Apple /// Computer Information
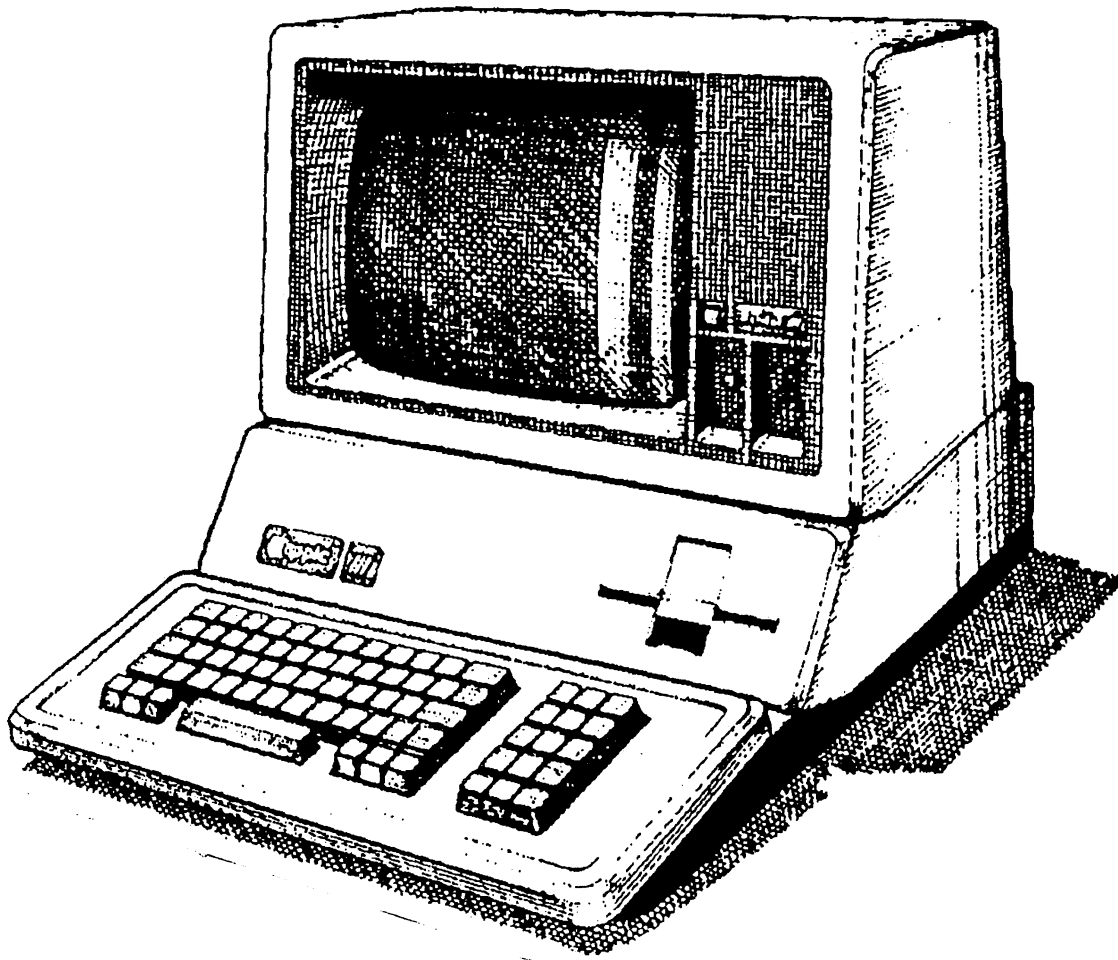
DOCUMENT NAME	#
APPLE /// COMPUTER TECHNICAL PROCEDURES (REPAIR INFO)	38

Ex Libris David T. Craig

42 pages

Apple Service Manual

Apple ///
Computer
Technical
Procedures

Ex Libris David T. Craig

 apple computer inc.

APPLE /// TECHNICAL PROCEDURES

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Apple /// Technical Procedures

Section 1

Takeapart

Contents:

"_085.PICT" 323 KB 2001-08-22 dpi: 600h x 600v pix: 4474h x 6190v

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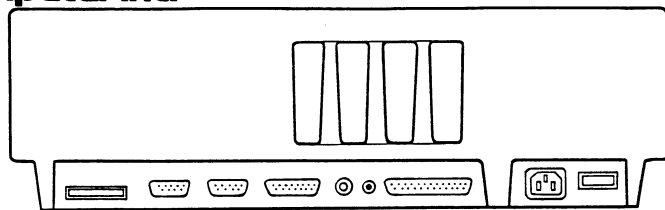
FIGURE 1

FIGURE 2

FIGURE 3

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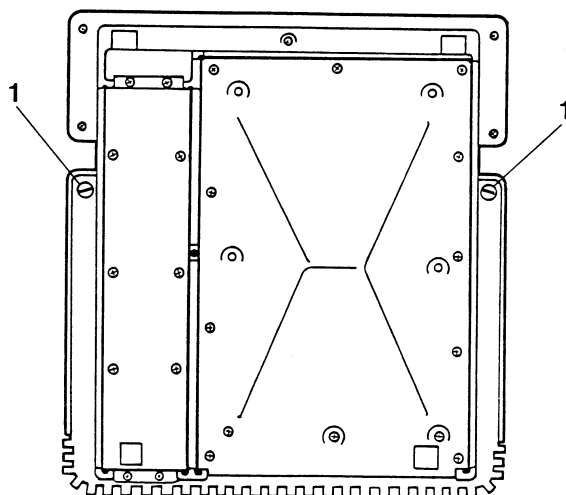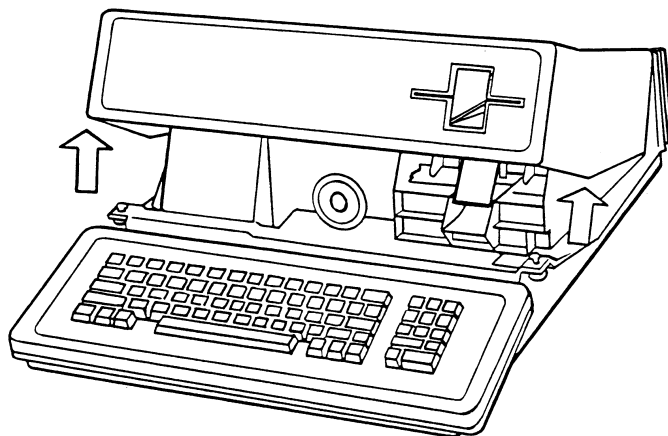
A. REMOVING THE COVER

1. Power down and disconnect the AC power cord from the source and then from the back of the Apple ///.

2. Disconnect all other external cables from the back of the Apple ///. (See Figure 1).

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

4. Use a flat blade screwdriver to turn the locking screws, one on each side of the Apple III, 1/4 turn counterclockwise. (See Figure 2, Item 1).

   DO NOT REMOVE THESE SCREWS--they are self-capturing and are supposed to stay in.

5. Lower the Apple /// to the operating position and with a hand on each side, lift the cover up and pull it forward to remove it. (See Figure 3).

B. REPLACING THE COVER:

1. With the Apple /// in operating position, place the cover on making sure that it is seated properly all the way around. Be sure that the four tabs on the back of the cover fit into the four slots in the back of the Apple.

