AppleService Technical Procedures

Apple II/II Plus

Apple Technical Procedures

Apple II/II Plus

Section 1 — Take-Apart

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Note: These procedures apply to the pre-RFI Apple II. Because of successive revisions of the Apple II design, you may notice slight differences in the configuration of screws on particular machines you work with. These differences will not significantly alter the procedures.

❏ HOUSING

Materials Required   #2 Phillips screwdriver

Remove

1. Turn off the computer. Disconnect the power cord and video cable.

2. Remove the lid.

3. Remove all the peripheral cards and cables.

CAUTION: *Touch the power supply before touching anything inside the case. Failure to do so can cause damage to the computer or peripheral cards.*

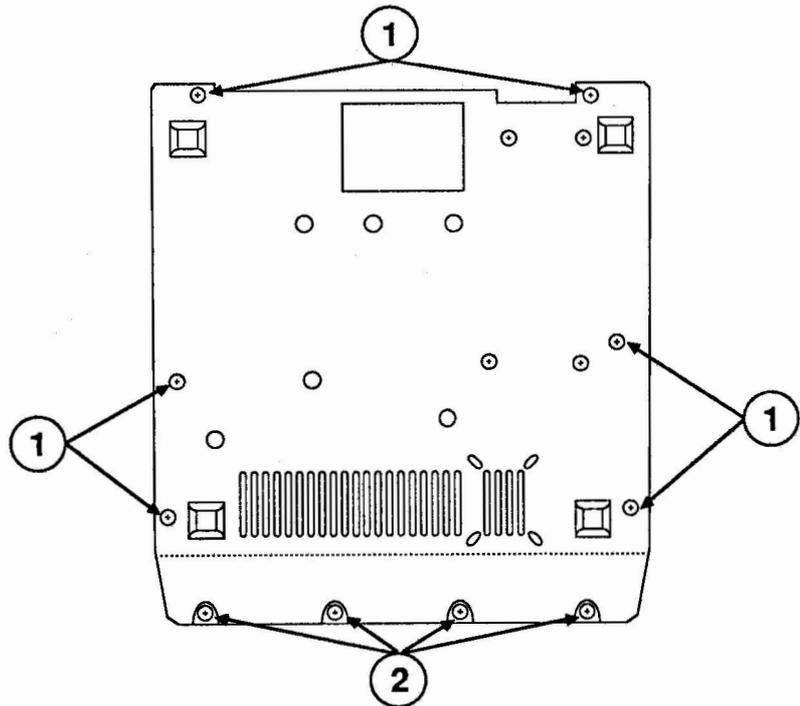4. Turn over the computer and place it upside down on a padded work surface.

FIGURE 1

5. Remove the six flat-head screws (Figure 1, #1) from the three outside edges of the flat portion of the base pan.

6. Remove the four round-head screws and lock washers (Figure 1, #2) from the angled portion of the base pan.

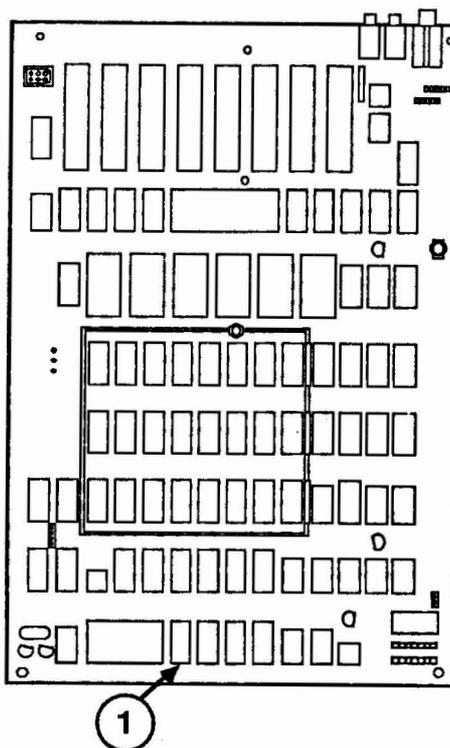7. Grasping both the base pan and the housing, turn the computer right-side up.

FIGURE 2

8. **Gently** lift the front of the housing slightly off the base pan and unplug the keyboard connector (Figure 2, #1) from the front of the motherboard.

9. Lift the housing off the base pan and set it aside.

Replace

1. Place the housing in position on the base pan.

2. Lift the front of the housing slightly off the base pan and attach the keyboard connector to the motherboard.

3. Grasping both the base pan and the housing, turn over the computer and place it upside down on a padded work surface.

4. Replace the six flat-head screws.

5. Replace the four round-head screws and lockwashers. Turn the computer right-side up.

6. Replace all the peripheral cards and cables.

7. Replace the lid.

8. Attach the power cord and video cable.

❏ MOTHERBOARD

Materials Required   5/16" nutdriver
                              Needlenose pliers

