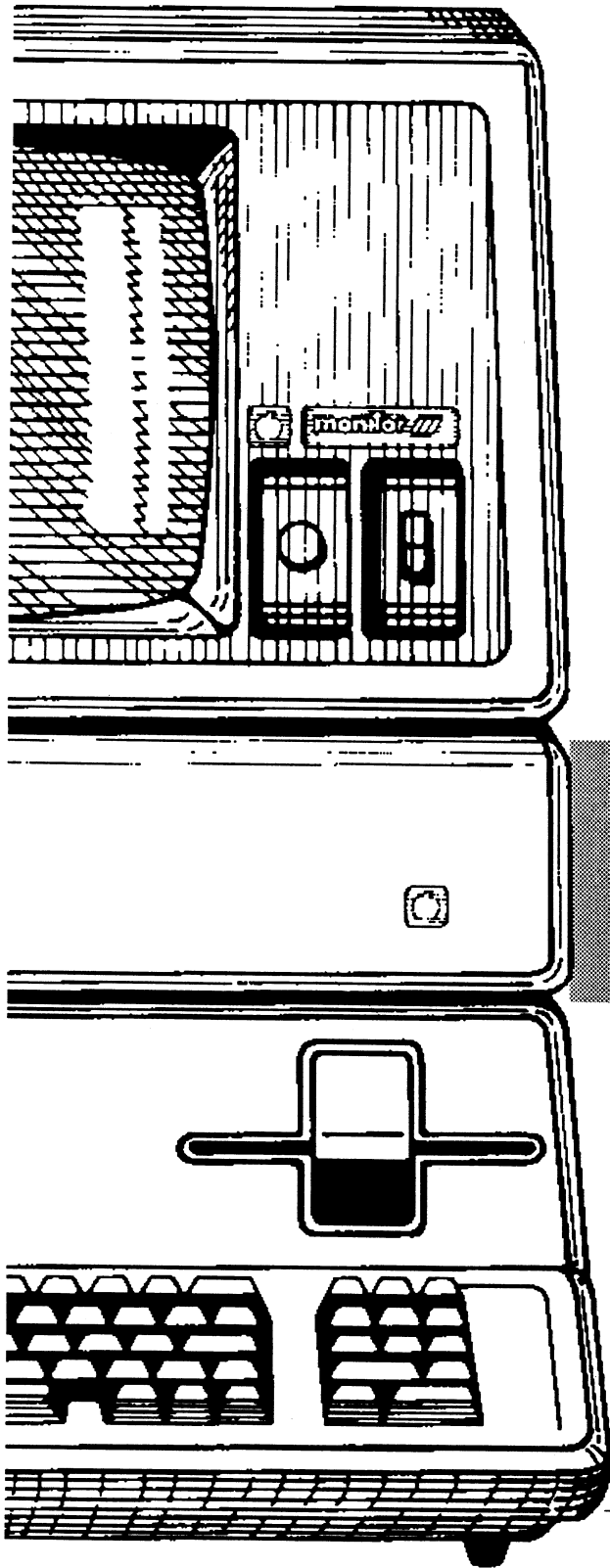
Apple /// Computer Information



DOCUMENT NAME		#
<i>Repair Info;</i>	<i>Sun Remarketing</i>	228
<i>Do-it-yourself Guide for Apple III</i>	<i>1987</i>	

Ex Libris David T. Craig

Total Pages: 43



**Do-it-yourself
Guide for
the Apple III**

1987

By Sun Remarketing, Inc.

Page 1

Important — Please Read!

Caution

Nobody likes problems, and we here at Sun Remarketing hope that you never have any problems with your Apple /// computer. We understand, however, that problems are bound to happen sooner or later with almost anything, including your usually reliable Apple ///. That's why we compiled this book. This book is designed to help you figure out what is wrong with your computer, and in general make you more familiar with your Apple ///.

Although this book has been written by experts and experienced Apple /// users, it can't contain everything that can go wrong with your computer. If you can't figure out your problem with the aid of this book, call us here at Sun Remarketing. We have a staff of experts that will be happy to help you get your machine back up and running again.

There are a few things we should warn you about before you start through the book:

1: *Never open the power supply!* It's dangerous in there! High voltages may be useful to your computer, but your body won't like them at all! Even if you have the machine unplugged high voltage can remain in the power supply for hours — long enough to shock you senseless (if you are that lucky).

2: *Never open a monitor!* The exact same logic which applies to the power supply also applies here — high voltage can kill you.

In short

If you need work done with a power supply, order a complete replacement power supply from us. We can send you a power supply that you can replace safely. *Never open a power supply or monitor (t.v. screen) — let an expert do it for you.*

Copyright

Copyright © 1987 by Sun Remarketing, Inc. All rights reserved. Except as permitted under the Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a data base or retrieval system, without the prior written permission of the publisher, with the exception that the program listings may be entered, stored, and executed in a computer system, but they may not be reproduced for publication. Certain portions of the book is copyright 1983, Apple Computer, Inc., and are used with permission.

*Apple and the Apple logo are registered trademarks of Apple Computer, Inc.
Apple ProFile and ImageWriter are trademarks of Apple Computer, Inc.*

Page 2

Do-it-yourself Guide for the Apple[®] ///

BY SUN REMARKETING, INC.

Sun Remarketing, Inc.
P.O. Box 4059
Logan, Utah 84321
801-752-7631

Page 3

THIS PAGE IS BLANK

THIS PAGE IS BLANK

Page 4

Contents

How to Use This Book	6
General Troubleshooting	7
ProFile Troubleshooting	10
Titan ///+ IIe Troubleshooting	12
Disk /// Troubleshooting	15
Motherboard Replacement	17
Main Memory Replacement	18
Power Supply Replacement	19
Internal Disk Drive Replacement	20
Keyboard Replacement	21
Clock Upgrade Installation	22
Video Interlace Upgrade	24
UPIC Installation	26
128K RAM Diagnostics	27
Disk Drive Maintenance	28
Motherboard Identification	29
Adding a Driver to Your Current Configuration ...	30
Standard Map of Motherboard	32
Apple /// Parts List	33
Adjusting Disk /// Disk Drive Speed	34
Errors - Messages During Startup	36
Fatal Error Codes - Apple ///	40
Non-Fatal Error Codes - Apple ///	41
Pascal Error Codes	43

Page 4 is blank

page 5

How to use this book

Introduction

Ever since Sun Remarketing was asked by Apple Computer, Inc. to provide support and national support for the Apple /// there has been a deluge of letters and phone calls regarding day-to-day solutions to inherent problems with the ///. Overall it is a very reliable piece of equipment. But, sometimes a component will fail or you will want to change the configuration of the machine to better match your uses. We provide this book to help you out in those cases.

Not everything that could be is included in this book. It has been kept on a non-technical basis so that first-time users will feel comfortable with its use.

There are only five main components to the Apple ///. We have explained how to troubleshoot and exchange these parts. It is our experience that, in most cases, this exchange will fix your problem. In the event it doesn't or the book does not answer your question, please feel free to call our National Service Line (801) 752-7631. Operators are available from 7:30 am to 6 pm mountain time, Monday through Friday.

We maintain a national service center for the Apple /// and are qualified to provide parts or maintain your machine when you ship to us directly.

National Service Line
(801) 752-7631

Troubleshooting Chapters

The troubleshooting chapters of this book contain a number of different problems and possible solutions. To use the troubleshooting chapters, look for the description of your problem. Problem descriptions are always in a **bold** typeface. After each description is a possible cause for the problem. Each probable cause is followed by some diagnostics you can perform to see if that problem described is *really* the problem you are having. Some problem descriptions are repeated more than once, since different problems often exhibit the same symptoms.

Once you have decided what your problem is the guide will list one or more solutions to your problem. If the solutions do not solve your problem feel free to call Sun Remarketing — we're here to help!

Example

For Example:

Problem: I turn my power switch on, but nothing happens. The disk drive does not turn, nothing appears on the monitor and the system appears to be dead.

Possible cause: Machine is unplugged (don't laugh, it happens).

Diagnostics: Check both ends of the power cable. It's easy for one of the cable ends to become loose and break the connection between the wall socket and the power supply.

Solution: Press both ends of the cable firmly into their sockets.

Finally, this book contains several useful chapters that describe things like error messages, and instructions for using the *Apple /// Confidence Program* and *Apple /// Dealer Diagnostics*, both of which are included with this book.

General Troubleshooting

This chapter contains troubleshooting information for the Apple III power supply, motherboard, memoryboard, keyboard, and connections to the outside world. For information about disk drives, ProFiles™ or Titan™ cards, see the appropriate chapter.

Nothing Happens

Problem: I turn my power switch on, but nothing happens. The disk drive does not turn, the power-on light does not come on, nothing appears on the monitor, and the system appears to be dead.

Possible cause: Machine is unplugged.

Diagnostics: Check both ends of the power cable. It's easy for one of the cable ends to become loose and break the connection between the wall socket and the power supply.

Solution: Press both ends of the cable firmly into their sockets.

Problem: I turn my power switch on, but nothing happens. The disk drive does not turn, nothing appears on the monitor, the power-on light does not come on and the system appears to be dead.

Possible cause: Bad power supply.

Diagnostics: Check to make sure the power cord is plugged in. If so, listen to the machine closely for a gentle buzzing or hissing sound. If you can't hear anything from the computer the power supply is probably bad.

Solution: Replace the power supply.

Loud Chirping Sound

Problem: When I turn the machine on it makes a loud chirping or buzzing sound that repeats constantly. Nothing else happens.

Possible cause: Bad, overloaded or shorted power supply.

Diagnostics: This type of problem is almost always a problem with the power supply. This can happen if a component on the motherboard or one of the interface boards is bad, or if the power supply itself is bad.

Solution: Replace the power supply.

Nothing Appears On Monitor

General Troubleshooting Continued

Problem: The computer turns on and the program appears to load, but nothing appears on the monitor. The monitor switch is turned on and the monitor power light is lit.

Possible cause: Bad or loose monitor cable.

Diagnostics: Check both ends of the monitor cable carefully. These connections tend to loosen over time and break the video circuit.

Solution: Press both ends of the cable firmly. If this doesn't help, replace the cable.

Problem: The computer turns on and the program appears to load, but nothing appears on the monitor. The monitor switch is turned on and the monitor power light is lit.

Possible cause: The video generator on the motherboard is bad.

Diagnostics: This is the probable cause if the video cable is known to be good.

Solution: Replace the motherboard.

Disk Drive Does Not Turn On

Problem: The machine turns on, but the disk drive does not turn and the word DIAGNOSTIC appears on the screen.

Possible cause: The power light is burned out or loose.

Diagnostics: Check the power-on light. If it is not lit it will cause this problem.

Solution: Replace the power-on light or hold the control key down while turning the machine on.

Program Appears To Freeze

Problem: While using the computer the program appears to freeze and the computer will not respond. Pressing Control-7 on the keypad does not seem to help. The computer also once in a while has an error while booting.

Possible cause: Bad motherboard.

Diagnostics: This problem will manifest itself in a number of ways, but the most common way is the "freeze" described above. The freeze usually occurs while typing on the keyboard. The problem is usually erratic at first, but eventually happens almost every time the machine is used.

Solution: Replace the motherboard.

General Troubleshooting Continued

SYSTEM FAILURE

Problem: My machine has crashed with the words SYSTEM FAILURE in the lower right hand corner of the screen.

Possible cause: Depends on the number of the system failure. Refer to the appendix for more information and solutions.

**Key On Keyboard
Not Working**

Problem: Any key or several keys typed on my keyboard does not work. The computer appears to otherwise function properly.

Possible cause: Bad motherboard.

Diagnostics: Try the keyboard with several programs. If the keyboard acts the same with several programs, the motherboard is bad.

Solution: Replace the motherboard.

Problem: One key on my keyboard is bad. The other keys seem to function properly.

Possible cause: Bad key on keyboard.

Diagnostics: Try the key with several programs. If the key acts the same with several programs, the key is bad.

Solution: Replace the keyboard or the key.

Printer Doesn't Work

Problem: My printer doesn't print anything at all (or my modem doesn't work), no matter what program I use.

Possible cause: Incorrect cable.

Diagnostics: Attach a null-modem cable between the computer and the existing cable. If the computer starts to print, the existing cable was incorrect for the printer. *Warning!* This technique will work best with a standard Apple or Sun Remarketing cable. Some cables available at electronics stores are not appropriate for Apple products. If the problem is not resolved with the cable, continue to the next problem.