2. Tip up the front edge of the Apple and tighten the two locking screws by turning them 1/4 turn clockwise.

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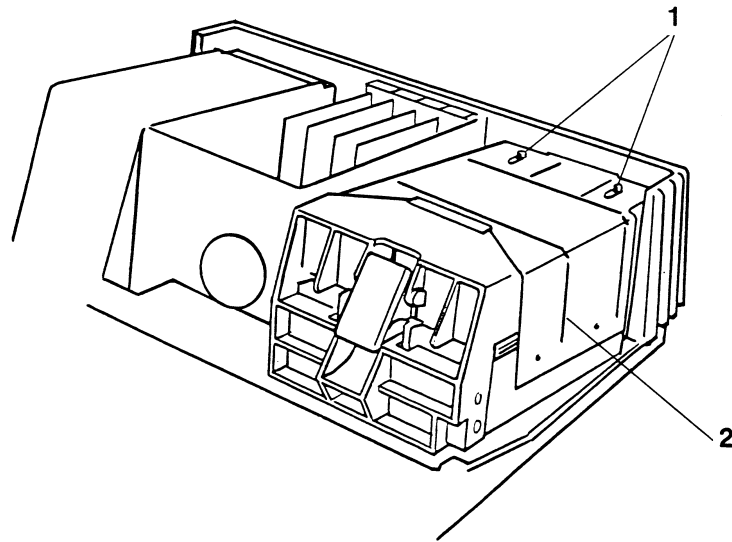
FIGURE 4

FIGURE 5   **FIGURE 6**

apple computer inc.
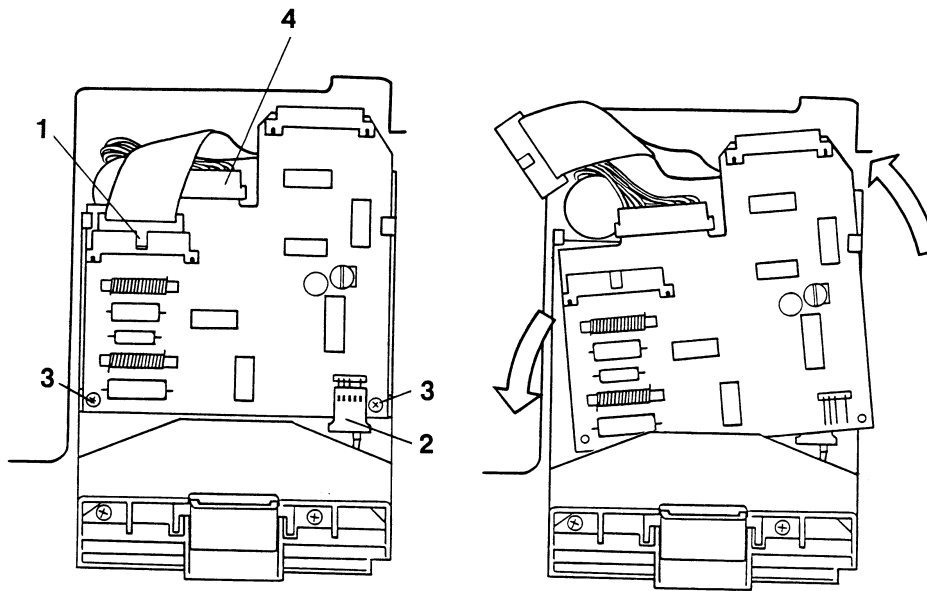
C. REMOVING THE ANALOG BOARD

1. Remove the cover.

2. To get to the analog board you must first remove the disk assembly shield. To do this, use a flat blade screwdriver to slide the two Tinnerman retaining clips on the disk assembly shield forward. (See Figure 4, Item 1).

   NOTE: The clips should come off easily. However, they sometimes fly so you should keep a finger on them.

3. Remove the disk assembly shield by flexing the side out (See Figure 4, Item 2) and lifting up on the shield.

   The shield is only retained by the spring tension of the sides and four dimples which fit into depressions of the disk casting.

4. Disconnect the disk ribbon cable. If it is hard to remove, work it off by pushing on the center tab or the sides of the plug with a small screwdriver. DO NOT PULL IT OUT BY THE CABLE! (See Figure 5, Item 1).

5. Disconnect the read/write head cable. (See Figure 5, Item 2).

   NOTE: Do not try to remove the motor control cable yet. (see Figure 5, item 4).

6. Remove the two small Phillips head mounting screws which hold the analog board at the front of the casting. (See Figure 5, Item 3).

7. 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 on the right. (See Figure 6).

8. Remove the motor control plug (Figure 5, 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.

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D. REPLACING THE ANALOG BOARD

1. Connect the motor plug. Make sure the nylon pawls are engaged in the holes.

2. Turn the board slightly counterclockwise and hook the board under the right retainer and then the left retainer.

3. Replace the two screws in front.

4. Replace the disk ribbon cable.

5. Replace the read/write head cable.

6. Replace the disk assembly shield.

7. Replace the Tinnerman clips by putting them over the posts and sliding them back. Use a screwdriver to press down firmly on the sides of the clips to secure them.
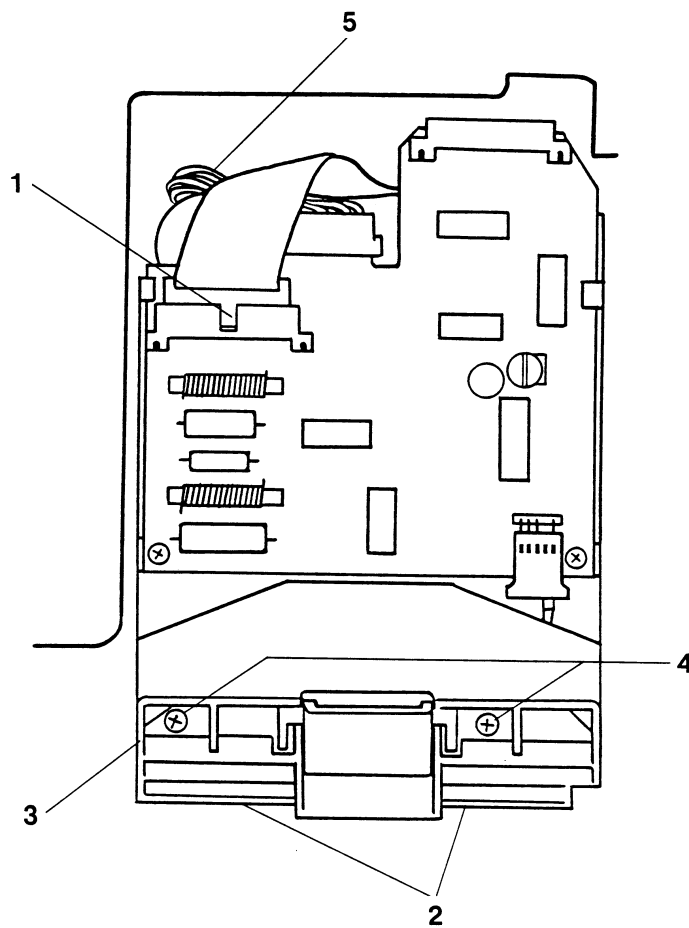
8. Replace the cover.

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5

1

4

3

2

FIGURE 7

"_091.PICT" 277 KB 2001-08-22 dpi: 600h x 600v pix: 4426h x 6190v

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E. REMOVING THE DISK ASSEMBLY

1. Remove the cover.

2. Remove the Analog card.

3. Draw a pencil line on the Apple III chassis along the front (See Figure 7, Item 2) and left side (Figure 7, Item 3) of the disk assembly bezel. This will serve as a location reference when the disk assembly is re-inserted.

4. Loosen completely (but don't remove yet) the two Phillips head screws that mount the disk assembly to the Apple /// chassis. They can be seen by looking down through the front diskette guide and door assembly. (See Figure 7, Item 4).

5. Loosen but don't remove the screw in the double retaining clip that secures the back of the disk assembly. (See Figure 7, Item 5).

6. Remove the assembly by sliding it forward until it clears the retaining clip. Lift it from the chassis.

7. Recover the two front screws from the disk assembly.

F. REPLACING THE DISK ASSEMBLY

1. Slip the disk assembly under the double retaining clip so that the front is in line with the pencil line you drew earlier.