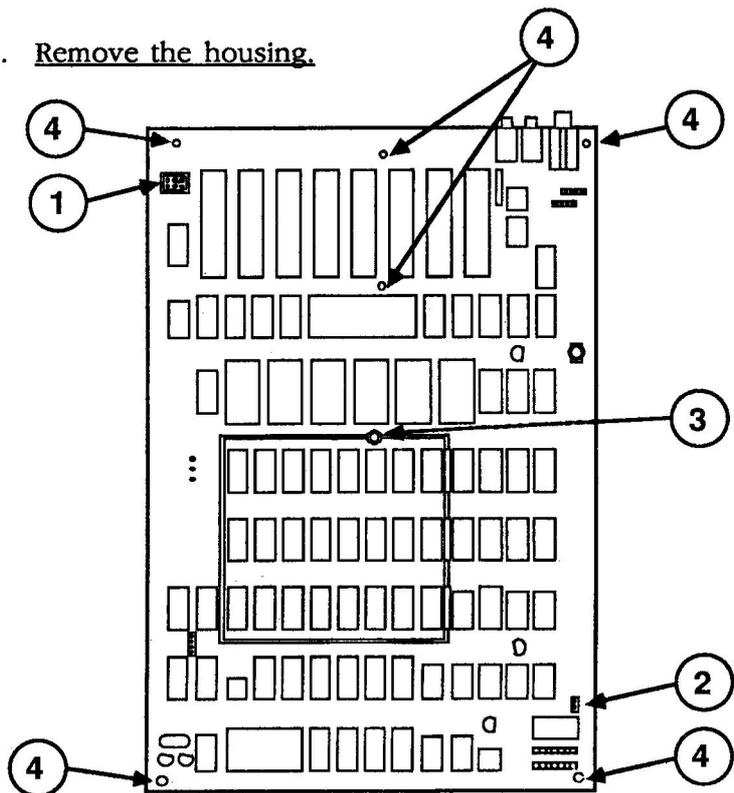**Remove**   1. <u>Remove the housing.</u>

FIGURE 3

2. Pinch the front and rear sides of the power supply connector (Figure 3, #1) and pull the connector from its mating socket.

3. Unplug the speaker connector (Figure 3, #2).

4. Using the nutdriver, remove the nut and lockwasher (Figure 3, #3) in the middle of the motherboard.

5. Using the needlenose pliers, push in on the flanges of the six standoffs (Figure 3, #4).

6. **Carefully** lift the motherboard up off the base pan.

Replace

1. Place the motherboard in position over the six standoffs. Press the motherboard down at each location until you hear a click.

2. Install the washer and nut in the middle of the motherboard and tighten until snug.

3. Attach the speaker connector.

4. Attach the power supply connector.

5. Replace the housing.

❏ KEYBOARD

Materials Required

5/16" nutdriver
#2 Phillips screwdriver

Remove

1. Remove the housing.

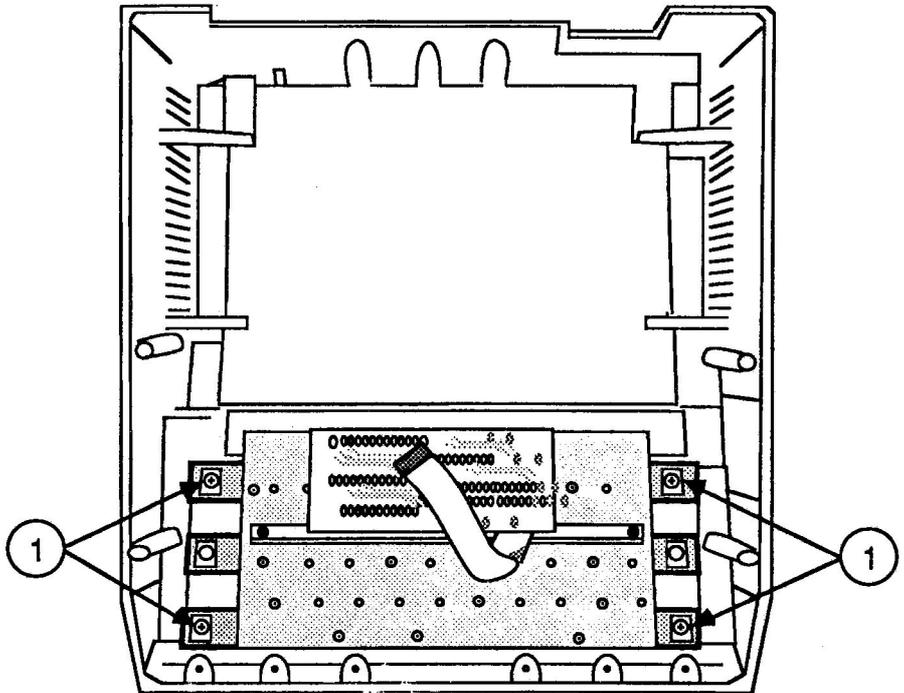2. Place the housing upside-down on a padded work surface.

FIGURE 4

3. Remove the four nuts and lockwashers (Figure 4, #1) securing the keyboard to the housing, and remove the keyboard.

   Note: Some keyboards may be secured to the housing using Phillips screws instead of nuts.