Solution: Leave the null-modem cable attached.

Printer Prints Garbage

Problem: My printer just prints garbage, or nothing at all.

Possible cause: Wrong baud rate (the rate at which data is transferred).

Diagnostics: This problem usually shows up as garbage on the printer, but sometimes the printer will not print at all. Compare the values in your driver's configuration block with the speed your printer expects.

Solution: Adjust the driver or the printer so that the two speeds match.

ProFile™ Troubleshooting

This section contains information about ProFile™ drives. For information about the Apple /// in general, Apple /// floppy disk drives or Titan cards see the appropriate chapter of this book.

Inconsistent Buzzing Sound

Problem: My ProFile seems to work properly, but makes a funny buzzing sound every so often.

Possible cause: Static Ground Arm needs adjustment.

Diagnostic: As stated above.

Solution: Although the buzzing sound does not adversely affect your hard disk, you may wish to get rid of the noise. If you wish to get rid of the noise, have the arm professionally adjusted. **WARNING! Do not attempt to do this yourself! Failure to properly adjust the arm will cause your ProFile to malfunction.** Sun Remarketing performs this service at a very reasonable charge.

Indication Of Bad Blocks

Problem: The System Utilities Program shows bad blocks on my ProFile.

Possible cause: The ProFile media has been damaged.

Diagnostic: As above.

Solution: The ProFile needs a "Factory Format". This operation must be performed at an authorized service center (Note: Your local dealer does not perform this service).

Indication Of Structure Damage

Problem: The System Utilities Program says that the directory structure is damaged on my hard disk.

Possible cause: The directory files on your disk have been improperly written.

Diagnostics: Improper directory structure is the only possible cause of this error.

Solution: Reformat disk using System Utilities and restore data from backups.

ProFile Troubleshooting Continued

Doesn't Become Ready

Problem: The ProFile does not become ready after about five minutes of operation.

Possible cause: Damaged hard disk controller or damaged media.

Diagnostics: The ProFile light may blink for a while, but eventually stops blinking and refuses to do anything.

Solution: Have the ProFile serviced.

Becomes Ready But Doesn't Respond

Problem: The ProFile becomes ready, but does not respond when you attempt to use it.

Possible cause: ProFile driver not in SOS.DRIVER, or driver slot wrong.

Diagnostics: Use the System Utilities program to check the contents of SOS.DRIVER.

Solution: Update SOS.DRIVER appropriately.

Problem: The ProFile becomes ready, but does not respond when you attempt to use it.

Possible cause: Bad interface cable.

Diagnostics: Check both ends of the cable to make sure that they are making good contact. Check the cable for unusual wear.

Solution: Press both ends of the cable firmly into the socket, or replace the cable if damaged.

Problem: The ProFile becomes ready, but does not respond when you attempt to use it.

Possible cause: Bad interface card.

Diagnostics: Examine the cable and ProFile. The cable should be firmly connected and the ProFile light steady.

Solution: Replace the card.

Titan™ ///+//e Troubleshooting

This section contains information about Titan ///+//e cards. For information about the Apple /// in general, floppy disk drives or Pro-File™ drives see the appropriate chapter of this book.

Screen Flashes And Startup Menu Returns

Problem: My startup disk loads properly, but when I try to go into the emulation mode the screen flashes and the startup menu returns.

Possible cause: Joystick shorting plug is not working properly.

Diagnostics: Check the plug located on the upper right corner of the ///+// board. This problem will be caused if no joystick is connected, the plug is in backwards, the plug is missing, or the plug is broken.

Solution: Replace or re-align the plug.

Drive Spins and Stops

Problem: My startup disk loads properly, but when I try to run a program the disk drive spins for a few seconds and stops.

Possible cause: Boards are not in the proper slots.

Diagnostics: Check the boards. They *must* be in slots 2 and 3.

Solution: Put the boards in the correct slots.

Problem: My startup disk loads properly, but when I try to run a program the disk drive spins for a few seconds and stops.

Possible cause: Narrow ribbon cable is improperly attached.

Diagnostics: Turn the ribbon cable that joins the two cards together over. Some cables supplied by the factory were incorrectly assembled.

Solution: Align the cable properly.

Startup Won't Load

Problem: My startup disk won't load.

Possible cause: Bad diskette.

Diagnostics: Try another copy of the startup disk. If the copy works the original is defective.

Solution: Use a good startup disk.

Titan Troubleshooting Continued

No Disk Will Load

Problem: No disk will load, regardless of whether it is the Titan Startup or an Apple III disk.

Possible cause: Bad Titan Boards.

Diagnostics: Remove the boards and replace the video chip. If Apple III disks will then work the boards are bad.

Solution: Have the boards repaired.

Machine Freezes

Problem: When I load a disk I get garbage on the screen and the machine freezes.

Possible cause: Wide ribbon cable is broken or incorrectly installed.

Diagnostics: Check the wide ribbon cable and make sure that it is properly plugged into the video socket and that no pins are broken.

Solution: Align the cable properly.

Problem: When I load a disk I get garbage on the screen and the machine freezes.

Possible cause: Bad Titan boards.

Diagnostics: Check the cable as describe in the previous problem. If it is OK the boards are bad.

Solution: Have the boards repaired.

Printer Doesn't Work

Problem: My printer doesn't work in emulation mode.

Possible cause: Jumper J4 is improperly installed.

Diagnostics: Check jumper J4. It should be on both pins if you want to use a serial printer, or on only one pin if you want to use a parallel printer.

Solution: Align the jumper properly.

Problem: My printer doesn't work in emulation mode.

Possible cause: Startup disk printer settings do not match printer.

Diagnostics: Check your printer and determine its communication settings. The settings on the startup disk must match your printer.

Solution: Update the settings on your startup disk to match your printer.

Titan Troubleshooting Continued

ProFile Doesn't Work

Problem: ProFile does not work in //e emulation.

Possible cause: ProFile card modification not done.

Diagnostics: If the ProFile modification is not done as outlined in the manual your ProFile will not work in ///+//e mode. *Warning! Accessing the ProFile without the modification will severely damage your hard disk.*

Solution: Perform the modification and have your hard disk repaired.

Problem: I can't use my ProFile in emulation mode.

Possible cause: Jumper J5 is improperly installed.

Diagnostics: Check jumper J5. If you wish to use your ProFile jumper J5 must be on both pins.

Solution: Place the jumper properly.

Keys Make Hissing Sound

Problem: Certain keys in emulation mode cause a hissing sound to come from the built-in speaker, or the screen fills with garbage.

Possible cause: Bad boards.

Diagnostics: This is the only cause of this problem.

Solution: Have the boards replaced.

Disk /// Troubleshooting

This section contains information about Apple /// floppy disk drives. For information about the Apple /// in general, ProFile™ drives or Titan cards see the appropriate chapter of this book.

Drive Tries to Start Buzzes - RETRY

Problem: The built-in floppy tries to start from a disk, but buzzes and the word "RETRY" appears on the screen.

Possible cause: Bad floppy disk.

Diagnostics: Try changing to another disk. If it works, the original disk was defective.

Solution: Use a different copy of the original disk.

Problem: The built-in floppy tries to start from a disk, but buzzes and the word "RETRY" appears on the screen.

Possible cause: Bad disk drive.

Diagnostics: Try several disks in the disk drive. If no disk works the disk drive is probably bad.

Solution: Have the disk drive serviced.

Problem: The built-in floppy tries to start from a disk, but buzzes and the word "RETRY" appears on the screen.

Possible cause: Bad CPU Board.

Diagnostics: Open the machine and plug the second disk drive into the socket for the first disk drive. If the machine will not startup properly from either drive the motherboard may be bad.

Solution: Replace the motherboard.

Drive Spins and Stops

Problem: On startup the disk drive spins, but stops suddenly and the screen goes blank or shows apparently random garbage.

Possible cause: Non-bootable disk.

Diagnostics: This error usually occurs when a disk has been formatted by a foreign operating system (e.g. DOS 3.3, Apple // Pascal, CP/M, etc.). It may also occur if a disk has been damaged.

Solution: Don't use the disk.

Disk III Troubleshooting Continued

Error When Formatting

Problem: Whenever I try to format a disk I get a "Device Specific Error".

Possible cause: Disk speed is out of adjustment.

Diagnostics: Disk speed is the only documented cause of this error.

Solution: Adjust the disk speed using the Dealer Diagnostics Disk.

Recognizing Extra Drives

Problem: Some of my programs recognize my second (or third or fourth, for that matter) disk drive, and some don't.

Possible cause: Operating system has not been told that the disk drive exists.

Diagnostics: Use the System Configuration Program to check the number of active disk drives for the program or programs in question.

Solution: Set the number of disk drives to reflect your situation.

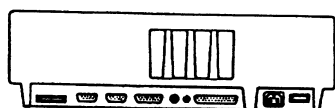


Figure A

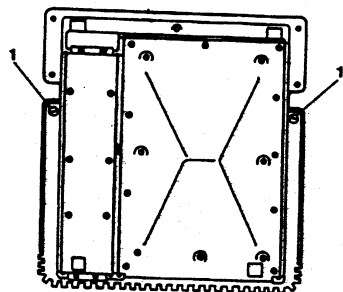


Figure B



Figure C

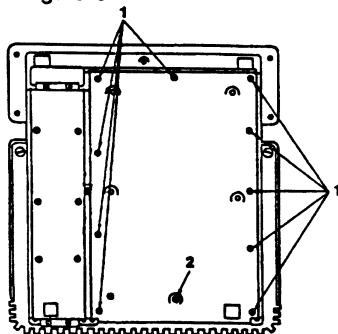


Figure I

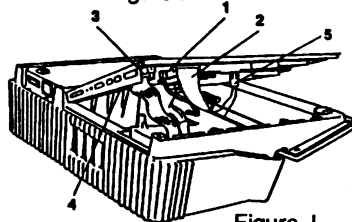


Figure J

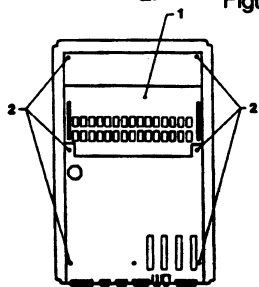


Figure K

Apple III Do-it-Yourself Manual

Motherboard Replacement

INSTRUCTIONS

Preparing Your Apple III for Disassembly

Disconnect power cable from computer.

Disconnect all other external cable. (figure A)

Lift up the front edge of the Apple and tip it so it rests on the back of the casing.

Use a flat blade screwdriver to turn the locking screws on each side under the cover towards the front (fig B, item 1). Turn the screws 1/4 turn counterclockwise.

Lower the Apple III to the table, lift the cover up and pull it forward to remove. (figure C)

Remove all peripheral cards from their slots

Replace the cover (you need not lock screws in place).

Removing the Baseplate

Place the computer upside down on a table, rear facing you.

Remove the 11 screws around the large plate (figure I)

Lift bottom plate from right side just a few inches.

Carefully disconnect the speaker, keyboard and disk drive cables (figure J items 1, 2, and 3).

NOTE: Remember where cable goes for reassembly. You remove the larger cables with a gentle side-to-side rocking motion. DO NOT pull on the cable itself, it could cause future failures.

Lift the assembly and finally remove the power supply plug.
Treat your motherboard gently. Avoid static electricity by grounding yourself out to a doorknob or such before proceeding.

If you need to remove your memory card follow these instructions:

Removing the Main Memory Card from Motherboard

With the motherboard placed flat on a work surface pull the Memory Card from the motherboard by gently rocking on side and then the other until the memory board is off. Try to pull straight up as much as possible so as not to bend the pins of the main logic board. (fig K)

Removing the Motherboard from the Baseplate

Unscrew the six screws that hold the board to the baseplate.

Lift the old motherboard from the baseplate.

Install your new motherboard.

To reassemble reverse the steps of assembly.

Mounting the Replacement Memory Card

Align the connectors of the replacement memory board over the connectors of the motherboard. The best way to do this is to tilt the Memory Card and align the pins on one side then do the same on the second side.

Make sure each male pin is aligned properly to its female counterpart then gently push straight down on the connectors on both sides of the Memory Card until the connectors are fully seated.

NOTE: Make sure the board is properly oriented. the reference notches on the Memory Card ICs should face to the rear of the logic board (towards the output connectors). This is opposite the reference notches found on the motherboard.