2. Replace the two front screws.

3. Tighten the retaining clip screw in the back.

4. Replace the Analog card.

5. Replace the cover.

"_092.PICT" 412 KB 2001-08-22 dpi: 600h x 600v pix: 4474h x 6166v

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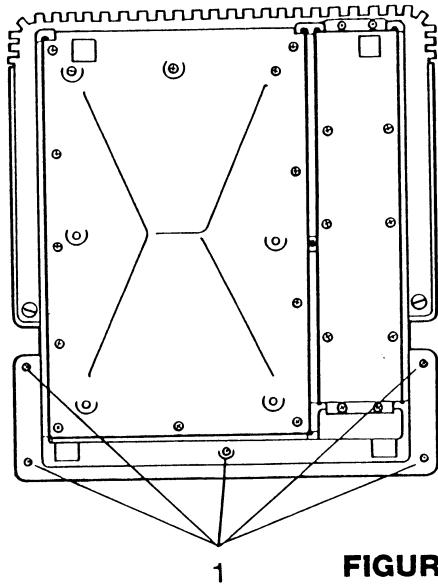
FIGURE 8

FIGURE 9

FIGURE 10

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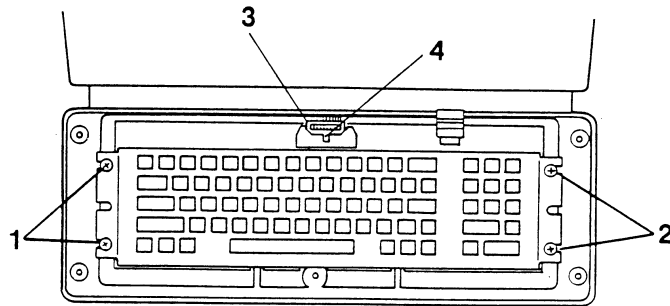
G. REMOVING THE KEYBOARD

1. Check to see that the power is off on the Apple /// and that the AC power cord is disconnected.

2. Turn the Apple completely over.

3. Remove the five keyboard cover mounting screws. (See Figure 8, Item 1).

4. Remove the keyboard cover.

5. Turn the Apple rightside up again.

6. Remove the two retaining screws on the left end of the keyboard. (See Figure 9, Item 1).

7. Loosen but don't remove the two retaining screws on the right. (See Figure 9, Item 2).

8. Remove the keyboard by lifting the left end and sliding the right end from under the loosened screws. (See Figure 10).

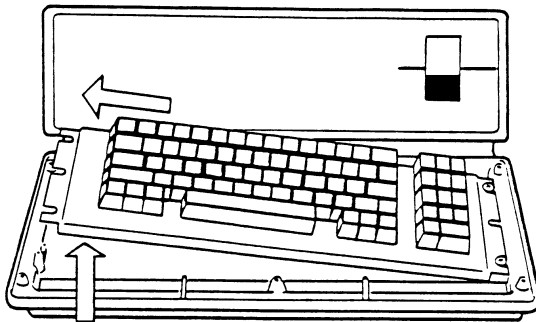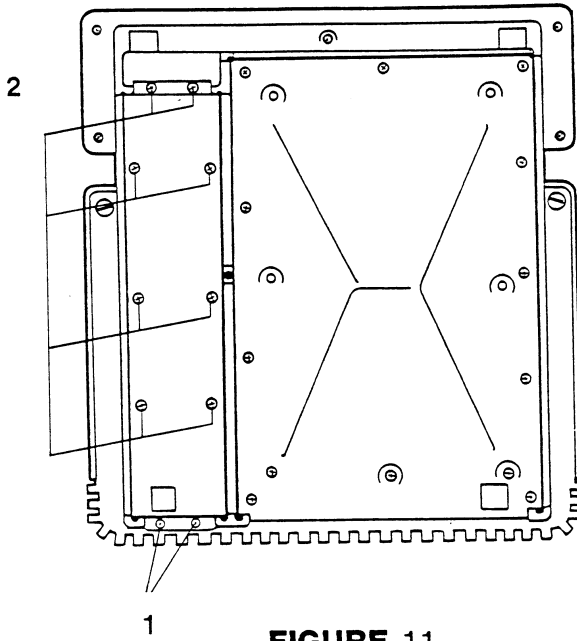9. Disconnect the keyboard cable (See Figure 9, Item 3) by using a screwdriver to push on the tab or the sides of the cable connector (See Figure 9, Item 4).

   CAUTION: Do not pull on the cable!

H. REPLACING THE KEYBOARD

1. Replace the keyboard cable. Make sure it wraps tightly around the printed circuit board and does not stick out.

2. Replace the keyboard.

3. Replace the two retaining screws on the left end of the keyboard.

4. Tighten down the two screws on the right side of the keyboard.

5. Replace the keyboard cover.

6. Tip the Apple /// up, keeping one hand on the loose keyboard cover.

7. Carefully replace the five keyboard cover mounting screws. Don't overtighten them because they are just threaded into the plastic of the cover and will strip very easily.

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2

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FIGURE 11

1

FIGURE 12

"_095.PICT" 360 KB 2001-08-22 dpi: 600h x 600v pix: 4450h x 6190v

apple computer inc.
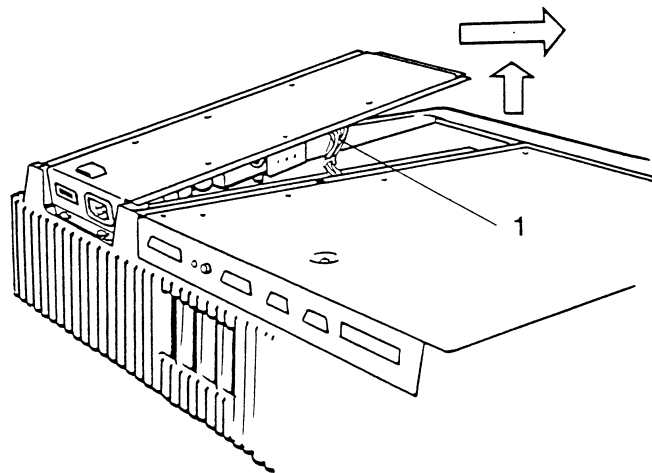
I. REMOVING THE POWER SUPPLY

1. Make sure that the power is off on the Apple /// and that the AC power and all other external cables are disconnected.

2. Turn the Apple upside down with the back facing you, putting it on a soft pad.

3. Loosen but don't remove the two Phillips head screws located on the rear edge of the power supply bottom cover, near the on/off switch and power supply receptacle. (See Figure 11, Item 1).

4. Completely loosen the eight screws that secure the power supply to the chassis. Do not try to take them out (See Figure 11, Item 2).

5. Lift up the edge of the power supply and slide it until it clears the two rear mounting screws. Lift the power supply out. (See Figure 12).

6. Turn the power supply over.

7. Disconnect the power supply connector by squeezing in on the tabs and gently (with a rocking motion) pull the connector out. (See Figure 12, Item 1).

8. If there is a wire tie holding the cable, clip it.

J. REPLACING THE POWER SUPPLY

1. Place a new wire tie on the cable.

2. Plug in the cable connector.

3. Replace the power supply. Slide the cover under the two rear screws and lower the power supply into place.

4. Tighten down all the screws. BE CAREFUL! DON'T FORCE THE SCREWS! If excessive force is applied, the screws will strip out the chassis. Make sure the screws are not crossthreaded. If one doesn't go in easily, back it out and try again.

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FIGURE 13

FIGURE 14

FIGURE 15

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"_097.PICT" 437 KB 2001-08-22 dpi: 600h x 600v pix: 4439h x 6166v

apple computer inc.
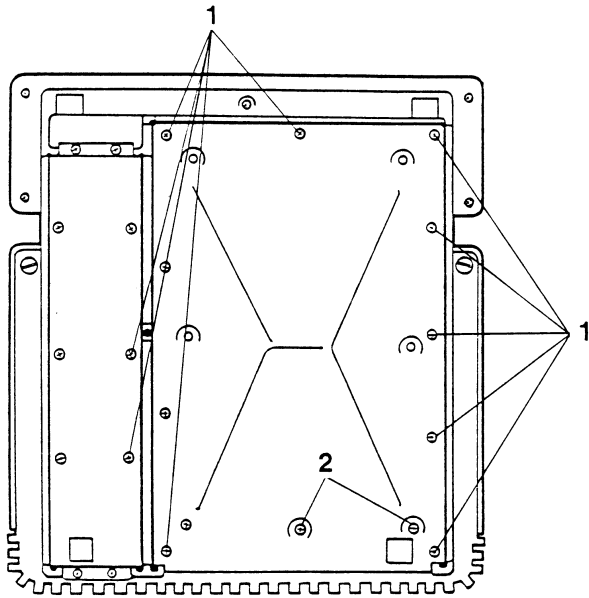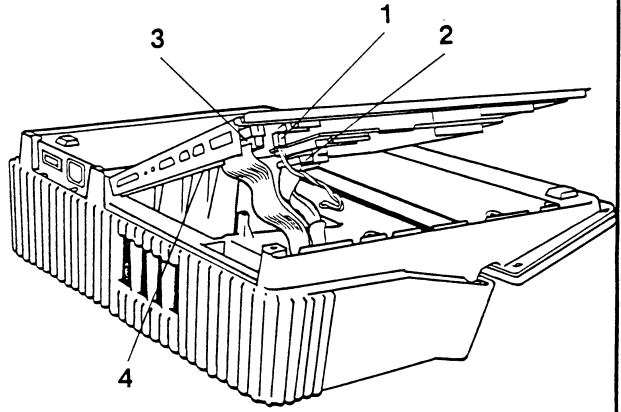
K. REMOVING THE MAIN LOGIC ASSEMBLY