Replace

1. Place the keyboard in position in the housing.

2. Replace the lockwashers and nuts.

3. Replace the housing.

❏ POWER SUPPLY

Materials Required   #2 Phillips screwdriver
                             #0 Phillips screwdriver
                             Strain relief bushing pliers, or regular pliers

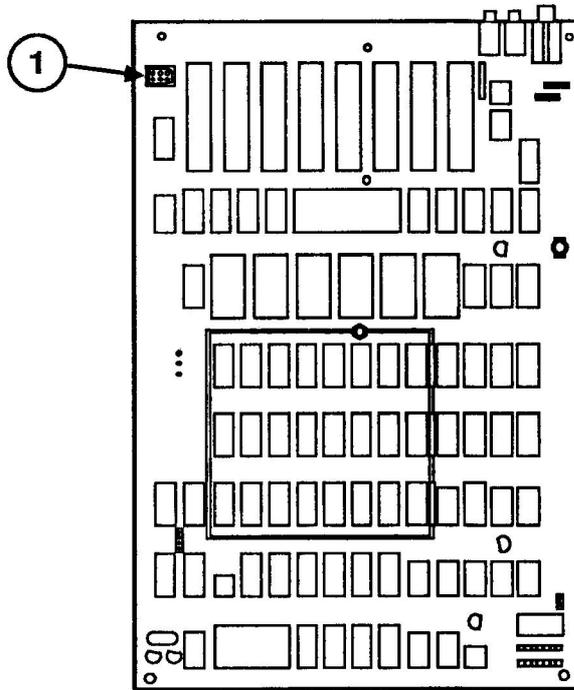**Remove**   1. <u>Remove the housing.</u>

FIGURE 5

2. Pinch the front and rear sides of the power supply
    connector (Figure 5, #1) and pull the connector from
    its mating socket.

3. Turn the base pan over and place it upside-down on
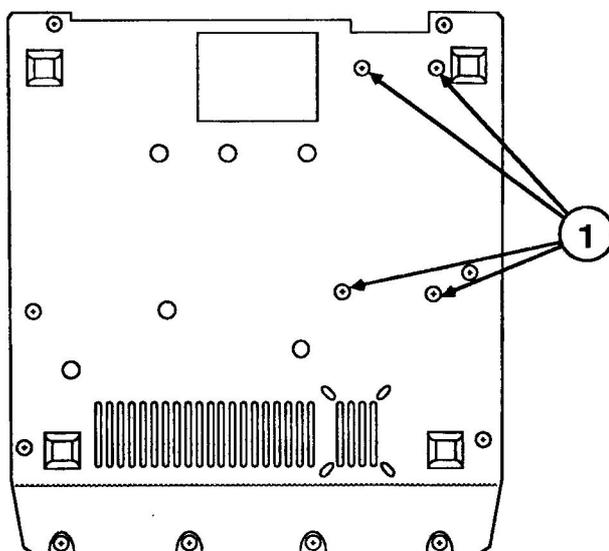   a padded work surface.

FIGURE 6

4. Using the #2 screwdriver, remove the four Phillips screws (Figure 6, #1) that secure the power supply to the base pan. Remove the base pan from the power supply.

Replace

1. Place the power supply in position on the base pan. Check for the following:

   • Longer versions of the power supply may conflict with the speaker. If you encounter this problem, before proceeding to step 2 perform the "Speaker Modification" procedure that follows this replacement procedure.

   • Shorter external power cabling on some power supplies may prevent the power supply connector from reaching its mating socket. If this condition exists, before proceeding to step 2 perform the "Power Cable Extension" procedure that follows this replacement procedure.

2. Grasping both the power supply and base pan, turn the two over and place them upside-down on a padded work surface. Replace the four Phillips screws.

3. Attach the power supply connector.

4. Replace the housing.

**Speaker
Modification**

1. Remove the speaker from the base pan by wedging the flatblade screwdriver under the speaker and **gently** prying up until it comes free.

CAUTION: Be careful not to damage the speaker while performing this step.

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2. Apply a small amount of contact cement to the base of the speaker.

3. Place the speaker approximately 1" back from the start of the incline of the base pan.

**Power Cable
Extension**

This procedure should be performed only if a short power cable is preventing the power supply connector from reaching its mating socket.

WARNING: Do not perform the following procedure with the power supply connected to a power cable.

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1. Using the #0 Phillips screwdriver, remove the two flat-head screws (Figure 7, #1) and the two round-head screws (Figure 7, #2) that secure the power supply cover to the power supply. Remove the cover from the power supply.
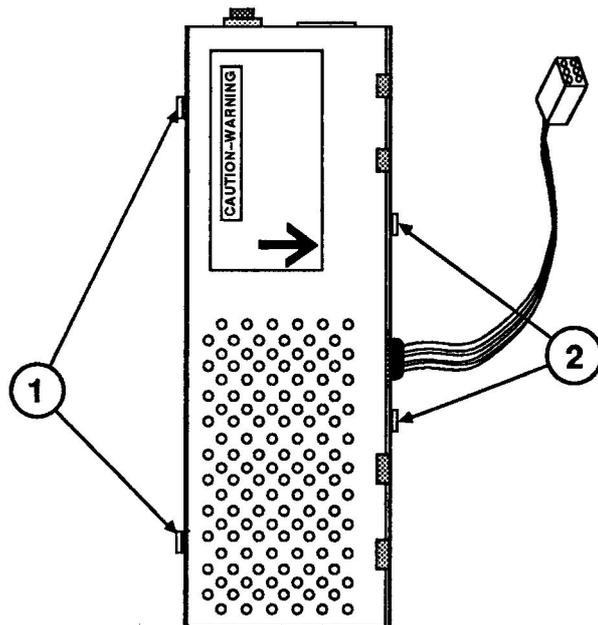

FIGURE 7

2. Using the bushing pliers (or regular pliers if strain relief bushing pliers are unavailable), pinch the power cable strain relief bushing (Figure 8, #1), and pull the bushing from the power supply housing.

3. Pull excess power cabling through the power supply housing. Pull until the cable (Figure 8, #2) inside the power supply is taut. Make sure this cable is routed between the housing and heatsink (Figure 8, #3), and is not touching the heatsink. The proper positioning is shown in Figure 8.

