Apple II Diagnostics: An Evaluative Review

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Best Diagnostic Routines
Conclusions

MIND (n.) "A mysterious form of matter secreted by the brain; Its chief activity consists of attempting to understand its own functions; the futility of the attempt being due to the fact that it has nothing but itself to understand itself with." (Ambrose Bierce, THE DEVIL'S DICTIONARY, 1911)

These diagnostics are reviewed:

AE RAM Testers [RamFactor, ZRAM-IIc, Ramworks] (c1988)
Apex II Diagnostics (c1986)
Apple Diagnostics [IIe/IIc/IIgs] (c1990)
AppleCillin II Diagnostics (c1982)
Apple Fixer (c1992)
Applesurance Diagnostic Disk Controller v.3.1 (1982)
Aptest Diagnostics II+/IIe/IIc (c1986)
Bit Banger [IIgs ram tester] (1993)
Certifix IIe/IIc Disk Diagnostics   (c1983)
Internal Self-Test IIe/IIc/IIgs (c1985-92)
Master Diagnostics IIe/IIc v. 7.0 (1990)
MECC Computer Inspector v.1.0 (1988)
MultiRam IIe or IIc Diagnostics by CheckMate Technology (1985)
Power Up! Computer Checkup (1984)
RAM-4000 [IIgs RAM tester]   (c1993)
Real Diagnostics IIe/IIc (c1989)
Sequential Meg-80Z Memory Tester v. 2.1 (1993)
Tuning Apple II Floppy Drives (1995)
Vitesse Disk Drive Diagnostics (1993)
XPS Diagnostics IIe (1985)
Yo Yo Duck Diagnostics IIe/IIc (c1990)
ZIP CHIP IIe/IIc 8 MHz Diagnostics (c1989)
ZIP-GS Diagnostics (c1991)

INTRODUCTION

DIAGNOSTICS are software programs that test computer hardware. When things go wrong, the diagnostics can guide repairs by identifying and scaling problems. Diagnostics have been available since the early heyday of Apple II computing, but these programs are especially important today. Today, Apple II loyalists may find it difficult or impossible to locate technicians who are willing or capable of fixing our equipment. Thus, to keep our equipment alive and well, we Apple II loyalists must do repairs ourselves or reciprocally for one another.

This paper describes the capabilities of many Apple II diagnostics. Nearly all of these diagnostics are now out of print, and their publishers have abandoned their support of the Apple II. I wish to support others who share my interest in keeping the Apple II alive.

Most of the diagnostics reviewed here apply to the IIe, IIc, and II+. Few are IIgs-specific. I have IIe, IIc, and IIgs Apples, but have never used a II+. [The II+ computers I have owned were kept briefly as sources of cannibalized parts]. The IIgs, in IIe emulation mode, can run most of this software although its RAM banks are arranged differently. II+ users can benefit from most of this software, especially software packages dated before 1985. In the following sections I have not commented on II+ diagnostics because I have no way directly to judge II+ compatibility.

GENERAL FEATURES OF DIAGNOSTICS

Each diagnostic package has some special features and these will be described. But many features are shared in common. Common features will be described generally here, and notable exceptions in each diagnostic program will later be identified.

Some features of diagnostic software confirm that the hardware works properly, but they are of limited value for identifying the problem to be fixed. In other words, the test verifies that a hardware feature is in working order, but it does not give sufficient information to guide the repair. Confirmatory information will be appreciated when buying or selling the equipment; the buyer wishes to verify that the equipment works. When breakdown occurs, the program might simply advise the user to seek repairs from a technician.

RAM testing software is a good example of confirmation-oriented diagnostics. It is reassuring to note that the RAM tests have been passed and that the RAM memory functions well. But when RAM tests are failed, few manuals give the user enough information to identify the RAM chip that needs to be replaced. Also, if one of the eight RAMs in the lower 64K bank were to fail, the diagnostic disk itself would be completely unplayable! [Fortunately, the ROM-controlled internal self-test in the IIc and in late-model IIe computers will identify any bad RAM among the 16 RAMs even if disks cannot be booted.]

Apple II 5.25" floppy drives are intended to operate with a rotational speed of 300 rpm [5 revolutions/sec]. A DISK SPEED TEST is included in almost all diagnostic packages, for these reasons. First, the mechanical design of early belt-driven 5.25" floppy drives [such as the venerable classic drive, the Disk II] required periodic speed adjustment - about once every 500 hours of use. Half-height 5.25" drives [e.g., Teac, Mitac, Meiji, BMC] which were introduced in the mid-80s typically had self-regulating speed-control circuitry that made frequent speed adjustment unnecessary.   Second, drive-related copy protection schemes were used widely by software publishers in the early 1980s, and drive speed irregularities caused much software to crash. In recent years, software copy protection has been abandoned by publishers and by users themselves.