1. Make sure that the power on the Apple is off and that all external cables are disconnected.

2. Tip up the Apple ///.

3. Remove the two locking screws that hold the cover on.

4. Remove the cover.

5. Remove any peripheral cards installed in slots 1 - 4.

6. Put the Apple cover back on to protect the disk bezel.

7. Place the Apple upside down and put it on a pad with the rear facing you.

8. Completely loosen (but don't remove) the ten Phillips screws around the edge of the logic access panel. (See Figure 13, Item 1).

9. Completely loosen (but don't remove) the two additional recessed screws that are about one and a half inches in from the rear edge of the panel. (See Figure 13, Item 2).

10. Lift up the logic board carefully from the right side. Allow the panel to remain resting on its edge nearest the power supply. (See Figure 14).

11. While holding the logic board on the underside, disconnect the speaker cable (See Figure 14, Item 1), the keyboard cable (Figure 14, Item 2), and the disk drive cable (Figure 14, Item 3). Note which plug goes where.
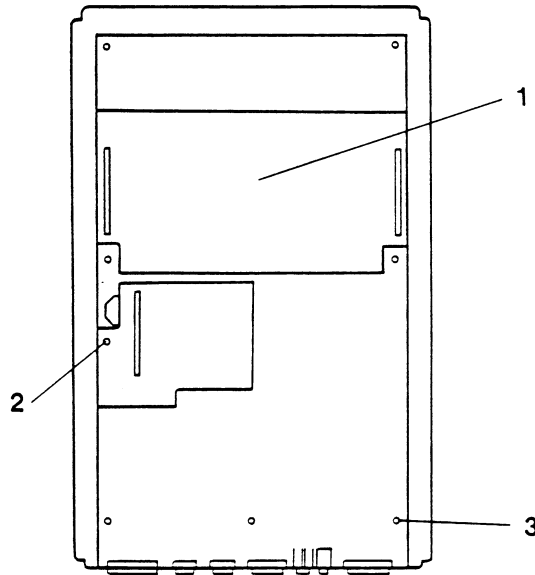
12. Lift the assembly so that you can unplug the power supply plug. (Figure 14, Item 4).

13. Lift out the logic assembly.

14. Lift up and remove the encoder board from its connector. (See Figure 15, Item 2). You may also have to lift it off a standoff that is on the main logic board of some Apple /// 's.

15. Place the logic assembly flat on the work surface, use both hands to lift off the memory board (See Figure 15, Item 1) from the main logic board (Motherboard).

    NOTE: Lift the memory board straight up so that the male connector pins mounted on the main logic board will not be bent or broken.

"_098.PICT" 539 KB 2001-08-22 dpi: 600h x 600v pix: 4438h x 6190v

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FIGURE 13

FIGURE 14

FIGURE 15

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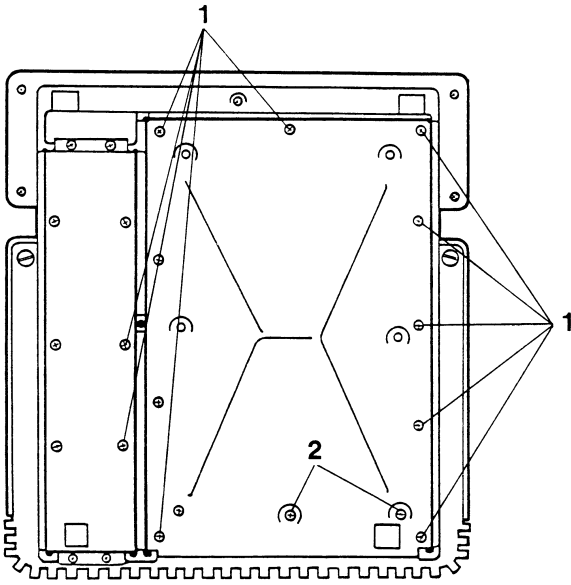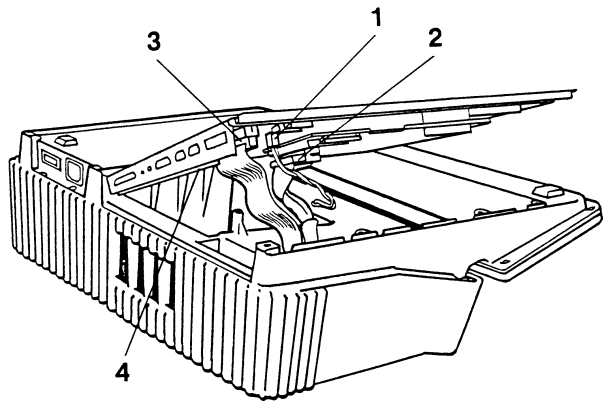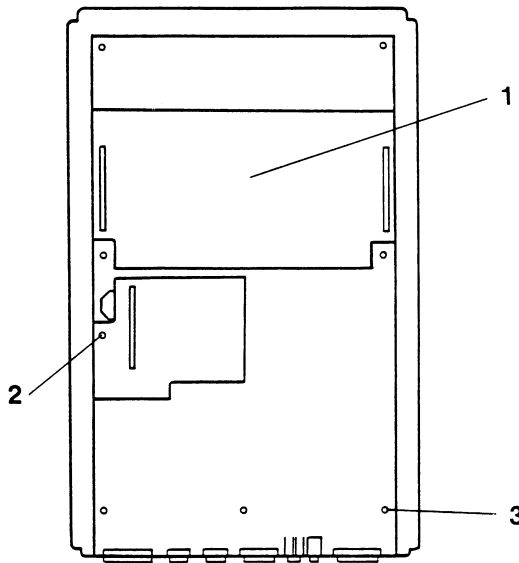
16. Remove the retaining nut or screw on the main logic board. (See Figure 15, Item 3).

17. Ease the plugs out of the back.

18. Slide out the board from the peripheral connector opening of the access panel.

L. REPLACING THE MAIN LOGIC ASSEMBLY

1. Make sure the insulating shield is in place to keep the board from shorting on the access panel.

2. Replace the main logic board by slipping the peripheral connectors into their cutouts in the rear access panel, and replacing the retaining screw with the nutdriver (Figure 15, Item 3).

3. Replace the encoder board. (Figure 15, Item 2).

4. Replace the memory board. (Figure 15, Item 1). Make sure the memory board is properly oriented. The RAM chips on the memory board point in the opposite direction to the chips on the main logic board. The notches on the memory board IC's should be facing the output connectors.

   Align the end pin in the end hole of the main memory board and then tip the board flat. When all pins are properly started, press it gently but firmly into place.

5. Rest the access panel on the power supply side and reach under and plug in the power supply. (Figure 14, Item 4).

6. Plug in the disk cable. (Figure 14, Item 3).

7. Plug in the keyboard cable. (Figure 14, Item 2).

8. Plug in the speaker cable. (Figure 14, Item 1).

9. Put the entire logic assembly panel in place and tighten down the 12 Phillips screws on the logic assembly access panel. (See Figure 13, Items 1 and 2).