4. Unclasp and reposition the strain relief bushing on the power cable. Cut any tie wraps that may prevent you from pulling the cable taut or from positioning the bushing near the power supply housing.

5. Clamp the bushing on the power cable, and replace the bushing on the power supply housing.

6. Position the cover on the power supply, and replace the two round-head screws and the two flat-head screws.
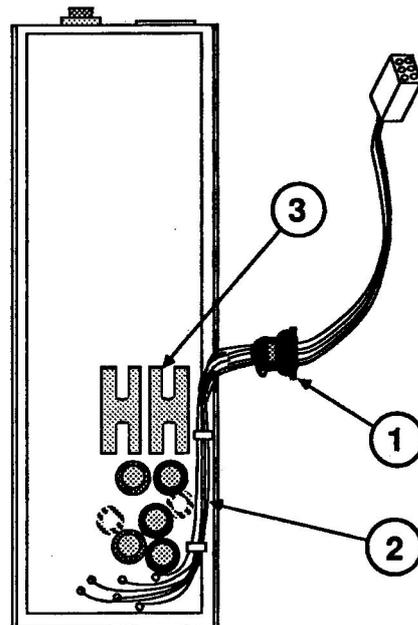

FIGURE 8

❏ POWER LIGHT

Materials Required   Needlenose pliers
Small, flatblade screwdriver
Replacement bulb

Procedure

1. Using the screwdriver, pry off the power light cap.

2. Lift off the shift-key keycap.

3. If the light has a full shield around it, pry off the shield. If the light has a half shield, don't try to remove it.

4. Using the needlenose pliers or your fingers, lift out the bulb.

5. Place the new bulb in position. Make sure to put both wires into their corresponding sockets.

6. If you removed the plastic shield, replace it.

7. Replace the shift-key keycap and power light cap.

⬤ Apple Technical Procedures

Apple II/II Plus

Section 2 – Diagnostics

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Note: The Apple II Product Diagnostic diskette cannot be used to test the Super Serial Card (which replaces the old Serial/Communications Card), the Apple II Parallel Card (which replaces the old Printer Card) or any other Apple interface cards introduced after 1982.

❑ GETTING STARTED

The Apple II Product Diagnostics diskette contains a series of tests that are designed to help you troubleshoot system problems and make adjustments to commonly used Apple peripherals. The job aids in this package provide brief descriptions of the function of each test, and guidelines on how to use them.

Before you can use the Product Diagnostics, you must have 48K of memory in the system (all of the memory sockets on the motherboard must have memory ICs installed in them.)
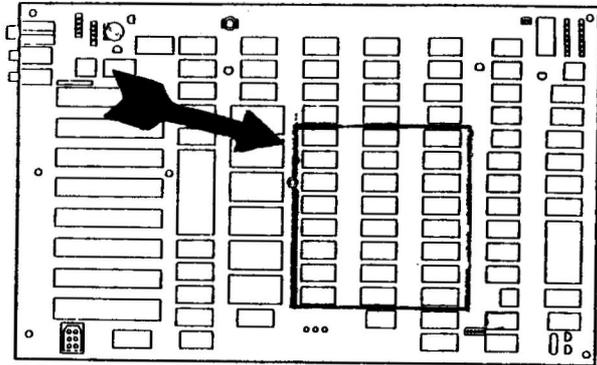
You must also have the P5A (341-0027) and P6A (341-0028) PROMs installed on the Disk Interface card in slot 6.
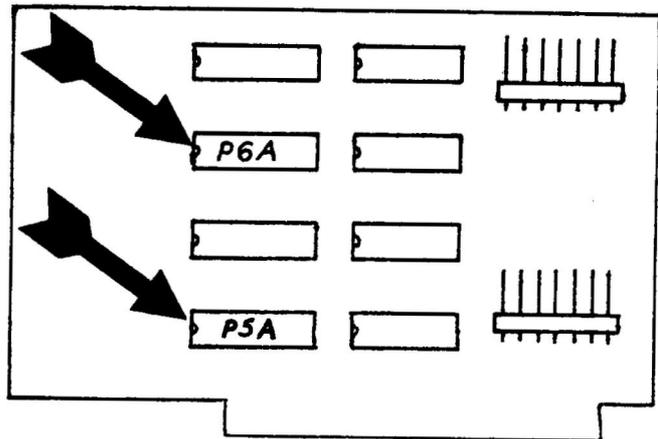
❏ TROUBLESHOOTING CHART

This chart is designed to help you decide which test to use for most common problems. Just find the type of complaint that the customer has in the first column, then use the test listed in the second column. Detailed test procedures are outlined later in this section.

Complaint	Test
• *Flaky System*	– Motherboard RAM
• *Can't use some BASIC programs (motherboard BASIC)*	– Motherboard ROM
• *Can't use some BASIC programs (firmware card BASIC)*	– AppleSoft/Integer ROM card
• *Can't use some programs (language card language)*	– Language card
• *Can't use some programs (not language related)*	– Motherboard RAM
• *ROM Utilities won't work*	– Programmer's Aid #1
• *Missing characters*	– Keyboard
• *Can't select menu items*	– Keyboard

Complaint	Test
• *Paddle/Button problems*	– Game Paddle/Button
• *Tape problems*	– Tape Read/Write/Verify
• *Display problems*	1. Color Bar 2. Motherboard RAM
• *Graphics Tablet problems*	– Graphics Tablet
• *Disk problems*	– Disk I/F card
• *Parallel printer problems*	– Printer card
• *Serial printer problems*	– Serial/Communications card
• *Silentype problems*	– Silentype test
• *Modem problems*	– Serial/Communications card

❑ MOTHERBOARD RAM TEST

You would use this test if the customer told you that his system acted "flaky" or wouldn't run certain programs (after you try a known good copy of the suspect program to eliminate the possibility of a software problem). The CONTINUOUS TEST option is useful for finding intermittent problems, and for "burning-in" a system (running it to make sure that it won't fail soon after the customer gets it home).