Drive speed should be adjusted as close to 300 rpm as possible. Speed adjustment can be done externally on some drives, but most require partial disassembly [or case removal] to gain access to the speed adjustment set screw. The technique is as follows: [1] Disassemble the drive and locate the speed adjustment screw [at the right-rear interior on full-height drives, and in the bottom analogue card of half-height drives], [2] Load the speed-test program, and insert a formatted blank disk into the drive to be adjusted, [3] with the disk spinning, adjust the speed adjustment set-screw as close as possible to the optimum 300 rpm. If exact adjustment to 300 rpm is not possible, then adjust the speed slightly slow of that mark. [Disk drives prefer to run slightly slow rather than fast.]

Note that speed adjustment is irrelevant to 3.5" drives [Unidisk 3.5, Apple platinum 3.5, IIc Plus internal 3.5" drive]. The 3.5" drive mechanism maintains a constant head-speed but not constant

rotational speed. As the head travels from inner- to outer tracks, the rotational speed slows to maintain constancy in head-travel speed. The complexity of the 3.5" speed-control algorithm is one reason why Apple II or Mac 3.5" drives have always been more expensive than the simpler drive mechanism used by IBM [, 1987].

ROM TEST DIAGNOSTICS:

Many diagnostic packages will do tests on ROM code. Several use ROM code to identify the computer model [Master Diagnostics, Apex II, Apple Co. Diagnostics], which is displayed impressively on an opening screen. Test algorithms might be applied to the ROMs to verify that they work properly. It must be kept in mind that ROMs were frequently updated so ROM diagnostics created for early versions may yield false "errors" when applied to more recent versions. For example, four versions of the IIc were produced [Original IIc, Unidisk 3.5 IIc, Memory Expansion IIc, and the IIc Plus]. Extensive ROM expansions were done with each revision, yet the Aptest IIc ROM test recognizes only the oldest IIc ROM set; all later ROMs, including those installed with the factory-recall free upgrade, general false "error" messages.

RAM MEMORY TESTS:

These are found in most diagnostics. The best RAM tests will identify the location of the bad RAMs: These location-specific testers include: AE RAM testers [RamFactor, ZRAM, RamWorks], Sequential Meg-80Z, and Bit Banger IIgs. Some testers will refuse to test other cards or configurations, while others will execute the tests on any RAM card. If a RAM chip goes bad in the lowest 64K bank, then disk-based RAM diagnostics are useless. But the internal self-test can always be used, and it will identify the location of any bad RAM chip. Most RAM testers optionally can be set for a single pass or to repeat continuously.

KEYBOARD AND MONITOR TESTS:

Tests of the keyboard or monitor are often included. Keyboard tests typically display a sketch of the keyboard layout. Screen pictures of keys change in their brightness as the user presses them. Alternative keyboard formats [IIgs, IIc, IIc Plus] can also be tested. The monitor tests include brightness, skewness of lines, high-res, double-hi-res graphics, etc. The most useful monitor tests are those which help in color adjustments.

Can faulty ICs be identified directly by software tests? In the case of IIe RAM, the answer depends on which the location of the faulty chip's RAM bank. Many older (pre-1983) diagnostics are designed to boot with just main 64K bank of memory. Most ProDOS-based software requires 128K of RAM --- both main and auxiliary memory. Presence of a faulty RAM chip in main memory (lower 64K was far more handicapping than when the faulty ram was located in the auxiliary (upper 64K) bank. The internal self-test is highly resilient in coping with damaged RAM - it identifies defective RAM chips equally well in either RAM bank.For the next revision of this review, I intend to do a series of motherboard "chip-zapping" tests to determine whether software can identify faulty non-RAM chips. The plan is damage intentionally various chips (CPU, ROM, MMU, etc.) on the motherboard, then to load and run the diagnostics. I was unable to complete these "chip-zapping" experiments beyond a brief pilot study with a faulty RAM chip but will do further tests prior to the next revision of this paper. I suspect that zapped motherboard processors will remain unidentified by software because the software will be unbootable. For example, CPU tests may become unbootable when the CPU itself is seriously damaged. In that event, CPU tests have value for confirming but not for diagnosing the faults.

Reviews of specific diagnostic packages will follow. For each diagnostic, the main menu screen will be presented, followed by other screens. Special features will be presented where applicable.

AE RAM TESTERS (c1982-c1990)
[RamFactor, ZRAM-IIC, RAM EXPRESS-IIC+, RamWorks]

These are fine diagnostics supplied with Applied Engineering RAM cards. They are copyable, and can be assembled together as a combined set on a single disk. Each test is for a specific RAM card: the card is shown graphically with each ram clearly positioned on its outline of the card. Diagnostics are available for these versions and their variations: (a) RamFactor (IIe and IIgs slot 1-7), ZRAM (65c02 and MMU socketed RAM card for IIC models), Ram Express (Socketed RAM card for latest IIC and IIC+), and RamWorks (IIe auxiliary slot card).