10. Turn the Apple /// rightside up.

11. Remove the cover.

12. Replace the peripheral cards.

13. Replace the cover.

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Apple /// Technical Procedures

Section 2

Diagnostics

Contents:

The Apple /// Dealer Diagnostics diskette (P/N 077-0013A) is to be used with the Troubleshooting Flowchart (below, section 3). This section describes how to run the tests on the diskette. Normally (see section D) you will use the TEST ALL option to run all the tests in sequence. If you wish to run or repeat an individual test, simply use the up- and down-arrow keys to select that test from the main menu and press RETURN to accept it.

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"_101.PICT" 382 KB 2001-08-22 dpi: 600h x 600v pix: 4473h x 6214v

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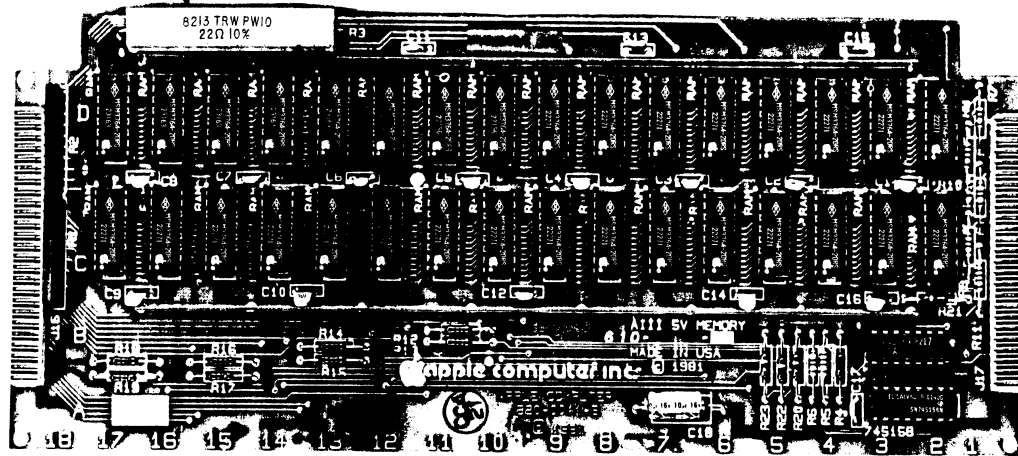
FIGURE 1

5V MEMORY BOARD

FIGURE 2
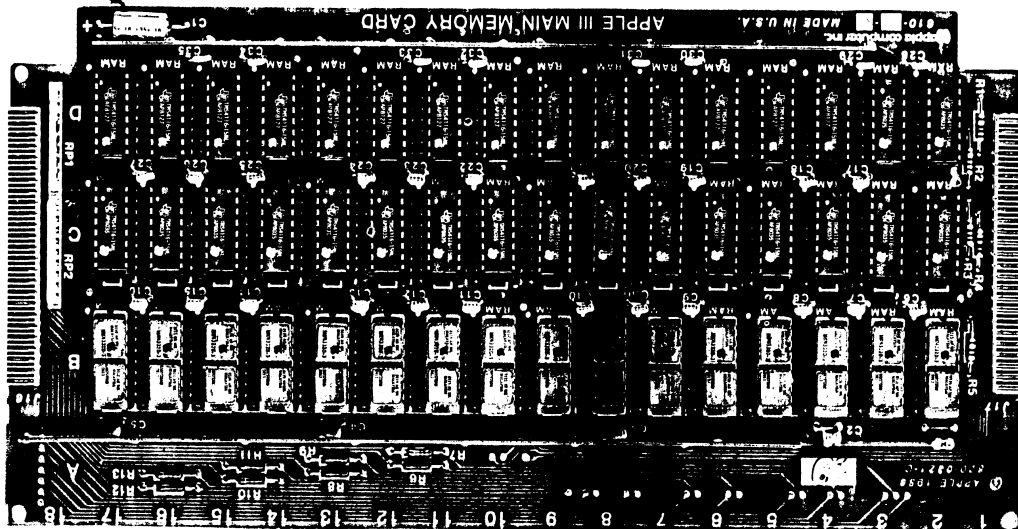
12V MEMORY BOARD

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"_102.PICT" 836 KB 2001-08-22 dpi: 600h x 600v pix: 4474h x 6190v

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A. DIAGNOSTICS SETUP

1. Determine whether the system under test has a 5-volt or a 12-volt memory board. (Early models of the Apple /// use a 12-volt memory board; later models use a 5-volt board. For the RAM tests (below, p.2.9), you need to know which style board is in the system under test.)

   a) Power down the Apple /// and remove the top cover.

   b) Look straight down through the main opening toward the front of the chassis. You will see the edge of the memory board projecting from under the keyboard, and on the left corner of the board you will see either a large grey ceramic resistor (5V board: Figure 1, #1), or a small blue tubular capacitor (12V board: Figure 2, #1).

   c) Write down which type board is in the Apple ///.

2. Replace the cover, and check to see that your Apple /// and associated peripherals are all properly connected.

3. Insert the diagnostics diskette into the internal disk drive and boot the system.

B. DIAGNOSTIC MENU

After you have successfully booted the diagnostic program, you will see the menu below displayed on the monitor screen.

```
            MAIN MENU

TEST ALL

VIDEO                    (NOT TESTED)
SOUND                    (NOT TESTED)
RAM TEST - 5V            (NOT TESTED)
DISK                     (NOT TESTED)
KEYBOARD                 (NOT TESTED)
ROM                      (NOT TESTED)

RAM TEST - 12V           (NOT TESTED)
MAKE TEST DISKS


PRESS:   UP/DOWN ARROWS TO SELECT TEST
         RETURN TO RUN TEST
PRESS:   ESC(APE) TO QUIT
```

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NOTE: Because the Apple /// runs several internal diagnostics before booting, having come this far is a vote of confidence for correct system operation.

You will notice that TEST ALL is highlighted in inverse video. The inverse video indicates which test will be run when RETURN is pressed.

The UP/DOWN Arrows will move the inverse cursor line through the list of menu options one-by-one. Pressing RETURN will accept and run the highlighted menu option.

Pressing the ESCAPE key will exit the diagnostics program altogether.

C. MAKE TEST DISKS

In order to run the DISK TEST (below, p. 2.7), you must first make a test diskette for each disk drive in the system.

1. Press the Down Arrow several times until "MAKE TEST DISKS" is highlighted.

2. Accept this option by pressing the RETURN key.

3. Remove the diagnostic diskette from the internal drive.

4. When asked for the drive number for which you will create your test diskette, type a number which corresponds to the drive (1 = INTERNAL; 2, 3, and 4 = EXTERNAL) and press RETURN. If you have more than one drive, you must make a test diskette for each drive.

5. Insert a blank diskette into the internal drive. Close the door and press RETURN.

6. When the test diskette is complete, you will be asked if you want to make another test diskette. To create a test diskette for another drive type "Y", press RETURN, and follow the directions on the screen.

7. When finished, reinsert the Dealer Diagnostic Diskette into the internal drive and reboot the system.

Now you are ready to run the diagnostics on your Apple ///.

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D. TEST ALL

Normally you should run all the tests when checking out a system.
Accepting the TEST ALL option will cause all the tests on the menu
(except the RAM - 12V test) to be run one-by-one as if they were
selected one at a time.

1. Skip through the tests with the arrow keys until TEST ALL is
   highlighted.

2. Accept this option by pressing RETURN, and follow through the
   tests, referring to the notes below where necessary.

3. TEST ALL runs the RAM - 5V test automatically, but **not** the RAM -
   12V test. If you are testing a system that has a 12V memory board,
   the RAM - 5V memory test will check the RAM. If no errors are
   encountered, the RAM on the 12V board is good. Should the RAM - 5V
   test fail, run the RAM - 12V test to get the proper location of the
   failed components. (See RAM - 5V and RAM - 12V TESTS, p. 2.9.)