To reassemble, reverse the steps of assembly.

Main Memory Replacement

INSTRUCTIONS

Preparing Your Apple III for Disassembly

Disconnect power cable from computer.

Disconnect all other external cable. (figure A)

Lift up the front edge of the Apple and tip it so it rests on the back of the casing.

Use a flat blade screwdriver to turn the locking screws on each side under the cover towards the front (fig. B, item 1). Turn the screws 1/4 turn counterclockwise.

Lower the Apple III to the table, lift the cover up and pull it forward to remove. (figure C)

Remove all peripheral cards from their slots

Replace the cover (you need not lock screws in place).

Removing the Baseplate

Place the computer upside down on a table, rear facing you.

Remove the 11 screws around the large plate (figure I)

Lift bottom plate from right side just a few inches.

Carefully disconnect the speaker, keyboard and disk drive cables (figure J items 1, 2, and 3).

NOTE: Remember where cable goes for reassembly. You remove the larger cables with a gentle side-to-side rocking motion. DO NOT pull on the cable itself, it could cause future failures.

Lift the assembly and finally remove the power supply plug. Treat your motherboard gently. Avoid static electricity by grounding yourself out to a doorknob or such before proceeding.

Removing the Main Memory Card from Motherboard

With the motherboard placed flat on a work surface pull the Memory Card from the motherboard by gently rocking on side and then the other until the memory board is off. Try to pull straight up as much as possible so as not to bend the pins of the main logic board. (figure K)

Mounting the Replacement Memory Card

Align the connectors of the replacement memory board over the connectors of the motherboard. The best way to do this is to tilt the Memory Card and align the pins on one side then do the same on the second side.

Make sure each male pin is aligned properly to its female counterpart then gently push straight down on the connectors on both sides of the Memory Card until the connectors are fully seated.

NOTE: Make sure the board is properly oriented. the reference notches on the Memory Card ICs should face to the rear of the logic board (towards the output connectors). This is opposite the reference notches found on the motherboard.

To reassemble, reverse the steps of assembly.

NOTE: Before you reassemble take the time to push on each chip on the motherboard with your thumb to insure that they are firmly seated. They often work loose with the heating and cooling of the machine as well as during shipment and handling.

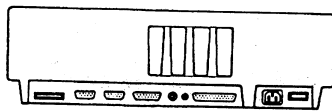


Figure A

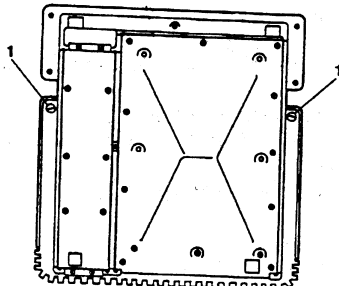


Figure B

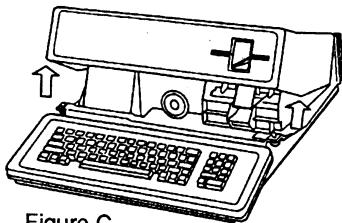


Figure C

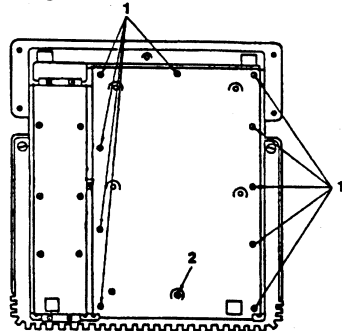


Figure I

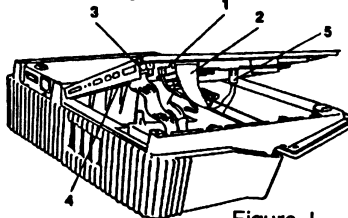


Figure J

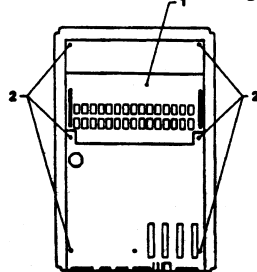


Figure K

Power Supply Replacement

INSTRUCTIONS

First prepare your Apple III for disassembly

- Disconnect power cable from computer.
- Disconnect all other external cables (figure A).

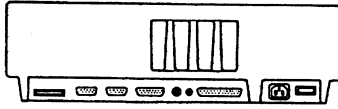


Figure A

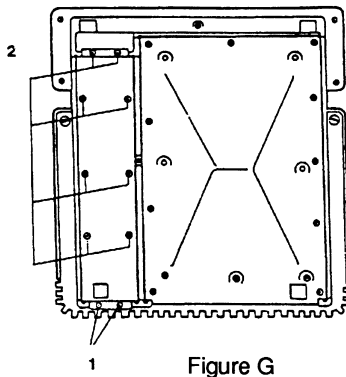


Figure G

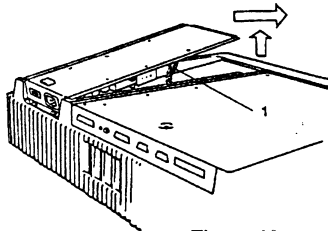


Figure H

Removing the Power Supply

- Turn the Apple III upside down with the keyboard facing you. You may want to place a foam block or such under the keyboard to keep the unit from rocking while it is upside down.
- Loosen (*DON'T REMOVE!*) the two small phillips head screws located on the rear edge of the power supply bottom cover, near the on/off switch and power supply receptacle (figure G item 1).
- Locate and remove the eight screws securing the power supply bottom to the chassis (figure G item 2).
- Lift up on the front edge of the power supply and slide it forward until the rear edge clears the two rear mounting screws.
- Gently lift up the power supply assemble to gain access to its connector. (figure H)
- Disconnect the power supply connector by gently rocking the connector from side to side and pulling at the same time.
- If the leads are secured to the power supply by a wire, tie and cut the tie. The power supply can now be completely removed.

Reassembly

- Reverse the above steps for reassembly.
- Prior to replacing the power supply, replace the wire tie, if one was removed.
- When re-installing the power supply, insert the bottom plate under the two rear most screws and lower the power supply into place.

NOTE: When re-installing the securing screws use only enough torque to rotate the screw. These screws will easily strip out the chassis starting at an angle to avoid cross-threading. If it appears that the screw is cross-threading, back it out and try again.

Internal Disk Drive Replacement

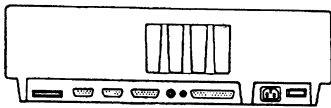


Figure A

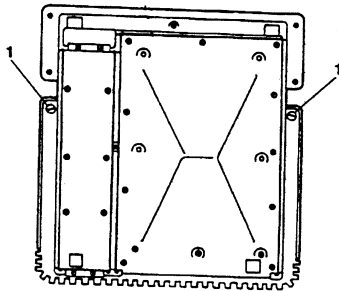


Figure B

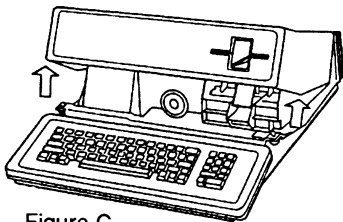


Figure C

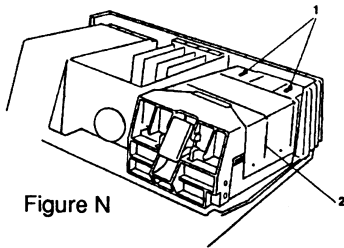


Figure N

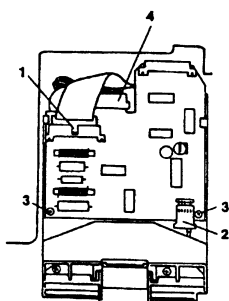


Figure O

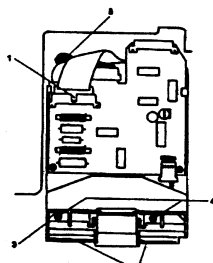


Figure Q

INSTRUCTIONS

First prepare your Apple III for disassembly

- Disconnect power cable from computer.
- Disconnect all other external cables (figure A).
- Lift up the front edge of the Apple and tip it so it rests on the back of the casing.
- Use a flat blade screwdriver to turn the locking screws on each side under the cover towards the front (figure B item 1).
- Turn the screws 1/4 turn counterclockwise.
- Lower the Apple III to the table, lift the cover up and pull it forward to remove (figure C).

Remove Disk Drive

- Locate the two retaining clips which hold down the Disk Assembly shield (figure N item 1).
- Remove and retain the clips by using the blade of a screwdriver. Slide the clips forward until the enlarged slots of the clips are around the mounting posts.
- Remove the Disk Assembly shield by flexing the side out and lifting up on it (figure N item 2). The shield is retained only by the spring tension of the sides and four dimples which fit into depressions of the disk casing.
- Remove the ribbon cable from the analog board by pushing on the center tab of the plug with a screwdriver (figure Q item 1).
- Remove the two phillips head screws located inside at the front of the Disk Assembly on either side of the diskette door latch (figure Q item 4).
- Loosen the single phillips head screw at the rear of the drive (figure Q item 5).
- Slide the Disk Assembly straight out.

Removing the Analog Board

- To remove the Disk III Analog board first disconnect the disk ribbon cable by working side to side. (figure O item 1)
- Disconnect the read/write cable. (figure O item 2)
- Remove the two small Phillips head screws. (figure O item 3)
- Remove the analog board by gently twisting it counterclockwise and moving it forward until it clears the guide on the left.
- Unhook it from the guide.
- Remove the motor control plug (figure O item 4) by disengaging the four nylon locking pawls which engage the two holes in the board from both top and bottom. Lift the pawls free and disconnect the motor control cable.

Reassembly

- Install the replacement Disk Assembly by reversing the steps as outlined above.

NOTE: When reassembling do not tighten the mounting screws until you have aligned the cover with the disk drive door to make sure it does not rub or catch upon opening and closing.

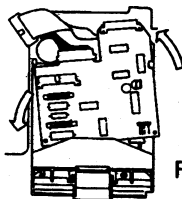


Figure P

Keyboard Replacement

INSTRUCTIONS

Removing the keyboard cover

Disconnect the power cord from the back of the Apple III.
Place the computer on its right side with the bottom facing you.
Locate and remove the five keyboard cover mounting screws as noted in figure D and remove the keyboard cover.

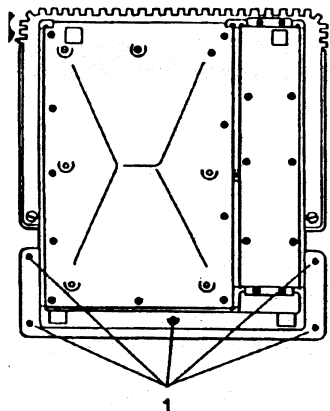


Figure D

Removing the keyboard

Place the computer in its normal operating position.
Completely remove the screws on the left hand side (figure E items 1 & 2).
Remove the keyboard by lifting the left end and sliding the right end from under the loosened screws. (figure F)
Disconnect the keyboard cable located on the middle rear edge of the exposed keyboard. Do not pull on cable. Instead use a small screwdriver to push on the tab on the front or small holes on each side of the cable connector (figure E item 4).

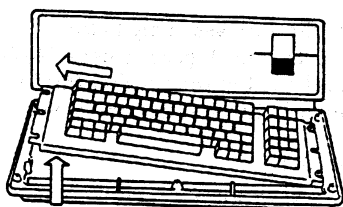


Figure F

Reassembly

Install the replacement keyboard by reversing the steps as outlined above. Note that the keyboard cable makes a tight turn where it wraps to the underside of the keyboard cover is to fit properly (figure E item 3).

NOTE: Take extra care when tightening the five keyboard cover screws to keep them from stripping the threads on the cover.

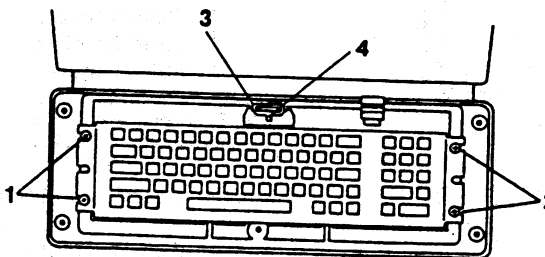


Figure E

Clock Upgrade Installation

INSTRUCTIONS

Contents of Kit:

- 1- Battery clip
- 1- Wire and connector assembly
- 1- Motherboard connection clip
- 1- Clock integrated circuit

First prepare your Apple III for disassembly

Disconnect power cable from computer.
 Disconnect all other external cables (figure A).
 Lift up the front edge of the Apple and tip it so that it rests on the back of the casing.
 Use a flat blade screwdriver to turn the locking screw on each side under the cover towards the front (figure B item 1).
 Turn the screws 1/4 turn counterclockwise.
 Lower the Apple III to the table, lift the cover up and pull it forward to remove (figure C).