Details of the RAM tests were not specified. Presumably, they would involve both write to RAM, and read from RAM. Tests repeat endlessly until stopped. Continuation of the tests is indicated with a simple spoke graphic that wheels its way across the screen. Bad or unused RAMs are indicated on the graphic outline with an "X" design. This style of identifying bad RAM is clear, and is superior to coded indicators. Because the tests are repeated endlessly, thermal sensitivity of RAM can be judged. Some RAM that initially passes the tests may later fail following warm-up; such failures due to heat are identified by these tests. Overall, these are the best RAM tests available for the IIe, IIc, and IIc+.

APEX II DIAGNOSTICS, V. 4.6 [1986]

[Main Menu Screen]

CONFIDENCE TESTING	PRINTER TESTS
DISK DRIVE TESTS	VIDEO TESTS
RAM TESTS	SOUND TESTS
GAME-PORT TESTS	CARD TESTS
KEYBOARD TESTING	UTILITIES

APEX II is one of the best 8-bit diagnostic packages, and it is recommended highly. It includes a well-rounded comprehensive set of tests, developed for the II+ and early IIe. It also is applicable to later models. Its disk drive tests are very complete: a graphical drive speed test (a clone of APTEST), a Disk II drive ROM test, read/write tests, a write-protect switch test, and alignment tests. The alignment tests are of doubtful validity: they resemble APTEST's alignment test, yet their results are inconsistent with APTEST. The RAM tests also resemble those of APTEST.

The truly distinctive feature of APEX II is its "machine identification" program. This program identifies the model of the computer, and also the interface cards residing in slots. Cards are identified by a checksum routine based on the card's ROMs. My version of APEX presently can identify about 70 interface cards; these cards are listed in a user-inspectable card dictionary (listed under the Utilities menu). When an unfamiliar interface card is detected, the user is asked to identify the card. This identification is then added to the interface card dictionary file. The machine identification program is very helpful to identify unknown interface cards, and also to identify cards without having to "lift the hood" to see them.

APEX II has several utilities to supplement its diagnostics. These include (COPYA) (fast copier/formatter for unprotected 5.25" disks), a test result summarizer, and a disk surface verifier.

The disk operated smoothly: it is unprotected, and returns to the main menu or to sub-menus were smooth. Availability of upgrades beyond v.4.3 is unknown.

APPLE-CILLIN II DIAGNOSTICS   XPS INC. (1982)

[Main Menu Screen]

1 - RAM MEMORY	5 - LINK GROUP OF TESTS
2 - ROM MEMORY	6 - SET/CLEAR RESULT PRINT-OUT
3 - DISK II SYSTEM	X - END TEST SESSION
4 - OTHER TESTS	

[OTHER TESTS Menu Screen]	[Disk II Menu Screen]
O - PERIPHERAL CARDS	H - FORMAT DISK
P – KEYBOARD	I - SEQUENTIAL READ
Q - C R T [monitor]	J - SEQUENTIAL
R – PRINTER	K - RANDOM READ
S - TAPE SYSTEM [cassette]	L - RANDOM WRITE/READ
T - GAME CONTROLS [joystick]	M - TRACK SEEK
U - C P U	N - DRIVE SPEED
X - BACK TO MAIN MENU	X - BACK TO MAIN MENU

This disk predates the IIe, IIc, and IIgs, and its tests were made for the II+. The disk was produced by XPS Inc., a company that later released the XPS Diagnostic disk for the IIe and IIc. A similar sequel was released in 1984 under the name of Power Up Computer Checkup.

Tests are launched by selecting them from the menus, then pressing the "S" key to get them started. Prompts appear to remind the user how to get each routine started.

Apple-Cillin has a very unique "Tape System" routine, to test the cassette write/read ports on the II+ and IIe. (Someday I might test this function - I missed the early years of Apple II computing when cassettes were used for mass storage.) Most of Apple-Cillin's tests will work on the IIe and IIc. For example, the CPU test was intended for the 6502 but it works fine with the IIc's 65c02.

The Disk II routine is outlined by its menu, reproduced above. This routine has several variations for testing writing/reading to/from the disk. Errors in speed, writing, reading, track seeking are identified. These tests work well, and should be done if head-positioning problems with drives are suspected. In the random write/read test, the head is dragged quickly back and forth, so head-positioning faults will be identified. When testing, be sure that the program disk is removed from drive 1; otherwise, it could be erased accidentally.

The RAM-tests can be applied selectively to low- vs. high addresses. While in progress, a spinning odometer remains in motion. RAM chips are identified as either "G" (good) or "B" (bad), within each series of eight RAM chips. Flagging of defective RAMs was not seen because my IIc's RAMs are all good. The number of successively repeating RAM tests is indicated on the screen. RAM tests proceed continually until stopped by a press of the ESC key.