4. If any errors are encountered, refer to the Apple ///
   Troubleshooting job aid to determine follow-up action.

E. VIDEO TESTS

The VIDEO diagnostic tests all the various screen and color modes
available on the Apple ///. You will be presented with 13 different
video displays and be asked to make a subjective evaluation of each
one. After each display is presented, press:

SPACE BAR................................IF THE DISPLAY PASSES

RETURN KEY...............................IF THE DISPLAY FAILS

ESCAPE KEY...........................TO LEAVE THE VIDEO TESTS

LEFT ARROW KEY...........................TO RETRY THE TEST

NOTE: With a B&W monitor, different colors will be displayed as
different shades of grey. Some B&W monitors are not capable of
displaying all the different shades with a single setting of the
monitor controls; in particular, parts of the AHIRES screens will
be hard to see. You can adjust the brightness control on the back
of the monitor to make the picture visible; you should not expect
it to be perfectly clear on a B&W monitor.

You will find the chart describing your video display on the next page.
The list is in the same order as the test.

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WHAT YOU SEE

TEST DISPLAY	B&W MONITOR	COLOR MONITOR
HIRES MODE 1	B&W Pattern only	No Color
HIRES MODE 2	B&W Pattern only	No Color
280 x 192 COLOR HIRES MODE 1	Negative image	Red and Black
280 x 192 COLOR HIRES MODE 2	B&W Pattern	Green & White/ or Yellow
SUPER HIRES TEST 1	B&W Pattern only	No Color
SUPER HIRES TEST 2	B&W Pattern only	No Color
AHIRES TEST 1	Pattern divided into 4 different shades of grey.	From top to bottom, the pattern is colored: blue, green, & gold or orange.
AHIRES TEST 2	Pattern divided into 4 different shades of grey.	From top to bottom, the pattern is colored: blue, green, & gold or orange.
COLOR BAR & GREY SCALE TEST.	16 shades of grey from white on left to black on right--- may be difficult to resolve.	16 color shades, from left to right: white, aqua, yellow, green, pink, grey, orange, brown, light blue, medium blue, grey, dark green, light purple, dark blue, magenta and black.
APPLE II TEXT MODE 1	Sentence and Alphabet are displayed.	Same as B&W

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TEST DISPLAY	B&W MONITOR	COLOR MONITOR
APPLE II TEXT MODE 2	large #2 is displayed.	same as B&W
APPLE /// 40 COLUMN TEXT MODE	16 blocks of different shades of grey, with color names printed in each box.	16 different colored blocks with the color names printed in each box.
APPLE /// 80 COLUMN TEXT MODE	smaller characters across 80 columns	same as B&W

F. SOUND TESTS

The SOUND diagnostic has 3 parts: a soft bell, a hard bell, and a sound that gradually grows in amplitude. After each sound, press:

```
    SPACEBAR.................................IF YOU HEAR THE SOUND
or  RETURN KEY.........................IF YOU DO NOT HEAR THE SOUND
```

G. DISK TEST

The DISK TEST tests the seek and the read-write functions of the disk drives. IT IS VERY SENSITIVE AND MAY FAIL A DRIVE THAT IS ACCEPTABLE AND USABLE. If a drive passes this test, you can be sure it is good. If it fails, see note at end of this section.

NOTE: Before running the DISK TEST you must have made test diskettes (see section C above).

1. Remove the dealer diagnostic diskette from the internal drive.

2. Insert the test disk that you created earlier. Close the drive door and press RETURN.

3. You will now be asked for the number of external drives. Type the number of external drives in the test system (i.e., do not count the internal drive) and then press RETURN.

4. The test will now run automatically, ending with a test summary, telling you which drives have passed or failed.

5. Remove the test diskette from the internal drive.

6. Reinsert the diagnostic diskette and press RETURN.

NOTE: IF A DRIVE FAILS THE DISK TEST, 1) TRY THE TEST AGAIN WITH A DIFFERENT TEST DISKETTE (a worn test disk can cause failure); 2) TEST THE D-SPEED USING THE APPLE][CALIBRATION OR DISK ALIGNMENT AID DISKETTE IN EMULATION MODE, AND ADJUST IF NECESSARY [SOS 1.3 has a narrow tolerance (+ or - 10), so get as close to 0 as possible]; THEN TRY THE DISK TEST AGAIN. IF THE DRIVE STILL FAILS, SEE THE APPLE /// TROUBLESHOOTING CHART.

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H. KEYBOARD TESTS

The keyboard test is divided into 4 parts:

1. Alphanumeric Keys
2. Special Function Keys
3. Numeric Keypad Keys.
4. Keyboard Interrupt

NOTE: The steps below must be followed exactly or the test will fail.

1. Alphanumeric Keys:

   Every alphanumeric keystroke possible will be displayed on the screen. As you press the keys, their characters should disappear. Do not use the SHIFT key except where directed to, and press the SPACE bar last.

   a) Press the left SHIFT key and while holding it down press the 2 key.

   b) Press the right SHIFT key and while holding it down press the = key.

   c) Press the CONTROL key and while holding it down press the A key.

   d) Press all the remaining keys on the main keyboard except the SPACE bar. Each time a key is pressed, its character should disappear from the screen.

2. Numeric Keypad Keys:

   This test proceeds in the same manner as the Alphanumeric Key test, but for the keys on the numeric keypad.

   After you have removed all of the keys displayed on the monitor, you will automatically go to the Special Function Keys test. Notice that you can abort this test at any time by pressing ESCAPE.

3. Special Function Keys:

   a) After the special function keys appear press the ALPHA LOCK key once. This will test the ALPHA LOCK key.

   b) The diagnostic will then ask you to press the SPACE BAR and to hold it down. This is to test the slow repeat function. Don't release the SPACE BAR: to complete the next step you must still be holding the SPACE BAR down.

"_108.PICT" 507 KB 2001-08-22 dpi: 600h x 600v pix: 538h x 747v

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c) Next, you will be asked to press the OPEN APPLE key and SOLID APPLE key down simultaneously. This tests both the OPEN APPLE key and the fast repeat function.

d) Now release all the keys; then press first the SOLID APPLE key and then the SPACE BAR. This is to test the repeat inhibit function.

4. Keyboard Interrupt Test:

When the keyboard interrupt test comes up on the screen simply press any key to continue. The diagnostic will inform you of the keyboard status and then return to the main menu.

J. ROM TEST

The system takes over and you will see one of two messages:

ROM PASSES . . . or ROM FAILS . . .

NOTE: If you selected the TEST ALL option from the main menu, you will be returned to the menu after the ROM test. The test results will be displayed to the right of each test option.

K. RAM – 5V and RAM – 12V TESTS

If you use the TEST ALL option, the system will automatically run the 5V test, and if it reports no errors, you can be confident that all RAM are good, no matter which style of board is installed in the Apple ///. If it reports failures, however, you must run the RAM – 12V test in order to obtain the correct locations of failed RAM.

The instructions for both tests are the same (except for reading the failure messages). Read through the steps below, and then run the test.

1. Get the memory size from the bottom of the Apple /// where the serial number is located.

2. Select either the RAM – 5V or the RAM – 12V test, depending on the style of memory board in your Apple (see Section A above, p. 2.3), and press RETURN to begin the test.

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3. The test will now attempt to determine the size of memory in the system. There are three possible outcomes:

   a) A screen will appear with the correct memory size.

     (1) Press the SPACE bar and the RAM test will start.

   b) A screen will appear with the wrong memory size.

     (1) Press the RETURN key, and

     (2) A screen will appear and ask you for the correct memory size.

     (3) Type the letter that corresponds to the correct memory size.

     (4) The first screen will reappear with the newly selected memory size. If this is correct, press the SPACE bar and the test will start. If the memory size is not correct, press the RETURN key and the second screen will reappear so that you may reselect the correct memory size.

   c) The test will not be able to determine the size of memory by itself, so a screen will appear and ask you for the correct memory size.

     (1) Select the letter that corresponds to the correct memory size.

     (2) A screen will appear with the selected memory size. If this is correct, press the SPACE bar and the test will start. If the memory size is not correct, press the RETURN key and the second screen will reappear so that you may reselect the correct memory size.

4. The test will then check the RAM and report any failures. The 12V test gives RAM locations according to a grid of letters and numbers printed along the side and top of the 12V board (rows B, C, D; columns 2 through 17: see Figure 3).