Installing the battery clip

Connect the two separate ends of the wire assembly to the battery case. Red goes to positive (+), black goes to negative (-). Attach the clip to the heatsink to the left of the speaker. (fig L)
 Push the wires through the same hole the speaker wires pass.

Remove all peripheral cards from their slots.
 Replace the cover (you need not lock screws in place).

Removal of the Baseplate

Place the computer upside down on a table, rear facing you.
 Remove the 11 screws around the large plate (figure I).
 Lift bottom plate from right side just a few inches.
 Carefully disconnect the speaker, keyboard and disk drive cables (figure J items 1, 2 & 3).

NOTE: Remember where each cable goes for reassembly. You remove the larger cables with a gentle side-to-side rocking motion. DO NOT pull on the cable itself, it could cause future failures.

Lift the assembly and finally remove the power supply plug.

Removal of the Motherboard from the Baseplate

Treat your motherboard gently. Avoid static electricity by grounding yourself out to a doorknob or such before proceeding.
 Unscrew the six screws that hold the board to the baseplate.
 Lift the motherboard from the baseplate. (figure K item 2)

Installation of the Motherboard Connection Clip

Unscrew the yoke on the clip from the plastic base.
 Insert the yoke, from the bottom of the motherboard, into the two small holes located at position G-14. (see map page 32)
 Place the clock plate connector over the large hole, reinsert the screw and tighten the yoke and connector together. The cut corners are there to allow space for nearby components. Place the squared corner facing front and to the edge of the motherboard.

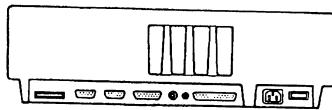


Figure A

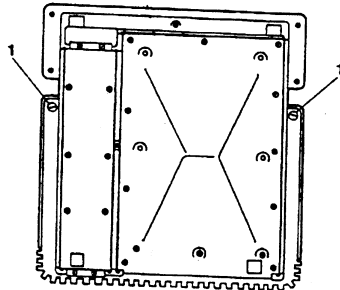


Figure B

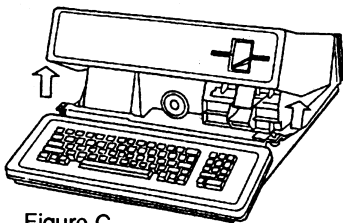


Figure C

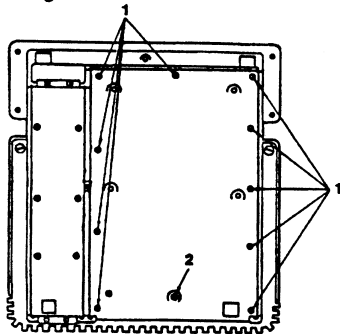


Figure I

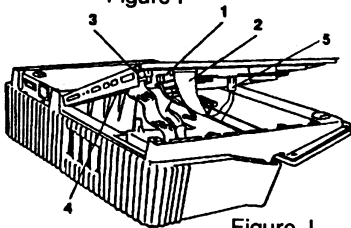


Figure J

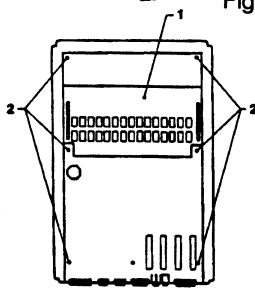


Figure K

Installation of the Clock Chip

Locate socket at position B-3. (see map page 32) It should be empty. Note the notch at one end of the chip. Make sure it is pointed the same direction as the other chips on the board. Do it wrong and say, "BYE, BYE" to your clock chip.

It may be necessary to bend the pins of the chip slightly so it will enter the socket. If that is the case, gently press the pins against a metal surface. Avoid touching the pins with your hands! Insert the clock chip into the socket and push it firmly into place. Check to be sure that all of the pins went into their locations without bending.

Reassembly

To reassemble, reverse the steps of assembly. Remember that you have a new cable that runs to your clock connector. The polarity of this connection is very important. The clock connector has a plastic nib that should be between the corresponding two nibs on the wire connector.

NOTE: Before you reassemble take the time to push on each chip on the motherboard with your thumb to insure that they are firmly seated. They often work themselves loose over time and use.

Once you have reassembled your computer, reinsert your peripheral cards.

While the top cover is still off, install three AA batteries in the battery clip observing indicated polarity.

Now that your new clock is installed you can set it using your SYSTEMS UTILITIES program under Device Handling.

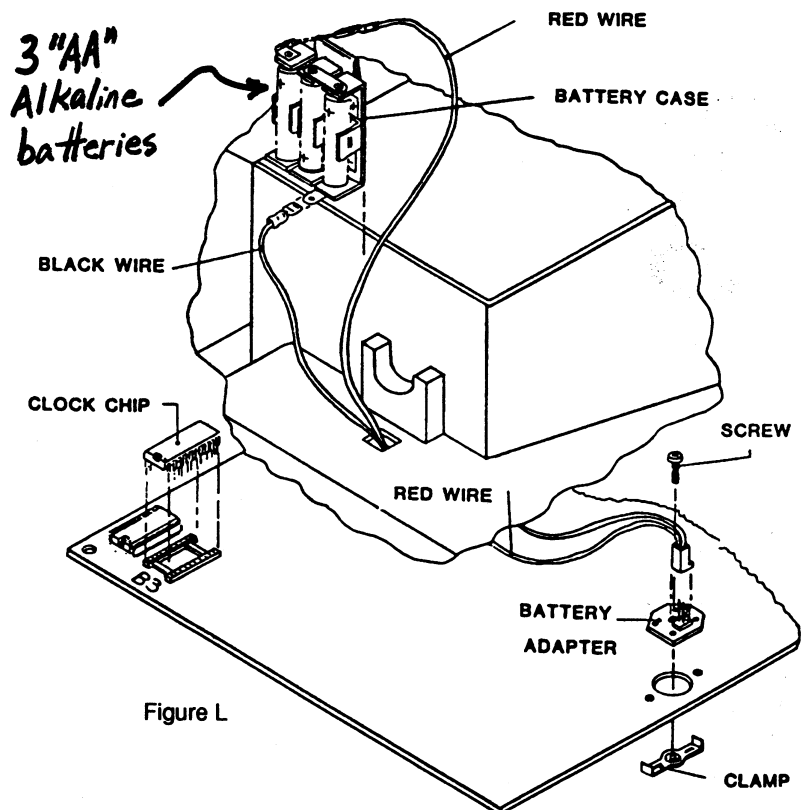


Figure L

Video Interlace Upgrade

INSTRUCTIONS

CONTENTS OF KIT:

- 1- Wire and connector assembly
- 2- Switch
- 3- ROM integrated circuit
- 4- Optional three pronged connector

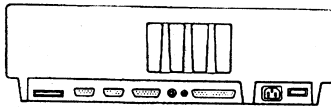


Figure A

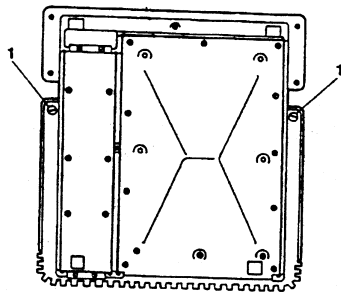


Figure B

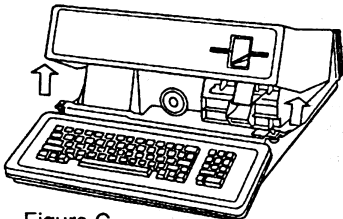


Figure C

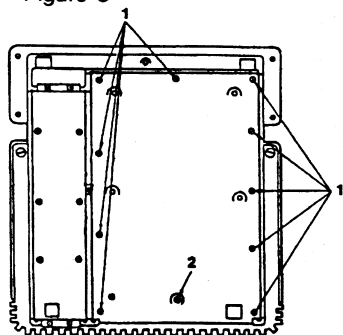


Figure I

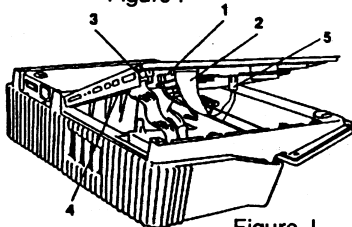


Figure J

First prepare your Apple III for disassembly

Disconnect power cable from computer.
 Disconnect all other external cables (figure A).
 Lift up the front edge of the Apple and tip it so it rests on the back of the casing.
 Use a flat blade screwdriver to turn the locking screws on each side under the cover towards the front (figure B item 1).
 Turn the screws 1/4 turn counterclockwise.
 Lower the Apple III to the table, lift the cover up and pull it forward to remove (figure C).

Remove all peripheral cards from their slots.
 Replace the cover, you need not lock the screws in place.

Remove the Baseplate

Place the computer upside down on a table, rear facing you.
 Remove the 11 screws around the large plate (figure I).
 Lift bottom plate from right side just a few inches.
 Carefully disconnect the speaker, keyboard and disk drive cables (figure J items 1, 2 and 3).

NOTE: Remember where each cable goes for reassembly. You remove the larger cables with a gentle side-to-side rocking motion. DO NOT pull on the cable itself, it could cause future failures.

Lift the assembly, and finally remove the power supply plug.
 Treat your motherboard gently. Avoid static electricity by grounding yourself out to a doorknob or such before proceeding.

Removal of the old ROM

Locate position G-9 on the motherboard. (see map page 32)
 Remove the IC with a small screwdriver, gently rocking it out of the socket. Be careful not to bend the metal strip behind the IC.

Installation of the ROM chip

Note the notch at one end of the chip. Make sure it is pointed the same direction as the other chips on the board. Do it wrong and say, "BYE, BYE!" to your ROM.
 It may be necessary to bend the pins of the chip slightly so it will enter the socket. If that is the case, gently press the pins against a metal surface. Avoid touching the pins with your hands!
 Insert the ROM into the socket and push it firmly into place.
 Check to be sure all the pins went into their locations without bending.

Installation of the cable connectors assembly

Locate position G-14. (see map page 32) You should find a three pronged connector near the large IC labeled J19.
 Connect the smaller of the two interlace connectors to the two prongs furthest from the IC.
 The two nibs on the connector should point to the inside of the motherboard.

NOTE: If your computer does not have the three prong connector installed you will have to solder the supplied connector to the point mentioned above or solder the wires direct.

Locate connector J20 at position on H-1 (see map page 32) and connect the larger of the interlace connectors with the holes facing up if the pins are bent horizontal or facing outward if the pins are vertical.

Attach the two free ends of the interlace wires to the switch.

See below for installing the switch.

Attach either wire to the middle pin and the second wire to any one of the remaining pins.

Reassembly

To reassemble reverse the steps of assembly.

NOTE: Before you reassemble take the time to push on each chip on the motherboard with your thumb, to insure that they are firmly seated. They often work themselves loose over time and use.

Installation location for the switch

There are many possible locations for the interlace activation switch. One location is as good as another as long as it is accessible and you remember where it is. Here are a few suggested locations:

- One of the unused holes on top at the rear of the computer's metal casing.
- One of the vent holes on the sides of the casing.
- A hole can be drilled in the vertical portion of the baseplate near the peripheral jacks. This position does have the advantage of never having to disconnect the switch when servicing the motherboard or in performing further upgrades. However, care must be taken not to damage anything while drilling.

Do not drill on the baseplate until you have removed the motherboard.

CAUTION!

UPIC Installation

Universal Parallel Interface Card

INSTRUCTIONS

The Apple III Universal Parallel Interface Card (UPIC) is a simple, yet powerful extension to your Apple III. Using nothing more than the UPIC, a cable, and the driver supplied on the enclosed diskette, you can set up your Apple III to do eight-bit parallel data transfers either to a printer, or both to and from a terminal or another computer.

Preparing a Backup Diskette

The diskette that came with your UPIC contains important software you will need for as long as you use the UPIC. Lest anything happen to your one and only copy of this diskette, we strongly urge you to make a duplicate copy. Use the Copy Diskette utility program as described in the Apple III Owner's Guide, Chapter 4. Then put the original diskette in a safe place for future use. The diskette you received also contains 13 other popular driver files.