ROM tests can be applied selectively to any of these: motherboard, II+ Slot #0, or to expansion ROMs. But the ROM tests are especially directed towards the IIc. In my Unidisk 3.5 IIc, only the AppleSoft ROM was recognized, all others were judged, "unknown." The "peripheral cards" test does not apply to the IIc. Only one IIc port was recognized by the software.

The CPU-test routine works with the 65c02 as well as the older 6502. It is text-based, and a series of specific subroutine tests are displayed with the words, "tests good." (One wonders whether the disk even load to run this test if the CPU were bad.)

The Peripheral Cards test is virtually inappropriate for the IIc. Only one port, #7, was recognized by Apple-Cillin. Although that port was recognized, it was not evaluated by the software.

Monitor tests are extensive, and particular still patterns or colors can be displayed.

Transition from tests back to the main menu is generally smooth, although the machine will hang when exiting from some tests. In that case, the computer must be rebooted. Tests can be linked together, and the results can be printed at the user's option. The disk is copy-protected but it can be backed up reliably by applying the bit-copier from Locksmith 4.1.

In summary, this disk is old. Its functions were modest by modern standards, and they were superseded by later software. But its disk drive diagnostic test has a few features not found elsewhere. Tests such as the CPU routine and parts of the Disk II test are unique.

THE APPLE FIXER (c1992)

by Adrian Vance
(AV Systems, Santa Barbara CA)

This software is recent and is currently supported by its author, who is a regular correspondent on comp.sys.apple2. AV Systems offers a range of Apple software products aimed mainly at educational users. Regrettably, my disk is temporarily misplaced. A full review of THE APPLE FIXER will be given in the next revision of this paper. I recall that it has a simple but attractive opening screen graphic, and that a modest array of standard tests (drive speed, etc.) are offered.

APPLESURANCE DIAGNOSTIC DISK CONTROLLER, V.3.1 (1982)

(SCREEN MENU, ENHANCED IIE)

LOCN	CHKSM	ID	PROC TEST DONE
DO	98EF	A	APPLESURANCE V.3.1
D8	CAED	A	APPLE IIE
E0	EC0B	A	QUICK TEST:
E8	5A09	A	MAIN RAM 0E
F0	520D	A	HIGH RAM 0E
F8	3EE3	A	ALT BANK 0E

This diagnostic differs from all others because it is ROM firmware implanted on a Disk II-style floppy disk interface card. I have two of them, marketed under these names: ALBERT COMPUTER DIAGNOSTIC DISK CONTROLLER (1982).

The diagnostics are simple: identification of a checksum on six ROMS, and a simple RAM test applied separately to main RAM (lower 64K), then to high ram (upper 64K), and finally to ALT

BANK (extended RAM). The ROM checksums listed here are for the enhanced IIe; if yours differ from the stated checksums stated above, then you must judge that your IIe is unenhanced.

These are few diagnostic tests, but they are done frequently-whenever the computer is powered up. The display fits within a single screen. Thus, little is done but what is done, is frequently seen.

The diagnostic appears quickly on the monitor and remains displayed for two or three minutes. Disk booting is not delayed; the boot continues while the diagnostics screen is displayed.

APTEST DIAGNOSTICS [Call Apple, c1985]

[Main Menu Screen: IIe]

1. APPLE IIE ROM TEST   8. KEYBOARD TEST
2. 48K RAM TEST - ONE PASS   9. PADDLE/JOYSTICK TEST
3. 48K RAM TEST – REPEATING   A. SERIAL PORT TEST
4. TOP 16K TEST - ONE PASS   B. MODEM TEST
5. TOP 16K TEST – REPEATING   C. EIGHTY COLUMN CARD TEST
6. DISK SPEED TEST   D. AUX RAM CARD TEST – ONE PASS
7. DISK INTERFACE TEST   E. AUX RAM CARD TEST – REPEATING

[Main Menu Screen, IIc]

THE APPLE TASTER

1. APPLE IIc ROM TEST   8. KEYBOARD TEST
2. 48K RAM TEST - ONE PASS   9. PADDLE/JOYSTICK TEST
3. 48K RAM TEST – REPEATING   A. SERIAL PORT TEST
4. TOP 16K TEST - ONE PASS   B. MODEM TEST
5. TOP 16K TEST – REPEATING   C. EIGHTY COLUMN CARD TEST
6. DISK SPEED TEST   D. AUX RAM CARD TEST – ONE PASS
7. DISK INTERFACE TEST   E. AUX RAM CARD TEST – REEPEATING

This disk was produced by CALL A.P.P.L.E., a large users' group. John Kohn (Shareware Solutions II) reported in December 1995 that the copyright owner has released this disk into the public domain, so it is freely copyable.