This diagnostic tests each RAM (Random Access Memory) IC on the motherboard. It also checks the RAM at location E2 on the Language Card if that card is installed. During the test, the disk drive is activated to cause electrical noise and put a heavy load on the power supply. These conditions make it more likely that marginal RAMs will fail the test.

Test

1. Boot the Apple II Product Diagnostics diskette.

2. Use the <ESC> key to move the cursor to the MOTHERBOARD RAM TEST line text on the main menu, then press <RETURN>.

3. When the title screen appears, you are given a choice of running the test or returning to the main menu (just in case you made a mistake). Press <RETURN> to run the test.

The test will run with no more inputs from you. First you will see a screen full of inverse "@"s, followed by a screen full of normal "?"s. Each of those screens lasts about 30 seconds, and some flickering during the first few seconds of each screen is normal. After these screens, you will see a screen of garbage (you'll know it when you see it), that will change a few times. When the test is over, the results screen will be displayed. This screen is self-explanatory. At the bottom of the screen is a mini-menu that works with the <ESC> and <RETURN> keys in the same fashion as the main menu.

4. If you want to run the memory test for an extended period, select CONTINUOUS TEST and press <RETURN>. The test will then cycle until you press <ESC>, which will return you to the results screen.

If bad ICs are indicated, replace them and rerun the test.

❏ MOTHERBOARD ROM TEST

You would use this test if a customer said that his system had problems running some or all BASIC programs.

This test checks each ROM (Read Only Memory) in the INTEGER or APPLESOFT set on the motherboard, whichever is present.

Test

1. Boot the Apple II Product Diagnostics diskette.

2. Use the <ESC> key to move the cursor to the MOTHERBOARD ROM TEST line on the main menu, then press <RETURN>.

   Note: This test MUST be observed during operation as it does not "keep records" and report its results as the RAM test does.

The test will run with no other inputs from you. As each ROM is tested the program will display the name of the ROM. After testing, it will report either "NO ERRORS FOUND" (for a good ROM) or "CAN'T MATCH CODE" (for a bad one). If there is an error, the test will stop; otherwise it will go on to the next ROM. When all of the ROMs have been tested, it will return to the main menu.

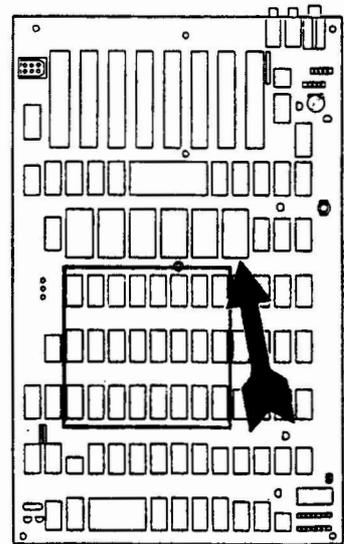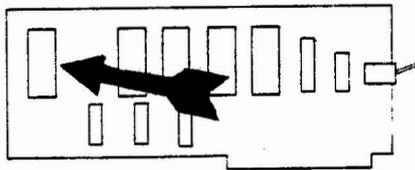If one of the ROMs fails, replace it and run the test again.

❏ PROGRAMMER'S AID #1 TEST

You would use this test if the customer complains that any or all of the functions supported by the Programmer's Aid #1 ROM aren't working correctly. (See the Progammer's Aid #1 manual for a list.)

The test checks the Programmer's Aid #1 utility ROM.

Test

1. Install the Programmer's Aid #1 ROM (341-0016) at the DO position on the motherboard (location F11) if you have an Apple II, or the INTEGER ROM card (location A1) if you have an Apple II+.

2. Boot the Apple II Product Diagnostics diskette.

3. Use the <ESC> key to move the cursor to the PROGRAMMER'S AID #1 TEST line on the main menu, then press <RETURN>.

   Note: This test MUST be observed in operation, as it does not "keep records" and report its results as the RAM test does.

The test will run with no further inputs from you. The message "NO ERRORS ENCOUNTERED" will be displayed if the ROM is good, otherwise the message "UNABLE TO MATCH CODE" will appear. The program will then return to the main menu.

If the ROM fails, replace it and run the test again.

❏ KEYBOARD TEST

You would use this test if the customer complains about missing characters when entering data/commands/text or not being able to select functions (like menu items) when using programs.

This test checks (actually, it allows you to check) each key on the keyboard, the keyboard encoder circuits, and the keyboard cable. The test procedure also checks the operation of the shift and control keys in combination with other keys.

Test

1. Boot the Apple II Product Diagnostics diskette.

2. Use the <ESC> key to move the cursor to the KEYBOARD TEST line on the main menu, then press <RETURN>.

After the test is loaded, an introductory screen will be displayed. This screen tells you how to run the test, and explains what you will see on the test screen.