Preparing the UPIC

Before you install the UPIC, set the switch marked Printer L.F. on the UPIC to NORM. Also, before you open the Apple III, be sure that the power is turned off. However, DO NOT unplug the Apple III. The ground connection through the power cord helps prevent damage to the Apple III's internal parts.

The Installation Procedure

First you must remove the cover of the Apple III. Turn the Apple III over and locate the two cover attachment screws halfway up each side of the bottom panel (figure B).

Loosen each screw a quarter turn, and then turn the Apple III right-side up with the keyboard facing you. Now lift the top cover and carefully pull it toward you and off (figure C).

Install the UPIC in slot 1 (figure R). Grasp the upper corners of the UPIC so that the gold fingers of the edge connector is toward the back of the Apple III. Insert the UPIC in slot #1, making sure the metal Radio Frequency Interference (RFI) shield fits snugly against the Apple's case and the front edge of the UPIC slides into the vertical guide. Gently rock the UPIC back and forth until it is firmly seated.

Replace the top, carefully slipping the four tabs along the back of the cover into the corresponding four square holes in the case. Turn the Apple upside down again, and then push in and retighten the two cover attachment screws.

Connecting the Cable

Attach the smaller of the two cables supplied directly the UPIC with the 20 pin female connector. Then, connect the longer of the two cables to that adapter and the other end directly to the printer.

Setting up the Device Driver

To install the device driver, which is a set of computer instructions designed to pass information to and from whatever is connected to it, refer to Chapter 4 of the Apple III Owner's Guide. We have also included our own set of instructions to perform the necessary change in the configuration of your boot disks. The correct driver for the UPIC is noted on the Master Driver Data diskette on the file named UPIC.DRIVER. This driver is correctly configured to operate most parallel printers.

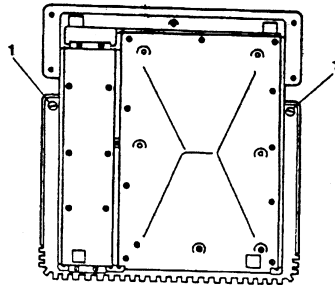


Figure B

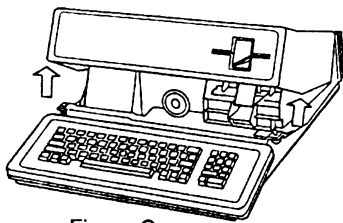


Figure C

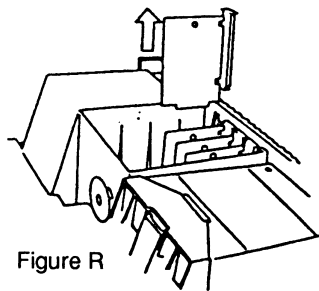


Figure R

128K RAM Diagnostics

There is a RAM diagnostic built into the monitor ROMs of all Apple IIIs that's useful for testing the memory of a *12-volt 128K Apple III* (typically, Apple IIIs with serial numbers less than 100,000). This test self-test, unfortunately, *will not* work on newer machines or 5-volt 256K machines.

NOTE: Before running this test, remove all peripheral cards from the Apple III, especially any ProFile interface cards and Grappler printer cards.

To run the diagnostic:

1. Hold down the CTRL and Open Apple keys, and then press and release RESET key. The MONITOR prompt, a right arrow and a flashing underline, should appear in the upper left corner of the screen.
2. Type F6E6G and then press the RETURN key.
3. The test should now begin to cycle: in the upper left hand corner of the screen you'll see, about every 20 seconds, a pattern of dots like this: (figure 1).

If the test runs for 20 minutes and displays only dots, the RAM isn't defective. If characters or inverse blocks show up in the matrix, however, the diagnostic has found defective memory chips.

The position of the non-dot character in the display (usually an inverse "1") above corresponds with the chart below, which lists the chip location on the 12-volt memory board.

Replace the bad memory chip(s) and run the test again. If the system once again fails the memory board test, replace the memory board itself. If that doesn't help, replace the main logic board. (Error messages displayed below the DIAGNOSTIC RAM grid, by the way—such as "ACIA", "ROM", or "VIA"—indicate a problem with the logic board.)

Please remember that this is not a fool-proof test, it is however right most of the time. Main logic boards (motherboards) and memory boards are in stock and available from Sun. We do not have individual chips for sale.

DIAGNOSTIC RAM

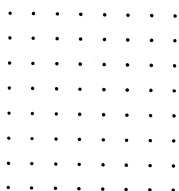


Figure 1

B9	E6	B7	B8	B5	B4	B3	B2
B17	B16	B15	B14	B13	B12	B11	B10
B9	B8	B7	B6	B5	B4	B3	B2
B17	B16	B15	B14	B13	B12	B11	B10
C17	C16	C15	C14	C13	C12	C11	C10
D9	D8	D7	D6	D5	D4	D3	D2
D17	D16	D15	D14	D13	D12	D11	D10
C9	C8	C7	C6	C5	C4	C3	C2

Figure 2

Disk Drive Maintenance

Protect Your Media

INSTRUCTIONS

We get a lot of calls that deal with disk drive problems and have found that a good bunch of them can be cured by just performing a little housekeeping. You shouldn't be afraid of tackling such a project no matter how mechanically inclined you think you are.

Sometimes "disk drive problems" are really media problems, caused by the way disks are stored. Make sure you keep disks away from dust, heat, electromagnetic inducing devices such as power supplies, CRTs, magnets, and the like.

You Will Need:

1. Q-tips
2. Solution of 80% denatured alcohol and 20% deionized or distilled water

The following preventive maintenance procedures should be performed whenever a repair or adjustment is done on a disk drive.

Disk ///

1. Remove the cover and clean the guide rails (the metal shafts that the head slides on) with the alcohol/water solution. Do not use grease.
2. Inspect the head for worn or dull spots in the ceramic. If you find any, replace the assembly containing the head.
3. Clean the head with the alcohol/water solution.
4. Remove the bottom of the drive and inspect the disk drive belt for cracks, slippage, and elasticity (should not be dry and cracked). Replace if necessary.
5. Move the head assembly back and forth along its full length of travel.
Check for blockage and smooth easy movement.

Motherboard Identification

If you ever have the occasion to have to call our Service-Line it is important that, in order to give you correct information, that we know exactly what we're dealing with. That is especially true when trying to diagnose a problem over the telephone without the benefit of being able to personally observe the symptoms. Here is how to tell the different types of motherboards (main logic boards) apart.

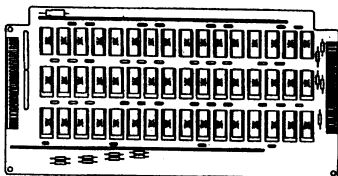
There are two types of Apple /// main logic and memory board combinations. They are typically referred to as either being "5-volt" or "12-volt".

Background

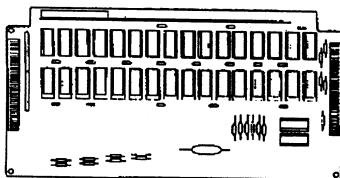
Since there are two types of boards found in Apple ///s, the first step in servicing yours is to identify whether the system contains 5 or 12-volt boards. Systems above serial number 100,000 are 5-volt systems. When the Apple /// was first introduced, 64K random-access memory (RAM) chips were too expensive to incorporate into its design. Approximately a year later they became economically feasible and began to replace the mixture of 16K and 32K RAM chips used until then. An additional advantage was that a 256K system would actually draw less power than the original "mixed" 128K system.

The first and best way is to look at the part numbers of the ROM chips at locations C11 and C13. (see map page 32) Here is what to look for:

Here's what to look for



12 Volt Memory Board



5 Volt Memory Board

5-volt		12-volt	
Location	Part #	Location	Part #
C11	341-0061	C11	341-0044
C13	341-0062 (128K) or	C13	341-0042
C13	341-0063 (256K)		

The 342-0063 part number works for either a 128K or 256K configuration. The second method of verifying which main logic you are working with is to look at R58, which is located just above location C13. (see map page 32) On a 12-volt logic board a 27 ohm, 1/4 watt resistor will be present. On a 5-volt logic board R58 will be missing and a solder bridge will connect the small solder pads on the logic board under R58's mounting position on the board.

There are also two different types of Apple /// memory boards. The 12-volt board has three rows of RAM on it. Two rows are filled with 16K RAM (Apple part # 334-0002) and one row with 32K RAM (part # 333-0002). A 256K 5-volt board has two rows of 64K RAM (part # 334-0003) mounted on it. A 128K 5-volt board has one row filled with RAM and one row empty. Five-volt boards are also marked "5-Volt Memory Board" on the top center of the card.

No mixing of boards

The two memory boards and the two logic boards are not totally interchangeable. Always remember that logic and memory boards of the same voltage must be used together. Main logic boards can be modified to work with either type of memory board, but memory boards cannot.

Upgrade Kits are available for both types of systems if you would like to swap for more memory from 128K to 256K.

Adding a Driver to Your Current Configuration

Introduction

The Apple III's Sophisticated Operating System (SOS) has the unique ability to make your system handle peripherals pretty much in the manner you would like them handled. As the SOS communicates with the different parts of the Apple // it used a special system called drivers to carry instructions to and from the peripheral devices.

So, whenever you add a new device to your Apple III it stands to reason you need to get a new roadmap set up to let the new device communicate through the operating system. Thus, the need to run something called the System Configuration Program (SCP) to install the proper device.

The Sophisticated Operating System (SOS) has to be installed on each boot disk in order to supply the necessary groundwork for your applications software to run and the Device Drivers are part of that system. Each boot disk must receive that new information each time you change or add a device to your system configuration.

This is not a terribly difficult thing to do but it seems to psychologically scare people. Follow these simple directions and you'll find out just how easy it really is to accomplish.

Getting started

Take out your backup copy of the Systems Utilities Program. Put the disk into the built-in drive of your Apple III. After the files are loaded into the memory your screen will display the following menu: (see screen 1)

Next, to get into the SCP simply type the letter "S". This is what will greet you: (see screen 2)

Now choose the Read a Driver File option by typing the letter "R". At the top of the screen it will tell you that no drivers have been loaded yet. At the bottom of the screen it will be asking for information regarding the Pathname of the Driver File you wish to read.

If you are adding or changing a driver to a program boot disk (Systems Utilities, AppleWriter, //EZ Pieces Boot, VisiCalc, etc.) you can nest insert that disk in one of your disk drives. Depending upon where the disk (volume) you want to read from is, you'll want to now enter the Pathname ".D1/SOS.Driver" and press RETURN. It will take 10 to 15 seconds for the driver file to be added.

Adding the new driver

Simply take the driver file (data disk or boot disk), whichever you are wanting to get the appropriate driver from, and slip it into one of your drives and enter the correct Pathname as described in the previous step.

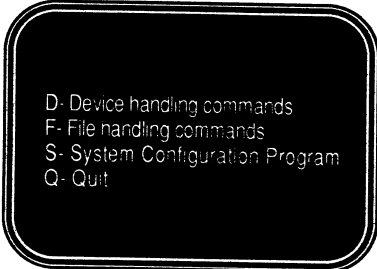
If you are getting your new driver information from a data disk you will have to refer to the specific name of that file that contains the needed driver such as (.D1/Printer.Driver.). If you are retrieving a driver form another boot disk you will need to read the entire SOS.DRIVER file and then delete any duplicate or unnecessary files before generating the new configuration.

The new driver will be read and added to those already on the screen.

NOTE: If you do not know the file name of the driver on a Driver Data diskette when you are asked to enter the pathname, address the device (.D1 or .D2) and after the slash (/) enter the "up" arrow. You will see the file names included on that particular disk displayed in the upper right hand corner of the screen. Simply choose the one you would like to access by using the up or down arrows to locate and right arrow to specify, then hit RETURN. That specific file will then be read into your current driver configuration.

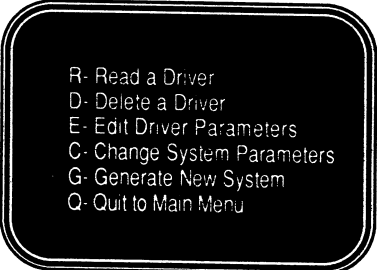
Generating a new system

Next you want to press escape, until you get back to the main menu, and type "G" (Generate a new system). If the volume (disk) to which you would like the new system to be generated is in drive 2, simply press RETURN.