APTEST is menu-driven, and there is easy return to the main menu from most (but not all) subdirectory screens. It has interesting full-screen repetitive inverse-flashing patterns for its RAM tests. Its age is evident (c1982) in some of the tests, such as the diagnostics for the 300 baud Micromodem II by Hayes. Different main menu screens pop up for the IIe vs. IIc. Absent from the IIc menu screen is the track-centering realignment programs and their brief accompanying docs. (IIc users can still tune their drives by recopying the alignment-related files onto a separate disk; See my disk-document, TUNING APPLE II FLOPPY DRIVES, for further details.

The best programs on APTEST are those for track-centering alignment. These is also an excellent gauge-centering drive-speed tester, equal in quality and style to the drive-speed tester on Nikrom Master Diagnostics IIc/IIe. The drive-speed tester scales both the direction (+/-) and extent of speed deviation from the desired 299 rpm.

APPLE DIAGNOSTICS V.3.0

[Main Menu Screen: IIc]

a. EXECUTE ALL DIAGNOSTIC TESTS
b. EXECUTE SELECTED TESTS
c. CHOOSE TESTS [FOLDER]
d. OPTIONS
e. SPECIAL
f. QUIT

[Choose Tests Screen: IIc]

a. ROM/ CPU TEST
b. SYSTEM INTERRUPTS TEST
c. MMU/ IOU TEST
d. RAM TESTS
e. SERIAL PORTS TESTS
f. DISK PORT TESTS
g. SOUND CIRCUITRY TESTS
h. VIDEO PATTERN TESTS
i. KEYBOARD/ MOUSE TESTS

[Options Menu: IIc]

a. Loop Tests until ESC is Pressed
b. Continue on Error Until ESC

[Special Menu: IIc]

a. DISPLAY ERROR LOG
b. CLEAR ERROR LOG
c. CLEAR TESTING STATUS LINE
d. DISPLAY CURRENT SYSTEM STATUS
e. LOAD SELECTED TEST SEQUENCE
        FROM DISK
f.   SAVE SELECTED TEST SEQUENCE
        TO DISK

This is a diagnostic disk provided by Apple, apparently for use by its technicians. It has several unique features. (a) Like other diagnostics (Aptest, Mecc Computer Inspector), the software instantly recognizes (from ROM code) the computer model. Specific tests relevant to the model are then arrayed on the menu screen. (b) Like Yo Yo Duck, the tests can be linked for continuous long-term testing. (c) An Appleworks-style folder screen is used, so users who are familiar with Appleworks can use the disk even if the manual is unavailable.

The sophistication of its tests is intermediate - more sophisticated than Yo Yo Duck, yet less advanced than Master Diagnostics. But users can typically identify their computer's suspected problem area (e.g., RAM), and these tests can be selected to repeat indefinitely.

The software is compiled on a single 3.5" disk, bootable and recognizable by various Apple IIs: IIe, IIc, IIc Plus, IIgs. The disk is formatted in ProDOS, so specific routines can be recopied freely to other disks. For example, IIe or IIc users can recopy the programs relevant to their machines (with launching files) onto self-booting 5.25" floppies.

BIT BANGER (IIGS Ram Tester, 1993)

by Harold Hislop

This is a sophisticated RAM tester for the IIgs. It performs an extensive series of tests on RAM, repeating endlessly if instructed to do so. It appears to be very similar to the RAM tester from Appleworks-GS (1989, Claris).

Docs are included; they state that the IIgs must first pass the internal self-test before BIT BANGER can be used. If an accelerator with more than 128K of cache memory, it must first be disabled. As with all RAM testers, any information held on a RAM disk will be lost.

These RAM tests are executed: a preliminary overall test, and tests for stuck bit, nibble, byte, page, bank, and crosstalk errors. A refresh test is done with a 5 minute delay, to assess whether information is held accurately for that brief duration. The tests are done sequentially within each bank, and then sequentially across the banks. Addresses of RAM error locations are displayed.

Tests are lengthy: testing one meg of RAM will take about 10 minutes even at accelerated speeds. Overnight burn-in testing is recommended. At the end of the tests, a colorful scrolling rainbow pattern is displayed. Before rebooting, the computer must be turned off.

I have not seen BIT BANGER yet confront a bad ram chip, but it certainly looks impressive with its sequence of clearly identified subtests.

CERTIFIX DISK DIAGNOSTICS V. 2.0

[Opening Menu, CERTIFIX]

RUN CERTIFIX (PRODOS)	RUN DRIVE SPEED TEST
RUN CERTIFIX (DOS 3.3)	CREATE 40 TRACK 'CERTIFIX'
RUN " RESCUE"	CERTIFIX DOCUMENTATION
RUN DRIVE SPEED TEST	QUIT TO BASIC

This diagnostic is focused on identifying and locking out any defective blocks on 5.25" floppies. It also formats disks in either DOS 3.3 or ProDOS, and includes a simple speed tester. The software can also allow formatting of 40-track Apple II 5.25" floppies. Some disk drives are capable of 40-track formatting - most older full-height drives cannot do this.