3. Press any key to proceed to the test. When the test screen is displayed, blank out the keyboard "picture" by pressing keys. Make sure that you test both shift keys in the process. To extinguish the inverse characters, hold down the <CTRL> key and press the appropriate letter keys. The <ESC>, <RETURN>, and <ARROW> keys blank out the brackets, backslash, and underscore that represent them on the "picture".

4. After all of the "keys" are blanked out, press the SPACEBAR to return to the menu.

If any single key fails the test, replace the keyboard mechanical assembly (or just the key if you wish). Any other problem indicates a bad keyboard electronic assembly (piggy-backed to the rear of the keyboard mechanical assembly) or the cable, so replace one of them (then the other if the problem remains). After replacing the appropriate module, run the test again.

❏ GAME PADDLE/BUTTON TEST

You would use this test if the customer complains that his paddles aren't working properly.

This test allows you to check the game paddles/buttons, and the circuitry on the motherboard that interfaces with the paddles/buttons.

Test

1. Connect the Game Paddles to the GAME I/O socket near the motherboard's right rear corner (to the right of the front end of the last peripheral slot).

2. Boot the Apple II Product Diagnostics diskette.

3. Use the <ESC> key to move the cursor to the GAME PADDLE/BUTTON TEST line on the main menu, then press <RETURN>.

After the test is loaded, a screen will be displayed. This screen explains how to use the test screen.

4. Press any key to get to the test screen. Markers on the bottom and right edges of the white square show the actual values being read from the paddles.

5. Slowly rotate each paddle control through its entire range. The asterisk should move around the white area. The markers should keep pace, indicating values from 0 to 255. The sweep of values should cover the full range of rotation of the control (i.e. they shouldn't read 0 or 255 when the control isn't near one of it's limits).

6. Push each paddle button. The white area should turn black and the asterisk should turn white. The "colors" will swap repeatedly if the button is held in.

7. Press <ESC> to return to the main menu when you have finished.

If any part of the test fails, replace the paddles and run the test again. If it still fails, replace the motherboard and run the test again. Alternatively you could test the paddles on a system with a known good motherboard. If the test fails there, the paddles are bad; if it passes, the motherboard in the customer's system is bad.

☐ TAPE READ/WRITE/VERIFY TEST

You would use this test when the customer complains that he can't save data or programs on tape or can't read them from tape.

This test checks the tape recorder itself, the audio cables, and the circuitry on the motherboard that writes to and reads from a tape recorder. It can also be used to "calibrate" a tape recorder to work with the system.

Test

1. Connect a cable between the CASSETTE OUT jack on the rear of the Apple II and the input (MIC) jack on the recorder (this is for the write phase). Connect another cable from the output (MON) jack on the recorder to the CASSETTE IN jack on the Apple II (this is the read phase).

2. Put a scratch (expendable) tape in the recorder and rewind it. Set the record and playback levels to mid-range.

3. Boot the Apple II Product Diagnostics diskette.

4. Use the <ESC> key to move the cursor to the TAPE READ/WRITE/VERIFY TEST line on the main menu, then press <RETURN>.

Instructions will be displayed for each phase of the test. Simply follow them as they appear. The write phase and read phase will each take about 10 seconds. The message "TAPE READ/WRITE TEST OK" will appear after the test is finished.

If errors are found, you will be told to readjust the recorder and try again.

If the test locks up (doesn't do anything new after a long time), nothing is being read from the tape. Make sure that the recorder is working (you can test it with a microphone and your voice). The cables must be good to carry the signal both ways. Check for continuity and shorts, or try a different set. The volume must be set - this is a trial and error process (the specification is 1V peak to peak at the cassette input jack).

If the recorder is working and set up properly (maybe it works with another system?) and the cables are good, replace the motherboard and run the test again.

❏ COLOR BAR TEST

You would use this test if the customer complained about display problems.

This test allows you to check the display device (monitor or TV), the video cable, and the video generating circuitry on the motherboard.

Test

1. Boot the Apple II Product Diagnostics diskette.

2. Use the <ESC> key to move the cursor to the COLOR BAR TEST line on the main menu, then press <RETURN>.

An introductory screen will be displayed, giving instructions on how to use the test screen. You are also given a choice of returning to the main menu or proceeding with the test.

3. Press <RETURN> to proceed with the test.

The test screen that is displayed consists of a set of color bars in a frame. The numbers along the bottom of the frame are the color codes. The colors are:

Color Codes

0=black	1=magenta	2=dark blue	3=purple
4=dark green	5=gray	6=med blue	7=light blue
8=brown	9=orange	10=gray	11=pink
12=green	13=yellow	14=aqua	15=white

Note: Don't try to adjust the color trimmer capacitor on a black and white display; you won't see any changes.

Intensity   Color
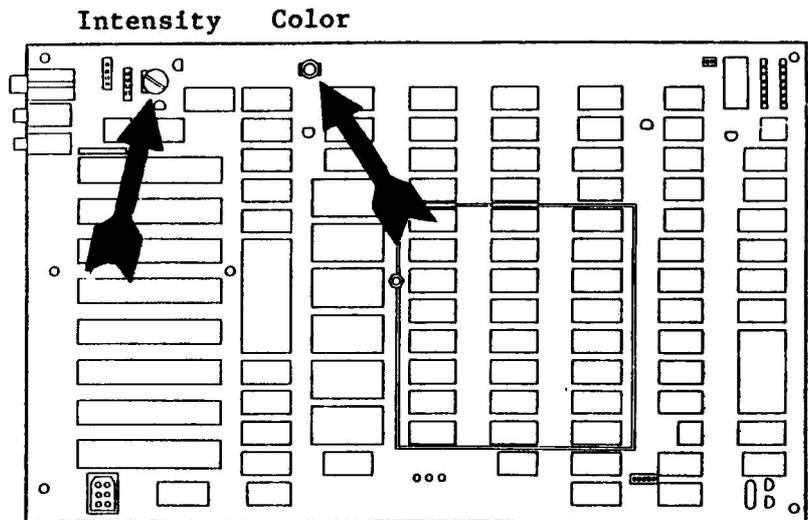
4. When you are finished, press <ESC> to return to the main menu.