The 5V test gives RAM numbers (U1 through U32). On early versions of the 5V board, these U-numbers were printed next to the RAM locations on the board; on later 5V boards, the U-numbers are no longer printed: to locate U-numbers on those boards, use Figure 4.
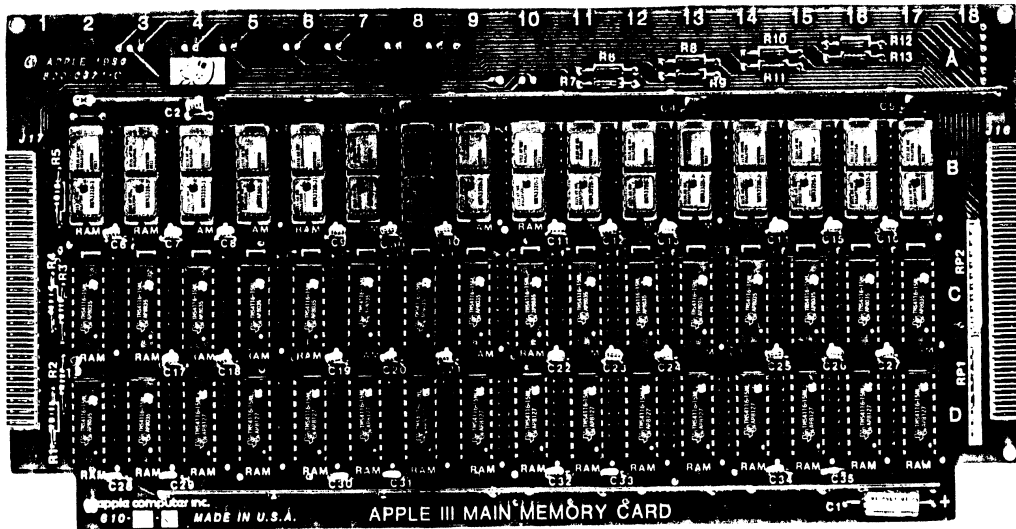
apple computer inc.
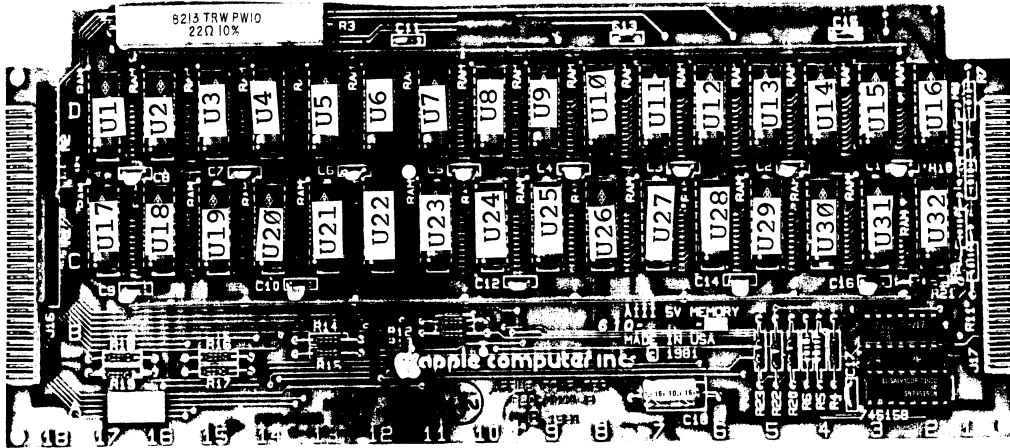

FIGURE 3 — 12V BOARD

FIGURE 4 — 5V BOARD

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Apple /// Technical Procedures

Section 3

Troubleshooting

Contents:

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A. USING THE DIAGNOSTIC FLOWCHART

1. The flowchart is made up of numbered and lettered boxes. The numbered boxes contain directions for proceeding through the flowchart based on the symptoms that show up on the Apple ///.

2. The lettered boxes contain a list of numbers. Each number refers to one of the 11 steps.

3. Always begin troubleshooting at Box 1 of the flowchart, "Power on with the SOS System Demonstration diskette." When the Apple ///'s symptoms lead you through the flowchart to a lettered box containing a list of troubleshooting steps, follow the instructions below:

    a. Turn the power off.

    b. Carry out the designated troubleshooting step. (Start at the top of the list of numbered steps.)

4. When a troubleshooting step leads you to open the Apple ///, you should:

    a. Check to make sure all connecting cables are properly hooked up.

    b. Check all boards to make sure all IC chips are properly seated.

    c. Power on to see if the problem is eliminated.

        (1) If the problem IS NOT eliminated:

            (a) Turn the power off.

            (b) Replace whatever spare module you just put into the Apple /// with original.

            (c) Carry out the next troubleshooting step listed in the lettered box.

            (d) Go back to Step 4c above.

        (2) If the problem IS eliminated:

            (a) Leave the swapped module in place and continue through the Diagnostic Flowchart.

            (b) Take the "bad" module and prepare it for shipment to your Level II Service Center.

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"_113.PICT" 484 KB 2001-08-22 dpi: 600h x 600v pix: 540h x 744v

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5. The Diagnostic Flowchart is designed to test only the basic Apple /// system. Disconnect any peripheral devices and cards and troubleshoot them separately according to the procedures explained in the appropriate Level 1 Service Training module.

6. Each swap step involves exchanging a known good part from your spares kit with the questionable part from the Apple ///.

   a. When swapping, first just connect the cable(s) to the new module so you can see if the swap fixes things or not.

   b. Don't fully install the new module and screw everything down--if the new module doesn't solve the problem you'll just have to take it out again.

B. STEPS REFERRED TO IN THE LETTERED BOXES OF THE FLOWCHART

1. Swap the appropriate connecting cable.
   V = Video cable (if available)
   PS = Power Supply cable
   DD = Disk Drive cable
   KB = Keyboard cable

   NOTE: The keyboard and disk drive cables are identical to each other. Your Spares Kit may only list the DD cable, but you can use it whenever you need to swap the KB cable.

2. Swap the power supply.

   a. Check the power supply fuse first; swap it if it's burned out.

3. Swap the drive.

   a. If the drive proves to be the problem, take the problem drive and further isolate the defective module down to the analog card or mechanical assembly:

   (1) Swap the analog card.

      (a) Take the analog card of the "bad drive", put it in the good drive, and power on again. If the drive does not work you know the problem with the "bad drive" is with the analog card. If the drive does work you know the "bad drive" is with the mechanical assembly.

      (b) If the mechanical assembly proves to be the problem it may just be an adjustment problem. You can run the disk tests for the Apple II in emulation mode on the /// and make any necessary adjustments to see if they eliminate the problem.

4. Swap the main logic board.

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5. Swap the keyboard.

6. Swap the RAM memory board. (You may have to reload the new board
   with the RAM from the original board.)

7. Try booting again.

8. Try booting a different SOS diskette.

9. Swap the video monitor.

10. Swap the speaker.

11. Swap the designated RAM IC chips. (Refer to the Apple ///
    Diagnostics — Section 2, RAM — 5V TEST and RAM — 12V TEST.)

"_115.PICT" 246 KB 2001-08-22 dpi: 600h x 600v pix: 4450h x 6202v

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- 1 -
Power ON
with
System Demo
(SOS Diskette)

- 2 -
Successful
Boot
?

NO
NOT
SURE

- 3 -
Error Message
On Screen
(Internal
Diagnostics)
?

YES

- 4 -
ZP
VIA ROM
ACIA or A D
Message
?

NO

- 5 -
RAM Error
Message or
Continuous
RAM Test

YES

NO

- 6 -
Drive
Starts
?

NO

- 7 -
Power
Light ON
?

YES

- 8 -
Power
Light ON
?

YES

YES

NO

YES

NO

- A -
- 3
- 1-DD
- 4
- 5
- 1-KB
- 6

- B -
- 5
- 1-KB
- 2
- 1-PS
- 4

- C -
- 4
- 6

- D -
- 4
- 11
- 6

- E -
- 5
- 1-KB
- 4
- 11
- 6

- F -
- 7
- 8
- 3
- 1-DD
- 4
- 6

- G -
- 8
- 1-V
- 9
- 3
- 1-DD
- 4
- 6

YES

NO

- 9 -
SOS
Announcement
On Screen
?