With a five minute intensive spin, the drive mechanism assesses the presence of any bad blocks on the disk surface. Users should keep in mind that identifying the source of faults is difficult and that persistence is needed.

INTERNAL SELF-TEST (IIE, IIC, IIGS)

The internal self-test is available on the enhanced IIe and enhanced IIc, as well as on all models of the IIgs. It can be retrofitted to older versions of the IIe or IIc by changing a single ROM chip. This enhancement is very worthwhile, especially because the test can identify the locations of faulty RAMs. Replacing faulty RAM chips is especially important for the IIC, which loses RAMs occasionally due to heat buildup resulting from faulty ventilation within the CPU.

The self-test is activated by holding down the open-apple and closed-apple keys at power-up. In the enhanced IIe and enhanced IIc, a Checker-board pattern appears on the screen for about a minute, changing slightly every five seconds. If all is well, the checkerboard display is replaced by the words, "SYSTEM OK" on the screen. When faults are detected a cryptic message appears on the screen to identify the fault. Tests are done on the CPU, MMU, IIc ports, RAM, and others. No message is displayed when subtests are passed. When a circuit fails, that failure alone is identified on the screen. Other failures are not identified until the first-identified failures are corrected.

RAM chips are identified by location, within each 64K bank: the main 64K, and auxiliary 64K. The 8 chips in the main 64K bank are identified on the screen by the word, RAM followed by eight zeros:

RAM   0 0 0 0 0 0 0 0

Any bad RAM chip is shown by a 1 rather than an 0. If the faulty
RAM is in the auxiliary 64K bank, the display is preceded by an asterisk:

* RAM   0 0 0 0 0 0 0 0

In the IIC, the 16 RAM chips are arranged in a column along the right edge of the motherboard. The eight RAMs closes to the front (keyboard end) are main RAM, while the eight RAMs closest to the rear (back panel) are auxiliary RAM. Positions in the display, counted from the right, represent motherboard positions counted from the front. For example, consider this RAM error display:

RAM   0 0 0 0 0 1 0 0

This RAM error message indicates that the THIRD ram in main memory is faulty -- the third RAM as counted from the front (keyboard) end of the RAM column.

The IIGS internal self-test is activated at powerup by holding down the open-apple and option keys. This self-test takes about two minutes. It generates a colorful, dynamic display of geometric designs and shapes, ending with the reassuring message, SYSTEM GOOD. These subtests are included: RAM, ROM, system speed, serial ports, internal clock, battery RAM, the desktop bus, interrupts, and possibly other tests.

The internal self-tests are impressive for several reasons.

First, I resurrected two junked IICs which merely had bad RAMs. Locations of the dead RAMs were identified accurately by the self-test. Second, because the self-tests reside in ROM rather than on disk, they are convenient to apply, even if no disk drives are presently connected. Third, they appear to test many motherboard functions. When inspecting hardware, these tests could be valuable to apply before making a decision to buy.

The limitation presented by these tests is that documentation is difficult or impossible to find. Owners' manuals mention little about them, and even technical reference manuals on IIgs/IIe/IIc given very scanty information. The most detailed listing of error codes on the IIgs self-test is found on an NDA: SUPER INFO III, V.3.0 (1992). The error codes are listed under the ERR/SELF-TEST pull-down menu. (SUPER INFO III is a $15 shareware item available from its author: Jim Luzar, Apt. 241, 5324 N. Lovers Lane, Milwaukee WI 53225).

MASTER DIAGNOSTICS IIE/IIC, V. 7.0, 1990)

(Main Menu Screen: IIc)

MENU OF OPTIONS   IIC

1 - ROM TEST   5 - DISK DRIVE ANALYZER
2 - 80 COLUMN TESTS   6 - PORT ANALYSIS
3 - MOUSE SCALE   7 - MONITOR ROUTINES
4 - RAM TESTS   H - HELP   % - EXIT

(Sub-menu: IIc Ram Test)   (Sub-menu: Disk-Drive Analyzer)

* TEST OPTIONS *   1 - DISK READ/WRITE TEST
1 - MOTHERBOARD RAM (AUTO)   2 - DISK SPEED UTILITY
2 - MOTHERBOARD RAM (MANUAL)   3 - WRITE-PROTECT SWITCH TEST
3 - MOTHERBOARD RAM (CONTINUOUS)   4 - HEAD CLEANING UTILITY
                                      5 - RETURN TO MENU
4 - AUXILIARY RAM   (AUTO)   6 - REBOOT
5 - AUXILIARY RAM   (MANUAL)
6 - AUXILIARY RAM   (CONTINUOUS)
7 - RETURN TO MENU

MASTER DIAGNOSTICS IIE/IIC gets my vote for the best all-around Apple II diagnostics software. There are two separate one-sided 5.25" disks, each for the IIe and IIc respectively. If the wrong disk is inserted, a prompt screen will appear. The disks are easy to use, the tests are extensive and accurate, and they are accompanied by an excellent manual. The disks are formatted in DOS 3.3, and copy protection was removed from later versions (Mine are v.7.0, dated 1990). Transitions to the main menu are smooth and users need not reboot when navigating among menu screens. The IIe and IIc software must be bought separately: I paid $85 for the IIe package (1991) and $35 extra to get the IIc version.