D- Device handling commands
F- File handling commands
S- System Configuration Program
Q- Quit

Screen 1



R- Read a Driver
D- Delete a Driver
E- Edit Driver Parameters
C- Change System Parameters
G- Generate New System
Q- Quit to Main Menu

Screen 2

Generating New Driver File

If you are generating a new driver file to a program disk you will probably see a message that asks if you want to erase the old file or create a new one.

That message is a warning that an old SOS.DRIVER already exists and you still have a chance to change your mind. If you type "N", the command will be cancelled. If you type "Y", the new SOS.DRIVER file will replace the old one and you may see a second warning at the bottom of your screen.

Again, you have the chance to change your mind. Typing "Y" will replace the old file with the new one.

After generating the new SOS.DRIVER file to your program disk, you will need to boot that disk in order to load in the new drivers by holding down the CONTROL key and pushing the RESET button behind the top right edge of the keyboard at the same time.

It's easy now to take that same file (SOS.DRIVER) and copy (replace) your old SOS.DRIVER file with the new one on any boot disk you want to contain the new driver instructions. To do this you simply use the Copy feature on the File Handling Commands option of your System Utilities Program.

Two -Stage Boot

What If there's not enough room on my diskette?

Because device driver take up so much space on a disk it is not reasonable to have all possible drivers installed. So, in some cases you may need to either create a two-stage (two disk) boot or delete unnecessary driver. A good rule is to put only the drivers actually needed on each boot diskette.

Creating a two-stage boot

In order to create a two-stage Utility Boot you simply need to divide the files onto two separate diskettes. First format two diskettes naming on SYS.UTIL1 and the other SYS.UTIL2. Then copy from your backup copy of the Systems Utilities Program the following files: (SOS.KERNAL), (SOS.INTERP) and (SOS.DRIVER) to the diskette you named SYS.UTIL1. Next, copy the files of (SYSTEM.MISCINFO), (SYSTEM.PASCAL) and (SYSTEM.STARTUP) to the diskette you named SYS.UTIL2.

In order to use these put the first disk in the built-in drive and enter CONTROL/RESET to boot the system. After that portion of the operating system loads it will ask you to "Put System Disk in Built-In Drive". After you insert your second diskette in the drive enter RETURN and the Utilities Main Menu will come to the screen. You'll now have plenty of room for even the largest of driver files.

The following tables list the meanings of each of the bytes in the Printer Configuration Block and the values normally used for the first two of them.

Printer Block Information

Printer Configuration Block

Byte	Meaning
00	Printer Speed
01	Communications Format
02	Carriage Return Delay
03	Line Feed Delay
04	Form Feed Delay

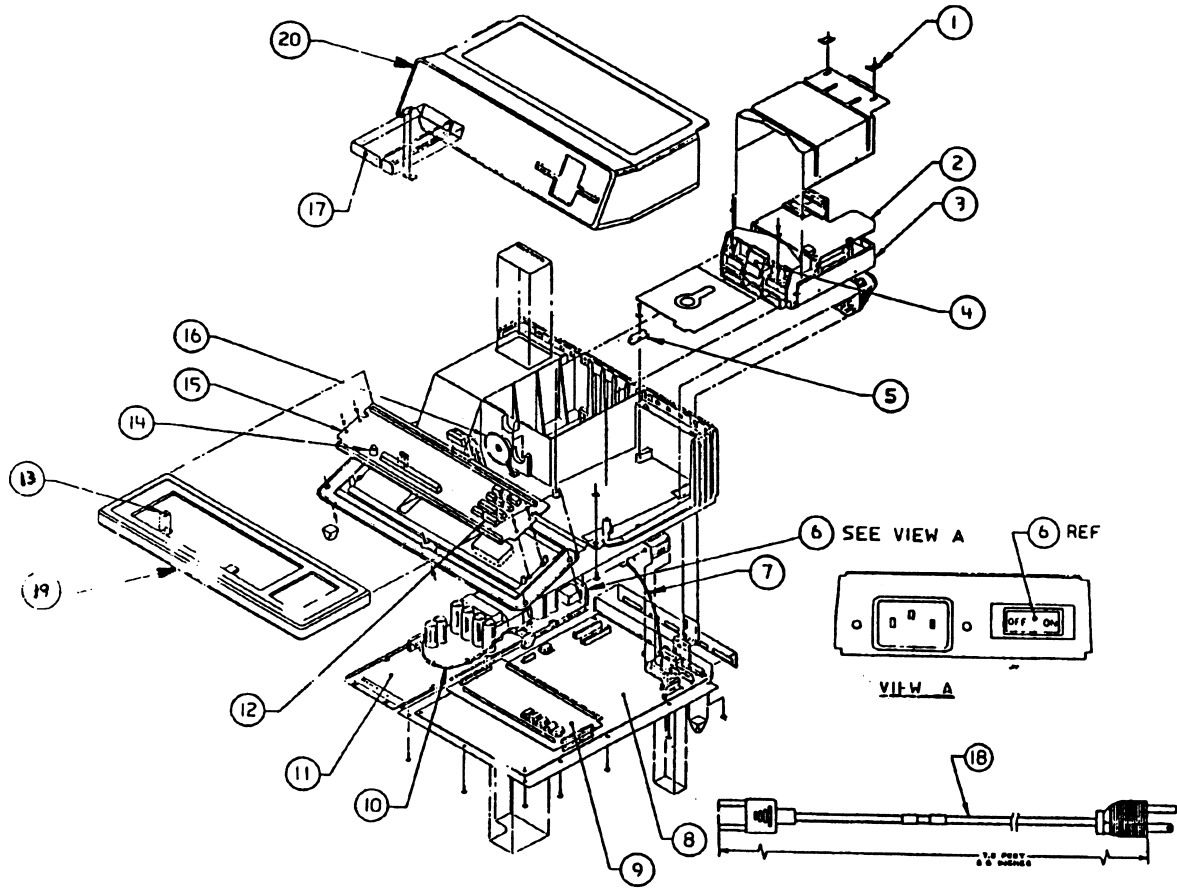
Communications Format Table

Value	Format
22	7 bits, odd parity
26	7 bits, even parity
2A	7 bits, mark parity
2E	7 bits, space parity
00	8 bits, no parity
42	6 bits, odd parity
46	6 bits, even parity
4A	6 bits, mark parity
4E	6 bits, space parity

Printer Speed Tables

Value	Speed
03	110 baud (Teletypewriter speed)
04	134.5 baud
06	300 baud (A common telecommunications speed)
07	600 baud
08	1200 baud (A common communication speed)
09	1800 baud
0A	2400 baud
0C	4800 baud
0E	9600 baud (A common printer speed)

Apple /// Parts List



ITEM	DESCRIPTION
1	Fastener, Retaining Clip
2	Disk Analog Card
3	Internal Disk Assembly
4	Door Clip, Disk
5	Clip, Disk Hold Down
6	Switch, ON/OFF
7	Cable, Keyboard
8	Logic Board (motherboard)
9	Memory Board w/RAM
10	Cable, Power Supply
11	Power Supply

ITEM	DESCRIPTION
12	Keycaps
13	Label, Power On Lens
14	Lamp, Keyboard
15	Apple /// Keyboard
16	Speaker Assembly
17	Apple Nameplate
18	Power Cable
19	Keyboard Cover, ///
20	Keyboard Cover, ///+

Adjusting Disk /// Disk Drive Speed

The solid state portions of the Apple ///s tend to be so reliable that we tend to ignore our mechanically operated floppy disk drives until something serious goes wrong with them. But because floppy drives have a large number of moving parts, friction tends to cause drive speed fluctuations after a period of time that can lead to serious drive errors.

The most common symptom of drive speed problems comes with "VOLUME NOT FOUND" errors, etc. Then upon inserting a second disk and you get the same error message. Errors while using the SYSTEM UTILITIES program are also evidence of disk speed problems. If the program bombs with a DEVICE DEPENDENT ERROR #34 the drive is operating too fast. DEVICE DEPENDENT ERROR #33 indicates a slow drive.

Sun's Service Center or your local dealer can fix the problem quickly or you can even make the necessary adjustment yourself. In this article we will suggest two ways of doing so.

Importance of Drive Speed

You may think of a diskette as a piece of recording tape stretched into a circle. Instead of recording heads "printing" varying amplitudes of magnetic energy that can be translated back into audible sound, a diskette very accurately writes small magnetic bars of the same size which are read by diskette drive heads as the "bits" of a byte. This type of system allows data to be written to a diskette far more densely than an audio recording system can.

Apple's Disk /// is designed to run at one revolution every 200 microseconds, which is also 5 revolutions a second or 300 revolutions a minute. This speed must be very accurate for the computer and drive to synchronize read/write operations at the correct spot on the diskette's iron oxide surface. If the speed is off too much you will read garbage from or, worse, write garbage to your diskette.

Furthermore, a diskette created on a drive running at one speed may be unreadable by a drive running at another, a very irritating condition if you need to transfer diskettes from one /// system to another at a remote site.

Tools Needed

You'll need the following tools:

- One small Phillips screwdriver
- One small flat blade screwdriver
- A couple of blank diskettes
- A 60 cycle strobe lamp or fluorescent lamp
- Apple /// Dealer Diagnostics Disk

It's a good idea to check your drive speeds once *before* pulling your system apart. If the speeds are right on target, something else is wrong with your drive, and for those repairs you should seek more qualified assistance for your drive repair.

Exposing the Drive

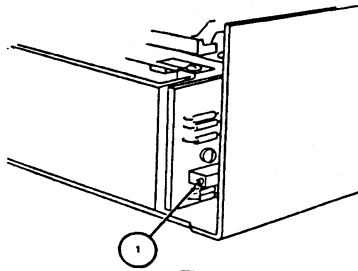


Figure 1

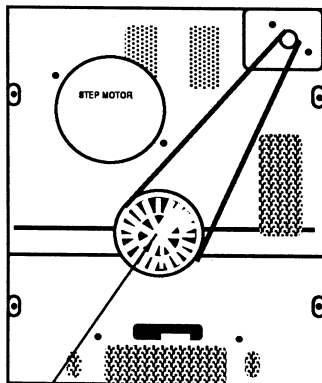
For proper adjustment, you will need to expose the internals of your particular drive. Turn off your /// off. Unplug your drive or drives (adjust each drive in turn as the second drive). If you are not using a strobe lamp the bottom cover may be left on. For access to it's upper portions, the external Disk /// requires that a large single Phillips screw be removed from the back first, and the cover pulled off, back to front. Then take out the four screws of the drive shield and remove it. The bottom cover, held on by four screws of small Philips screws, must also be removed. For your ///'s internal drive, simply remove the computer cover and drive shield. All other notes below for an external Disk /// apply to the internal drive.

Location of Speed Adjustment Potentiometer

The speeds of the Disk /// is controlled by a small potentiometer which is adjusted with the small flat blade screwdriver.

The Disk /// adjustment is a small, blue rectangular potentiometer located on a small circuit board on the back right-hand side of the drive (figure 1). It is adjusted by a small screw on the side of the potentiometer. Generally, when facing the potentiometer of either drive, to increase speed you will turn the screw clockwise and counter-clockwise to decrease speed.

Using a Strobe Lamp



Strobe Wheel

Figure 2

The strobe method of disk drive adjustment is an art for the patient, and while those familiar with strobes can get the speed pretty close, novices may not be as lucky. A120 volt, 60 cycle neon strobe lamp is best. These are available at many electronic stores. In a pinch, you can use a common neon lamp with an 100 ohm resistor, items found at any Radio Shack or even view the strobe pattern under a flouresent lamp.

After removing your drive's covers, plug it back into your /// and place it on its side so the adjustment potentiometer is easy to reach and the timing wheel is facing you (figure 2). Turn on your ///. Place a properly formatted diskette into your drive .

You will need to run the drive continuously to do the speed adjustment. The following Business Basic program works fine:

```
10 REM **** SPEED ADJUSTMENT PROGRAM ****
20 REM **** PRESS CONTROL-C TO END ****
30 CATALOG
40 GOTO 20
50 END
```

Bring the strobe close to the spinning wheel. If the drive properly adjusted the 60 cycle the blocks on the wheel will appear to freeze. If not, they will slowly move to the left or right. Turn the potentiometer adjustment until the blocks freeze. This takes a very fine hand, so relax, take a break, and check again. When the blocks have remained in place for some time, you can consider the drive adjusted.