- 10 -
RETRY
Message on
Screen
?

YES

- 11 -
Drive
Stops
?

- H -
- 8
- 3
- 1-DD
- 4
- 6

YES

A1

B1

C1

D1

E1

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"_116.PICT" 1032 KB 2001-08-22 dpi: 1200h x 1200v pix: 8971h x 12451v

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Apple /// Technical Procedures

Section 4

Modifications

Contents:

"_118.PICT" 219 KB 2001-08-22 dpi: 600h x 600v pix: 4461h x 6226v

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RED WIRE

BATTERY CASE

BLACK WIRE

CLOCK CHIP

SCREW

RED WIRE

B3

BATTERY
ADAPTER

CLAMP

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NECESSARY TOOLS:

```
#1 and #2 Phillips Screwdriver
Apple /// System Utilities diskette
Apple /// clock kit
Apple /// Clock Calibration diskette
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INSTALLING THE APPLE /// CLOCK KIT

1. Remove the Apple /// Main Logic Board and Top Cover. For instructions on removing the Main Logic Board refer to page 1.15 of the Apple /// Technical Procedures.

2. Place the Main Logic Board on a flat surface in front of you so that the empty socket at B3 is located to your left. Insert the Clock Chip into the empty socket with the notch on top of the the chip facing toward the front as shown in figure 1.

3. Lift the Main Logic Board gently and place the clamp through the two holes on the middle right-hand side of the Main Logic Board has shown in figure 1. Retain the clamp in place with your finger.

4. Place the battery adapter PCB over the large hole with the long flat side of the battery adapter PCB toward the right-hand edge of the Main Logic Board as shown in Figure 1. The battery adapter PCB should be seated between the legs of the clamp.

5. Insert the screw through the middle of the battery adapter and then tighten the screw until the battery adapter PCB is snug against the Main Logic Board.

6. Install 3 "AA" Alkaline batteries into the battery pack as labeled in figure 1, and on the battery pack. Now attach the lugs of the red and black wires of the battery cable to the battery case. Observe the proper polarity as shown in figure 1.

7. Turn the Apple /// right-side up. Clip the battery case on to the lip of the casting to the left of the speaker. Run the molex connector end of the battery cable down through the hole below the speaker on the Apple /// as shown in figure 1.

8. Reinstall the Main Logic Board. Be sure to connect the female end of the lug connector to the male end on the battery adapter PCB, now attached to the Main Logic Board.

9. Make all of the necessary connections to the Main Logic Board and reinstall back to the Apple /// case. Replace the Apple /// cover.

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SETTING THE APPLE /// CLOCK

In order to calibrate the Apple /// clock, the clock time must be set close to the exact second so the number of seconds lost or gained can be determined.

NOTE: To prevent confusion, any text that is to be entered into the computer is enclosed by curly-brackets {}. Type everything, including punctuation, between them; but don't type the curly brackets themselves.

EXAMPLE: If you are supposed to type 1-2-3-4, it will appear in the text as {1234}.

1. Boot the Utilities diskette and select {D}, Device handling commands.

2. Select {T} from the Devices Menu, set time and date.

3. The cursor should now be in the lower portion of the screen that says, "Set the date to: [   ]".

4. Type in the date in the format: {day <SPACE> month <SPACE> year}, where the month can either be the numerical representation or a three letter abbreviation and then press <RETURN>.

    If the date is January 1, 1982 it can be typed in as: {1 Jan 82} or {1 1 82}.

5. Find out what the correct time is. You can do that be calling the local time on the telephone.

6. The cursor should be in the box that says, "Set the time to: [ ]".

7. Listen to the time on the telephone: you should hear the hour-minute and the upcoming ten second mark and then a beep.

8. Type in the time including the seconds which will represent the upcoming beep in the format: {hour:minute:second <SPACE> Xm}.

    If the upcoming beep will be 4:10:00 pm, you may enter the time as {4:10:00 pm}, {16:10:00} or {04:10:00 pm}.

9. When you hear the tone, press <RETURN>.

10. Verify that the beeps occur at the same time as the seconds change on the Utilities time display in the upper right hand corner on the monitor.

11. Repeat steps 6 thru 9 until the beeps are approximately concurrent with the seconds displayed on the monitor.

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ADJUSTING THE APPLE /// CLOCK SPEED

The Apple /// clock is calibrated by comparing the Apple /// System clock
to the one second intervals at the clock chip. In order to calibrate the
clock within reasonable accuracy, without the the use of very expensive
clock calibration equipment, a 24 - 48 hour observation period is required.

1. Disconnect all connections on the back of the Apple ///.

2. Turn the Apple /// over and remove the 5 screws that fasten the beige
    Keyboard cover to the case.

3. Remove the keyboard cover, then turn the Apple /// rightside up and
    remove the 4 screws that hold the keyboard in place.

4. Connect the power cord and the video cable and boot the Apple ///
    Clock Calibration Program.

5. Select the 10 Second interval by pressing down the <ALPHA LOCK> key.

6. Lift the keyboard up and lay it carefully against the sloped Apple ///
    front cover.

7. Wait until the speaker clicks twice (20 seconds) and note the value of
    the indicated number. The number should read +560; +/- 9.

8. If the indicated number is not within the range indicated in step #7,
    adjust the trimmer capacitor located in the center of the keyboard
    with a small screwdriver. When you adjust the trimmer pot, the number
    will not change right away; it takes 10 seconds to update. Turn the
    trimmer capacitor clockwise to increase the value and counterclockwise
    to decrease the value.

9. Wait until speaker clicks at least twice to insure that the indicated
    number remains constant.

10. Repeat steps 7 thru 9 until the indicated number is between 551 and
    569. (+560 +/-9) Once the number has been set it may vary slightly.

11. Record the indicated number of the Apple /// Calibration Program on
    the piece of paper and attached to the front of the Apple ///.

12. After a 24 hour observation period, boot the Utilities diskette and
    press {D}.

13. Find out what the correct time is. You can do that be calling the
    local time on the telephone.

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14. Note the difference between the ten second beeps on the telephone and the seconds on the Apple /// clock in the upper-right hand corner of the monitor.

15. Record the time difference to the closest 1/2 second on paper.

16. If the observation period has been longer or shorter than 24 hours calculate the number of 24 hour periods by dividing the observation period by 24. Let's walk through an example.

    Suppose an Apple /// clock has been running for 28 hours and has gained 5 seconds. The current value of the Apple /// Clock Calibration Program is +780.

    Observation period in hours ÷ 24 = Number of 24 hour periods

    28 ÷ 24 = 1.16 (24 hour periods)

17. Calculate the time difference in seconds per 24 hour period by dividing the time difference recorded in step #14 by the Number of 24 hour periods .

    Time Difference -- Number of 24 hour periods = Time Difference in seconds per 24 hour period.

    5 ÷ 1.16 = 4.31 seconds difference per 24 hour period.

18. Calculate the Clock Offset by multiplying the Number of seconds per 24 hour period by 118.

    Time Difference in seconds per 24 hour period X 118 = Clock Offset

    4.31 X 118 = 508.58

19. Calculate the new Apple /// Clock Calibration value by adding or subtracting the clock offset. If the clock is gaining time, the offset value is subtracted from the Apple /// Clock Calibration Value. If the clock is losing time, the offset value is added to the Apple /// Clock Calibration Value.

    Since the clock is gaining time we subtract from the old value:

    780 (old value) - 508.85 (offset) = 271.15 (new value)

20. Adjust the Apple /// Clock Calibration Program Value to the new value found in step 19, following the procedure in steps 7 through 9.

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EXAMPLE 2

An Apple /// clock has been running for 34 hours and lost 2 seconds. The value of the Apple /// Clock Calibration Program value is +480. What value should the Apple /// Clock Calibration Program indicate after adjustment?

1. Number of 24 hour increments: 34/24 = 1.42

2. Number of seconds per 24 hour period: 2 X 1.42 = 2.84

3. Clock offset: 1.41 X 118 = 292.64

4. New Calibration Program value: 480 + 293 = 773

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