Many routines are the best available. Favorites are: Disk Drive Analyzer, RAM tests, 80 column tests, Port Analysis Tests (IIc only), and the interface card tests (IIe version only). An older version is available for the II+, but no IIgs version was ever produced.

DISK DRIVE ANALYZER: Routines are listed above. All are excellent. These routines would be great for demonstrating a disk drive at the time of sale. The Write Protect Switch Test is sometimes erratic; that test sometimes reported false write-switch errors. A HEAD CLEANING UTILITY is included. This utility sweeps the cleaning disk through all head positions. A partial run through the head positions will suffice. The IIe version (but not the IIc version) can initialize scratch disks for the read/write test and for the disk speed utility.

ROM TEST: This test is excellent. The software knows that ROMs were expanded in later IIc models, and those roms (D8, D0, E0, E8, F0, F8) are recognized and tested. Each ROM is identified clearly on the screen as the test proceeds.

This is the best of all Apple II diagnostics, but it could be improved. The $85.00 I paid in 1991 was hiked $10.00 above its $75 advertised price; certainly a price-hike should indicate that upgrade versions are on their way down the pipeline. No update was ever sent or announced. Customers should be told at time of purchase that updates will not be available in the future. The lack of disk updates should be publicized to uses. MASTER DIAGNOSTICS IIE/IIC should have

been updated to allow these tests: 3.5" 800k drives, SCSI hard drives, big RAM cards, ZIP CHIPS, and other modern interface cards, etc.

MECC COMPUTER INSPECTOR V.1.0 (1988)

(Main Menu Screen)

COMPUTER INSPECTOR

1. MACHINE IDENTIFICATION   5. RAM MEMORY TEST
2. MONITOR ADJUSTMENT   6. JOYSTICK/PADDLE TEST
3. PRINTER TEST   7. INFORMATION
4. DISK DRIVE TEST   8. QUIT

This diagnostic disk was produced by MECC, a major supplier of educational software, which is now phasing down its support for the Apple II. The menu screens resemble those of Master Diagnostics IIe/IIc; they are well labeled and easily used; no manual is needed. All routines allow smooth return to the main menu screen; rebooting is unnecessary.

One's first impression on seeing the opening screen is that few tests are presented. In fact, some of its diagnostics are excellent. This disk is worth adding to your collection. It is applicable to all late model Apple IIs: IIgs, IIc, IIc Plus, or IIe.

The best routine on MECC COMPUTER INSPECTOR is MACHINE IDENTIFICATION. By inspecting the computer's ROMs, this routine deduces the following information: model number, identity or function of all interface cards, and identity of all memory (main RAM, auxiliary RAM, and expansion RAM). IIc ports (corresponding to expansion slots) are identified correctly. This routine resembles an updated version of the peripheral card routine on APPLE-CILLIN II, although this routine is more efficient. It identifies cards and ports accurately, even without manual pre-identification as required by Apple-Cillin. I was impressed that even the make and model number of the SCSI hard drive in my flagship IIe was identified correctly. The only mistake it made in identification is that it falsely identified my IIc (Unidisk 3.5" model) as a IIc Plus. This error likely happened because it mistook my Zip Chip 8 MHz accelerator for the accelerator in the IIc Plus.

The MONITOR ADJUSTMENT option has three subprograms:

• normal text and graphics [a mixed test pattern with color patches, line grids, large type, and a simple graphic].
• a super-high resolution graphic [suitable for IIgs only], and
• a single-page 80 column text sample screen.

The PRINTER TEST is simple, but good. This test instructs the printer to reproduce the entire alphabet and supporting symbols.

The DISK DRIVE TEST has an excellent test of the write-protect switch. Its test of "general operations (write/read to disk) is hard to evaluate because it gave very little information on my successful tests. Hopefully, if any drive tests were failed, the faults would have identified. A drive speed test is included, but its performance was poor relative to drive speed tests on other diskettes. This drive-speed test is text-based only, without graphics. It identified the drive speed

of all my tested drives as 300 rpm. These drives are well adjusted for speed, but drive speed tests on other software identify even slight variations from true speed, unlike this program.