Using the the Diagnostic Diskette

After removing your drive's covers, plug it back into your ///. Turn on your ///, and boot the DIAGNOSTICS DISK. Use the program to create your test diskettes, then choose the drive check option. Go through the various disk check utilities for track writing, write-protect, switches, etc. If you have any failures with those, your drive may need more serious repairs. At the speed verification routine, your /// will spin the drive and display numbers running from -20 (slow) to +20 (fast). Turn the adjustment screw until the program displays the ideal speed: 0. Let the system run about a minute and, if necessary, adjust again. Press ESCAPE to end the routine.

Errors - Messages During Startup

Diagnostic messages

When you turn on your Apple III, it performs a number of diagnostic checks on its hardware. Of any of these tests fail, you will get one of the diagnostic messages below. If you get one of these messages, see your dealer. Do not use the computer: a defective computer could erase data from your diskettes.

RAM The test of the Apple III's random-access memory failed. The pattern on the screen indicates which component is faulty. See your dealer.

ROM The test of the Apple III's read-only memory failed. See your dealer.

ACIA The test of the Asynchronous Communications Interface Adapter (ACIA), which controls the RS-232-C serial port, failed. See your dealer.

VIA The test of the Versatile Interface Adapters (VIAs), which control various internal functions in the Apple III, failed. See your dealer.

A/D The test of the Analog-to-digital converter, which controls the joysticks, failed. See your dealer.

ZP The Zero Page test, which determines whether the Apple III's memory addressing circuitry is operational, failed. See your dealer.

SOS Errors

If the Apple III passes the diagnostic tests, it tries to boot the diskette in the built-in drive. If an error occurs during the boot process, a message is displayed (in black characters on a white background) in the middle of the video screen, the Apple beeps, and the system waits for you to try again. Any boot error is a fatal error: you must insert a proper boot diskette, hold down the CONTROL key and press the RESET button to reboot, generally with a different diskette.

These errors can be produced during a bootstrap operation:

(BLANK SCREEN) The diskette in the built-in disk drive is not a boot diskette. Insert a proper boot diskette into the built-in drive, hold down the CONTROL key and press RESET to attempt to reboot.

RETRY The disk boot failed. Either there is no diskette in the built-in drive, or the diskette is unformatted, or the data on the diskette has been destroyed; or the diskette is not inserted straight. Remove and reinsert the diskette, making sure it

is straight. If the error occurs repeatedly, place a known good boot diskette in the built-in drive, close the door, and attempt to reboot. If the error occurs with several boot diskettes, see your dealer.

DRIVER FILE NOT FOUND There is no file named SOS.DRIVER listed in the volume directory of the boot diskette. SOS cannot operate without device drivers, and the drivers must be stored in a file with this name, in the volume directory of the diskette.

DRIVER FILE TOO LARGE The SOS.DRIVER file is too large to fit into the system's memory along with the interpreter. Use the System Configuration Program to remove one or more drivers from this file.

EMPTY DRIVER FILE The SOS.DRIVER file contains no device drivers. SOS requires at least one device driver, usually, CONSOLE, to operate most interpreters.

INCOMPATIBLE INTERPRETER The interpreter is either too large or specifies a loading location that conflicts with SOS. This error usually occurs when trying to load an older interpreter with a newer version of SOS.

INTERPRETER FILE NOT FOUND There is no file named SOS.INTERP listed in the volume directory of the boot diskette. SOS cannot operate without an interpreter, and the interpreter must be stored in a file with this name, in the volume directory of the diskette.

INVALID INTERPRETER FILE The SOS.DRIVER file is not in the proper format for an interpreter file. This error occurs when a file that is not an interpreter is assigned the name SOS.INTERP and the system is then booted.

INVALID DRIVER FILE The SOS.DRIVER file is not in the proper format for a driver file. Make sure that the file was either created by the System Configuration program or obtained from a valid Apple III boot diskette.

I/O ERROR The loader has encountered an I/O error while trying to read the kernel, interpreter, or driver file from the diskette in the Apple III's internal disk drive. Make sure the diskette is correct and properly inserted in the drive. If the error occurs with several boot diskettes, see your dealer.

KERNEL FILE NOT FOUND There is no file named SOS.KERNEL listed in the volume directory of the boot diskette. The files SOS.KERNEL, SOS.INTERP, and SOS.DRIVER must all be present in the volume directory of a diskette to be booted.

ROM ERROR: PLEASE NOTIFY YOUR DEALER Your Apple /// contains an older version of the bootstrap ROM, which is not supported by this version of SOS. Your Apple dealer should be able to replace the ROM at no cost. If you receive this message, please contact your dealer or the nearest Apple Service Center.

TOO MANY BLOCK DEVICES. The SOS.DRIVER file contains too many block device drivers. Use the System Configuration Program to remove one or more of the block device drivers from this file.

SCP Errors

These errors are reported during the operation of the System Configuration Program.

No device drivers have been read. You're not allowed to do lots of things until you've read at least one.

Errors In Reading Driver Files

Illegal wildcard: Either (a) two wildcards were used where only one is allowed, or (b) a wildcard was used when only a single file is allowed (e.g., you can't send a directory listing to multiple files).

Invalid pathname: The specified pathname violates the syntax rules for pathnames. A common error is more than 15 characters in a local name.

Pathname too long: The specified pathname has more the 80 characters.

Errors in Editing System Parameters

File contents incorrect: The character set or keyboard set contains invalid data.

Slot number may not be altered for this driver: This driver works only if its device is in a particular slot.

Errors While Generating System

These errors will not prevent SCP from generating the system configuration, but they indicated that the system may not work.

Character set not loaded: Use Edit System Parameters to set the required items.

Duplicate Driver names: Use Edit Driver Parameters to change driver name of one of the two.

Keyboard layout not loaded: Us Edit System Parameters to set the required items.

One or more drivers require slot assignments: Use Edit System Parameters to set the required items.

System parameters are not set: Use Edit System Parameters to set the required items.

Filer Errors

These errors are reported during the operation of the Filer:

Bad disk medium/drive: The disk has been physically damaged and is unusable, or the disk drive is malfunctioning.

Blocked volume name expected: You specified a character device name when a block device name was expected.

Cannot read source diskette: The diskette that you are trying to make a copy of is unreadable. Make sure you have specified the proper source and destination drives, and that the diskette is correctly inserted in the source drive.

Command requires SOS-format disk: This command (e.g., Make a subdirectory) works only on SOS disks, not on UCSD-format disks.

Device dependent error #N: See manufacturer's documentation. The specific device is not connected to the system or is turned off.

Device not configured into the system: The driver for the specified device is not in the system configuration.

Device not on line: The specified device is not connected, not turned on, or (if a block device) has an open door or contains no volume or an unformatted volume.

Directory already exists: The specified operation will create a directory with the same name as one that already exists. As this operation will delete the old directory, you will be asked to confirm your intention.

Directory full: The specified operation would put more files into a directory than it can hold. One solution is to make a larger subdirectory and copy the files to it.

Disk drive not present/not configured: You specified a disk drive that you either have not physically installed in your system or have not configured your Utilities diskette to recognize. Make sure that your daisy-chain cables are connected securely, and use the System Configuration Program (see the chapter The Utilities Diskette) to configure your boot diskettes for the proper number of disk drives.

Error #N: Internal program error> The number N is returned by the language interpreter: see the manual for the language.

File already exists: SOS does not allow two files to use the same pathname. The specified operation will create a file with the pathname of a file that already exists, or will change the pathname of one existing file to that of another. If this happens, you will be asked for confirmation, and if you give it, the old file of that pathname will be deleted so that the new file can use the pathname.

File expected: This operation works only on files, and you specified something that was not a file.

File or blocked volume expected: This operation works only on files or block devices, and you specified a character device.

File or character device expected: This operation works only on files or character devices, and you have specified something else, like a block device.

File open: access not permitted: This error usually occurs when you have tried to delete a file that is open for access, such as a program that is executing. If you tried to delete SYSTEM.STARTUP from a boot diskette while that file's program was running, you would get this error.

Formatter device driver not present in system: The formatter device driver for a drive must be configured into the system before a drive can be used for formatting or copying volumes. These drivers can be found in the SOS.DRIVER file on the Utilities diskette.

Illegal disk format for this operation: Either (a) you tried to do something to a SOS disk that can only be done to UCSD disk, or (b) you tried to do something to a UCSD disk that can only be done to SOS disks.

Illegal character in volume name: The volume name must contain only letters, numbers, and periods; the first character must be a letter.

Illegal device name: Device name must start with a period, followed by a letter, followed by no more than 13 letters and numbers.

Illegal volume name length: The volume name must not exceed 15 characters.

Illegal wildcard: Either (a) two wildcards were used where only one is allowed, or (b) a wildcard was used when only a single file is allowed (e.g., you can't send a directory listing to multiple files).

Invalid copy: The specified copy operation is impossible: e.g., copying a subdirectory to itself.

Invalid number: The number violates a syntax rule: usually, because it contains a space or a comma.

Invalid pathname: The specified pathname violates the syntax rules for pathnames. A common error is more than 15 characters in a local name.

I/O error during format operation: Unidentified input/output error, such as an open drive door, no diskette, or an unformatted diskette.

I/O error: Unidentified input/output error, such as an open drive door, no diskette, or an unformatted diskette.

Medium is write-protected or not present: The diskette you are trying to format or copy onto is write-protected or is not present. If you wish to destroy the information on a write-protected diskette, remove the diskette from the drive, peel off the small tab that covers the write-protect notch, and reinsert the diskette. If the diskette is not write-protected, the drive may be configured in but unplugged.

Not enough memory (too many files at once): The specified directory is too large to load into memory.

Not enough memory to do copy: The volume directory has filled all available memory, leaving no room for storing information to be copied to another volume. The usual causes are (a) too many device drivers configured into the system, and (b) too large a directory to fit into memory. The solution may be to remove some drivers from SOS.DRIVER. See the *Standard Device Drivers Manual* for details.

No room on volume: The specified operation would try to put more information on a volume than it can hold.

Pathname too long: The specified pathname has more than 80 characters.

Root directory expected: This operation works only on a volume, or root directory, and you specified something else (e.g., Verify works only on volumes, not files).

Subdirectory expected: This operation works only on subdirectories, and you have specified something else.

Subdirectory not found: The specified subdirectory is not on the specified volume or device.

Unable to read file or directory: File or directory contains invalid data.

Volume already on line: The specified volume has the same name as another volume already in the system. If you copy the Utilities diskette to a volume in another drive, then try to read the directory of the copy, you will get this error.

Volume not found: (a) The specified file was not in any of the devices known to the system. (b) The specified device has no volume in it.

Write-protect error: The file or volume is write-protected and cannot be deleted or written to.

General Errors

SYSTEM FAILURE Indicates a catastrophic failure of SOS, from which the only recovery is to reboot your system. System failures are rare and usually can be attributed to sudden hardware failure or an unknown error in the operating system or language interpreter. If you receive the same system failure at the same place in the same program more than once, your program has probably encountered an error in the language or operating system.

- 01: Reentrant system call.
- 02: Interrupt not found.
- 03: Too many nested interrupts.
- 04: Unable to allocate NMI.
- 05: Event queue overflow.
- 06: Stack overflow.
- 07: Invalid request code.
- 08: Reserved.
- 09: Memory size less than 64Kbytes.
- 0A: Invalid volume control block.
- 0B: Invalid file control block.
- 0C: Invalid allocation blocks.
- 0D: Pathname buffer overflow.
- 0F: Invalid buffer number.
- 10: Invalid buffer request.