If the picture cannot be made acceptable, try a different monitor and/or cable and run the test again. If the problem persists, replace the motherboard and run the test again.

☐ GRAPHICS TABLET TEST

You would use this test if the customer complained about problems with a graphics tablet.

This test allow you to check the operation of the Graphics Tablet, Graphics Tablet Pen, and Graphics Tablet Interface Card.

Test

1. Install the Graphics Tablet Interface card in slot 4 and connect the tablet and pen to it.

2. Boot the Apple II Product Diagnostics diskette.

3. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

4. Use the <ESC> key to move the cursor to the GRAPHICS TABLET TEST line on the card tests menu, then press <RETURN>.

5. The first screen lists some things that must be done before the test will run. If any of the conditions have not been met, do whatever is necessary to meet them and start again. Otherwise, press <ESC> to continue.

The test will check the ROM on the interface card and report whether it is good or bad, give you instructions on adjusting the interface card, display a set-up screen for doing the adjustment, give instructions for testing the tablet, display a screen for that test, and tell you if the tablet works.

If the ROM test fails, replace the ROM and run the test again. If you can't get the correct display during the interface card adjustment, replace thepen and run the test again. If the attempted repair doesn't fix the problem, replace the interface card. If you get missing dots during the surface test, replace the tablet.

❏ APPLESOFT/INTEGER ROM CARD TEST

You would use this test if the customer complained about problems in running programs written in the type of BASIC contained on the firmware card.

This test checks each ROM in the APPLESOFT or INTEGER set on a firmware card, whichever is installed.

Test

1. Install the firmware card in slot 0.

2. Boot the Apple II Product Diagnostics diskette.

3. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

4. Use the <ESC> key to move the cursor to the APPLESOFT/INTEGER ROM CARD line on the card test menu, then press <RETURN>.

   Note: This test MUST be observed during operation as it does not "keep records" and report its results as the RAM test does.

The test will run with no more inputs from you. As each ROM is tested the program will display the name of the ROM. After testing the ROM it will report either "NO ERRORS FOUND" (for a good ROM) or "CAN'T MATCH CODE" (for a bad one), then it will go on to the next ROM. When all of the ROMs have been tested, it will return to the card test menu.

If any of the ROMs fail, replace it and run the test again.

❏ LANGUAGE CARD TEST

You would use this test if the customer complained about problems loading or running programs that use the language card (e.g. Pascal, Pilot, Logo, Fortran, Cobol, etc.).

This test checks the RAM and the Autostart ROM located on the language card. The disk drive is activated during the test to create electrical noise and to put a heavy load on the power supply. These conditions make it more likely that marginal RAM will fail.

Test

1. Install the Language card in slot 0. The cable replaces the RAM IC at location E3 on the motherboard (the left rear corner of the outlined memory area)

2. Boot the Apple II Product Diagnostics diskette.

3. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

4. Use the <ESC> key to move the cursor to the LANGUAGE CARD line on the card test menu, then press <RETURN>.

The test will check the language card RAM and display the results. The results screen has a mini-menu at the bottom that works with the <ESC> and <RETURN> keys as the other menus do. RETEST and BEGIN CONTINUOUS TEST refer to the RAM test only, not to the entire language card test.

5. Select PROCEED WITH TEST and press <RETURN>.

The test will display two status pages, then test the Autostart ROM. You'll have to press a key to proceed from each of those steps to the next. For the ROM test, the message "NO ERRORS ENCOUNTERED" (for a good ROM) or "CANNOT MATCH CODE" (for a bad ROM) will be displayed briefly (so you must be watching) before the test returns to the card test menu.

If any RAM is shown as bad on the results screen, replace the bad IC and run the test again. If any status states are bad, replace the language card and run the test again. If the ROM fails, replace the ROM and run the test again.
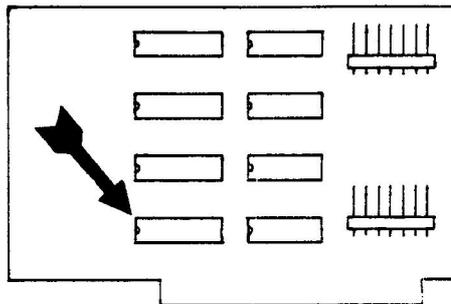
❏ DISK INTERFACE CARD TEST

You would run this test if the customer complained about problems in saving programs or loading them from a diskette.

This test checks the P5 or P5A PROM installed at location D3 on the Disk Interface card, whichever is installed.

Test

1. Note whether the Disk Interface card has a P5 (341-0009) or P5A (341-0027) PROM installed at location D3.

2. Install the Disk Interface card in slot 6.

    Note: If you are unable to boot using the Interface card being tested (because it has a P5 PROM or won't work), install it in a slot other than 0 or 6, and boot with a known good Interface card in slot 6.