The RAM MEMORY TEST has a text-based screen. In the IIe/IIe, it automatically tests main memory (lower 64K), auxiliary memory (upper 64K), plus any extended memory available. It recognizes and tests all IIgs memory, taking about ten minutes to test a 4 meg IIgs RAM card. All RAM tests were passed, so its reporting of RAM failures cannot yet be judged.

An excellent JOYSTICK TEST is included. The user does X-axis and Y-axis centering on a grid pattern. This adjustment is efficient and clearly understandable.

Docs, unfortunately, are minimal, consisting of three brief screens. They cannot be printed. The operating system is proprietary, neither ProDOS nor DOS 3.3. Thus the routines cannot be split from the package. The MACHINE IDENTIFICATION routine would be handy to use elsewhere, but it must remain with the package.

The MECC COMPUTER INSPECTOR program code was reviewed in COMPUTIST magazine, v 71, p. 17 (1989). The disk can be backed up with the bit copier on Locksmith v.4.1.

MULTIRAM IIE OR MULTIRAM IIC DIAGNOSTICS V.2.0 (1985)

CHECKMATE TECHNOLOGY INC.
by Steve Stephenson

(Main Menu Screen)

Status

Bank 1 ???K
Bank 2 ???K   Bank A
Bank 3 ???K   Group: ???K
Bank 4 ???K

Bank 5 ???K
Bank 6 ???K   Bank B
Bank 7 ???K   Group: ???K
Bank 8 ???K

TOTAL   ???K

[1] View status page   [2] Quit to Basic
Test: [3] Quick   [4] Full [5] Continuous

RETURN   ARROWS   SPACE BAR   ESCAPE
Starts   select   pause/resume   cancel

These diagnostics specifically test the two Checkmate RAM cards MultiRam IIe and MultiRam CX (512K for the IIc).

I have the disk, but not the docs. The IIe and IIc tests are on separate files. The question marks on the opening screen later identify the RAM capacity when the user returns to the status screen

after the tests. (For the 512K MultiRam CX card in the IIc, each of the eight banks has 64K, and each Bank Group has 256K.) Of the three test options [3], [4], [5], option [5] is recommended so that the behavior of the RAMs can be judged over time.

When the test is selected, an attractive screen appears, outlining the interface card, and identifying which sockets are filled with RAMs. The RAMs are each identified as (a) good, (b) good but unusable, or (c) bad/empty. The test proceeds sequentially across the eight RAM banks. Any bad/unusable RAMs are easily identified with this graphic display, which resembles the similar graphic display of AE RAMFACTOR or AE RAMWORKS.

The IIe version, MultiRam Diagnostics IIe, has a further set of options preceding its opening screen. These options are:

1. MultiRam IIe card (alone)
2. MultiRam IIe (on the RGB)
3. MultiRam RGB card
4. Exit.

I have only the IIc version: MultiRam CX. The IIe version shows a map of the 32 256K RAM chips in each of the configurations listed above. Tests on the IIe software will also examine other cards, although identifying the bad RAM chip - the main goal of these programs - will be ambiguous because the RAM maps are specific to these Checkmate cards. Onboard docs report that the MultiRam IIe and MultiRam RGB cards can be installed together, yielding a total of 1.75 megabytes of RAM. These tests could be useful to others in the sense that they will signal whether any RAM is bad; then other tests could be used as follow-up to identify the location of the bad RAM.

I got the software separately from my used MultiRam CX 512K IIc board. The disk has these extra programs other than the diagnostics: MRAM.SYSTEM, MD.PRO.CUSTOM, MULTIDRIVE.PRO, LOGO.SYSTEM, PRINT.DOC, RAM, and RAM.FILER. The three pages of on-disk v. 4.3 docs can be selectively viewed on the screen or routed to a slot #1 printer. Mainly, the docs outline the changes made in the successive versions of the software.

I received the Checkmate MultiRam diagnostics and related programs on a non-bootable disk that lacks menus. To simplify their use, I have recopied these files to a self-booting disk controlled with an excellent program launcher (Super Selector v.3.22). This disk will be sent to users on request.

Overall, this software is well arranged and is excellent for those who have the specific RAM cards for which the software is intended. For non-MultiRam cards, the software merely tells the user that a chip is bad without identifying its location clearly.

POWER UP! COMPUTER CHECKUP (1984)

William G. Peters, Software Publishing Corp.

This disk is an identical clone of XPS Diagnostics IIe; see the review of XPS. The disk is copy-protected, and the krack recipe published in COMPUTIST magazine failed to deprotect it. See the review on XPS.

RAM 4000 (RAM-GS TEST v.1.4, c1993)

This is a RAM testing disk supplied with the Chinook RAM 4000 memory expansion board for the
IIgs. It shows an outline drawing the of RAM card, with its 32 chips clearly identified. These RAM
tests are selectable: standard memory test (regular or extended), memory refresh test, and
unique address test. I have yet to see it identify a failed RAM chip.