Fatal Error Codes - Apple III

ERROR #	DESCRIPTION	POSSIBLE CAUSE	POSSIBLE SOLUTION
\$01	BADBRK - The Apple III tried to execute a BRK instruction code while another BRK instruction was in progress.	1. The memory containing SOS or a device driver is bad. 2. The user has shocked the machine.	1. Replace the memory. 2. Get rid of static electricity before using the machine.
\$02	BADINT - The Apple III received an attention signal from a peripheral card that it didn't know what to do with.	1. The user has shocked the machine. 2. The machine contains an interface card, but SOS either has an incorrect driver for the card or has no driver to handle the card.	1. Get rid of static electricity before using the machine. 2. Remove the card or install a proper driver for that card.
\$03	No Error exists for this number		
\$04	NMIHAND - The Apple III tried to disable the RESET key, but the user or a peripheral card has "pressed" it at about the same time.	1. The user has pressed the RESET button while a copy-protected program was trying to lock up the system. 2. An interface card has gone "bad".	1. Don't press the RESET button. 2. Replace the interface card.
\$05	EVOOVFL - The Apple III is receiving too many event requests.	1. A program has told SOS to ignore events. 2. An interface card has gone bad.	1. Complain to the program developer. 2. Replace the card.
\$06	STKOVFL - Stack overflow	1. Memory has been damaged. 2. The user is using a bad copy of a copy-protected program. 3. The program has a bug in it and has made too many subroutine calls, a bad return call, or has decremented the stack pointer.	1. Replace the memory. 2. Use an original copy of the program. 3. Complain to the program developer.
\$07	BADSYSCALL - the device system has detected an invalid control or status request.	1. Memory has been damaged. 2. Either SOS or a driver has gone crazy.	1. Replace the memory. 2. Use a different copy of SOS.INTERP or SOS.DRIVER.
\$08	MCTOVFL - Too many device drivers.	1. Someone has used an older version of the System Utilities program to install too many drivers. SOS limits the number of drivers to 15 character (i.e. .Printer, .Console) and 15 block (i.e. .Profile) drivers.	1. Remove some drivers.
\$09	MEM2SML - Memory too small	1. Memory has failed. 2. Someone is using an old Apple III. Apple recalled all machines that would report this kind of error in 1980.	1. Replace the memory. 2. Replace the computer.
\$0A	VCBERR - The system buffer control block has been damaged.	1. Memory failure.	1. Replace the memory.
\$0B	FCNERR - The system file control block has been damaged.	1. Memory failure.	1. Replace the memory.
\$0C	ALCERR - Allocation blocks are invalid.	1. Memory failure.	1. Replace the memory.
\$0D	No error exists for this number.		
\$0E	TOOLONG - Filename too long	1. The complete filename (i.e. the file name +any prefixes) is too long.	1. Shorten all file names, including any subdirectories.
\$0F	BADBUFNUM - Bad buffer number.	1. The user is using a bad copy of a copy protected program. 2. Memory has been damaged	1. Use original copy of program. 2. Replace memory.
\$10	BADBUFSIZE - Bad buffer size.	1. Bad memory.	1. Replace the memory.

Non-Fatal Error Codes - Apple III

ERROR #	DESCRIPTION	POSSIBLE CAUSE	POSSIBLE SOLUTION
\$0,0	No Error.	Invalid system call number.	Contact program manufacturer.
\$1,1	Invalid system call number.		Contact program manufacturer
\$2,2	Caller's zero page is not \$1A.		Contact program manufacturer
\$3,3	Invalid extend byte in pointer.		Contact program manufacturer.
\$4,4	Invalid System Call parameter count.		Contact program manufacturer
\$5,5	Pointer parameter out of bounds.		Contact program manufacturer
\$10,16	Device not found.	User has specified a driver name which does not exist.	Type the name of a driver that does exist.
\$11,17	Invalid device number.		Contact the manufacturer.
\$20,32	Invalid request code.		Contact the manufacturer.
\$21,33	Invalid control/status code.		Contact the manufacturer.
\$22,34	Invalid control/status parameter.		Contact the manufacturer.
\$23,35	Device not open.		Contact the manufacturer.
\$25,37	Resource not available.	User is trying to use a driver that needs part of the computer allocated to another driver.	This happens most frequently when using a machine that has both joysticks and SifenType printers.
\$26,38	Invalid operation.		Contact the manufacturer.
\$27,39	I/O Error.	This usually occurs when a disk drive has a problem (e.g. no disk in drive, unformatted disk in drive, bad sector on a formatted disk, etc.).	Check the disk drive.
\$2B,43	Device write protected.	The disk in a drive has had it's write protect notch covered.	Remove the write protect label.
\$2C,44	Byte count not a multiple of 512.		Contact the manufacturer.
\$2D,45	Block number too large.		Contact the manufacturer.
\$2E,46	Disk has been switched.	This happens when a user has an open file on one disk and has put another disk into the drive.	If original disk has been returned, try again. If not, return original disk.
\$30-3F, 48-63	Device specific error		Contact the manufacturer.
\$40,64	Invalid pathname syntax.	The user has specified an invalid pathname.	Check typing and try again.
\$41,65	Too many character files open.	The user is trying to print to too many devices at once.	
\$42,66	Too many disk files open.		Close some files.
\$43,67	Invalid file reference number.		Contact the manufacturer.
\$44,68	Path not found.		Check file name and try again.
\$45,69	Volume not found		Check names and try again.

Compiled by Harold H. Stuart - Technical Representative, Sun Remarketing.

Continued Next Page

Non-Fatal Error Codes - Apple ///

CONTINUED

ERROR #	DESCRIPTION	POSSIBLE CAUSE	POSSIBLE SOLUTION
\$46,70	File not found.		Check file name and try again.
\$47,71	Duplicate file name.	User is trying to create a file that has the same name as one that already exists or is trying to rename a file to a name that already exists.	Change the name.
\$48,72	Disk full.		Change disks.
\$49,73	Directory full.	A main directory can hold only a limited number of files.	Move some files into a subdirectory and try again.
\$4A,74	Incompatible file format.		Contact manufacturer. Should not occur.
\$4B,75	Unsupported storage type.		Contact manufacturer.
\$4C,76	End of file error.	Program is trying to read past the end of a file.	Contact manufacturer.
\$4D,77	Position out of range.	Program is trying to read past the end of a file.	Contact manufacturer.
\$4E,78	Access Errors.	User is trying to write to or delete a file that has been locked.	
\$4F,79	Buffer too small.		Contact manufacturer.
\$50,80	File busy.	Attempt was made to open and write to a file that is already open.	Close the file.
\$51,81	Directory error.	The structure of the directory has been damaged.	
\$52,82	Not an SOS disk.	The disk is probably an Apple // DOS or Pascal disk.	Switch disks.
\$53,83	Invalid value in list parameter.		Contact manufacturer.
\$54,84	Out of memory or system buffer.		Contact manufacturer.
\$55,85	Buffer table full.	Too many files are open.	Close some files or contact manufacturer.
\$56,86	Invalid system buffer parameter.		Contact manufacturer.
\$57,87	Duplicate volume online.	Two disks with the same name are in disk drives.	Remove or rename one of the disks.
\$58,88	Not a block device.	An attempt was made to treat a character device (i.e. printer, console) like a disk device.	Contact manufacturer.
\$59,89	Level error.	An attempt was made to set the file level to an invalid number.	Contact manufacturer.
\$5A,89	Bit map address error.	The disk has been damaged.	Re-format the disk.
\$70	Invalid joystick mode.		Contact manufacturer.
\$E0-E7, 224-321	Memory manager errors.		Contact manufacturer.

Page 42

Apple /// Do-it-Yourself Manual

"_119.PICT" 655 KB 2001-08-25 dpi: 600h x 600v pix: 4944h x 6450v

DAVID T. CRAIG

Pascal Error Codes

TABLE 1: EXECUTION ERRORS

1	Value range error
2	No procedure in segment table
3	Exit from uncalled procedure
4	Stack overflow
5	Integer overflow
6	Divide by zero
7	NIL pointer reference
8	Program interrupted by user
9	System I/O error
10	User I/O error
11	Unimplemented instruction
12	Floating point error
13	String overflow
14	Programmed HALT
15	Programmed break-point

When one of these errors occurs, a message is displayed giving the error number followed by a segment number, a procedure number, and a byte number. These numbers relate to the program listing.

TABLE 2: I/O ERRORS

This table lists all the error numbers that can possibly be returned by the IORESULT function. The notation (SOS) in the table indicates an error reported by SOS; some of the SOS errors are unlikely under the Pascal system, and are included here for completeness only.

0	No error; normal I/O completion
2	Bad unit number
3	Illegal operation (e.g., read from PRINTER:)
5	Lost unit — no longer on line
6	Lost file — file is no longer in directory
7	Illegal pathname
8	No room — insufficient space on diskette
9	No unit — unit is not on line
10	No such file in specified directory
11	Duplicate pathname
12	Attempt to open an already open file
13	Attempt to access a closed file
14	Bad input format — error in reading number
15	Ring buffer overflow — input arriving too fast
16	Write-protect error — diskette is protected
19	Too many files open for system to handle
32	(SOS) Invalid request code
34	(SOS) Invalid control parameter list
35	(SOS) Character device not open
36	(SOS) Device not available

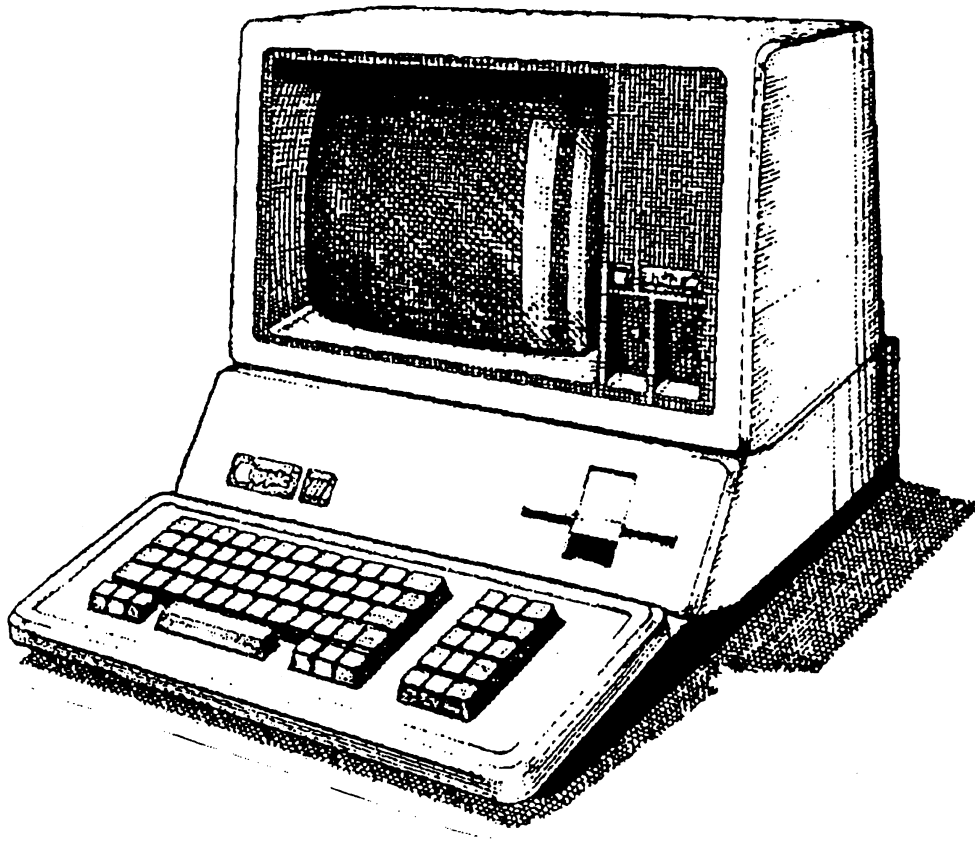
37	(SOS) Resource not available
44	(SOS) Invalid byte count
45	(SOS) Invalid block number
48..63	(SOS) Device-specific error
64	Device error — bad address or data on diskette
65	(SOS) Too many character files open
66	(SOS) Too many block files open
67	(SOS) Invalid file reference number
73	(SOS) Directory full
74	(SOS) Incompatible file format
75	(SOS) Unsupported storage type
76	(SOS) Attempted read past end of file
77	(SOS) File position out of range
78	(SOS) Illegal access attempted
79	(SOS) User's buffer too small
80	(SOS) File busy
81	(SOS) Volume format neither SOS nor Apple //
83	(SOS) Invalid value in list parameter
84	(SOS) Out of memory for SOS system buffer
85	(SOS) Buffer table full
86	(SOS) Invalid system buffer parameter
87	(SOS) Duplicate volume error
123..127	(SOS) System call error

These errors result in a run-time halt unless the Compiler option (\$IOCHECK-) is used to turn off I/O checking. With I/O checking off, the I/O error number can be returned to the program by the built-in function IORESULT.

FINIS



Apple III Computer Information



End of Document