3. Boot the Apple II Product Diagnostics diskette.

4. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

5. Use the <ESC> key to move the cursor to the DISK I/F CARD line on the card test menu, then press <RETURN>.

6. When prompted to do so, enter the slot number where the Disk Interface Card is installed.

7. When asked if the language card PROM is installed, answer Y if there is a P5A PROM or N if there is a P5 PROM on the card.

   Note: This test MUST be observed while running, as it doesn't "keep records" or maintain a results display like the RAM test.

The test will finish with no more inputs from you. If the PROM checks out OK, it will tell you so. If not, the message "UNABLE TO MATCH CODE" will be displayed. After reporting its results, it returns to the card test menu.

If the PROM fails, replace it and run the test again. If the problem persists, replace the interface card and run the test again.

❏ PRINTER CARD TEST

You would use this test if a customer complained about problems in the operation of a parallel printer (i.e. DMP, Epson or Centronics).

This test checks the PROM on the APPLE Parallel Interface card.

Test

1. Turn the Apple II off.

2. Install the Parallel Interface card in peripheral slot.

3. Boot the Apple II Product Diagnostics diskette.

4. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

5. Use the <ESC> key to move the cursor to the PRINTER CARD line on the card test menu, then press <RETURN>.

6. When prompted to do so, enter the slot number where the Parallel Interface card is installed (slot 1).

   Note: This test MUST be observed during operation, as it doesn't "keep records" and it returns to the menu when it is done.

The test will run with no further inputs from you. When it is done, it will report "CODE CHECKS OUT OK" for a good "PROM" or "UNABLE TO MATCH CODE" for a bad one.

If the PROM fails the test, replace it and run the test again. If the problem persists, replace the Interface card.
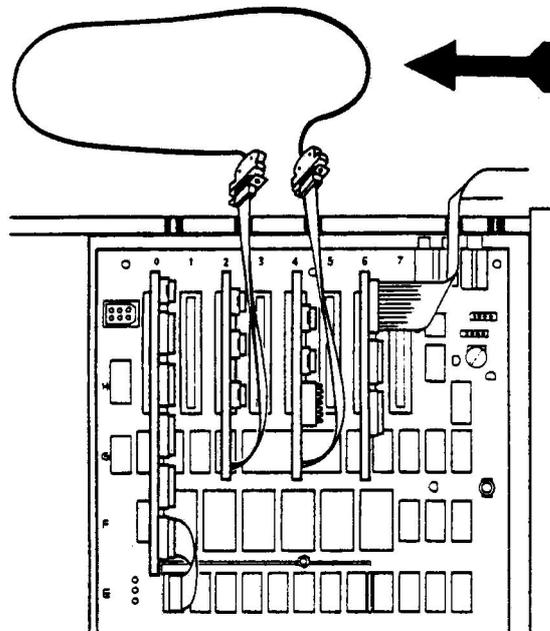
❑ SERIAL/COMMUNICATIONS CARD TEST

You would use this test if the customer complained about problems in the operation of a serial printer (e.g. Qume or Diablo) or modem.

This test checks the Apple Serial Interface card and the Apple Communications Interface card. Both cards must be installed for the test to operate.
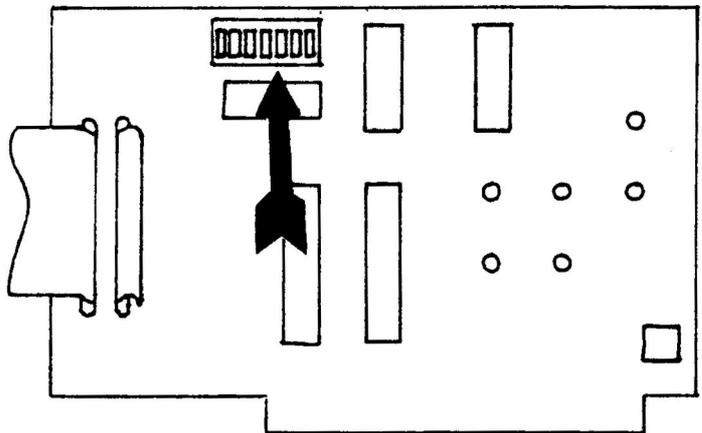
Test

1. Install the Serial Interface Card in slot 1, and the • Communications Interface card in slot 2.

2. Connect a loop-back jumper cable between the Serial Interface and Communications Interface connectors.

3. Boot the Apple II Product Diagnostics diskette.

4. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

5. Use the <ESC> key to move the cursor to the SERIAL/COMMUNICATION CARD line on the card test menu, then press <RETURN>.

6. When prompted to do so, enter the slot numbers for the Serial Interface card (slot 1) and the Communication Interface card (slot 2). The test will check the PROMs on both cards, reporting their status (CODE CHECKS OUT OK or UNABLE TO MATCH CODE).

7. When the switch test screen appears, make sure that the picture matches the actual DIP switch positions on the Serial card. Then manipulate each switch to both of its positions and watch to see that the picture follows the switch. Finish up with all of the switches ON except switch #2.

8. Press <ESC>. When the communications test screen appears, slowly type a few characters. The characters that you type should appear on both the SENT and RECEIVED lines.

9. When you are satisfied that the communication from Serial card to Communications card is good (about 8 characters), press <ESC> ONCE. This will reverse the direction of the test. The screen will look almost identical except for the labels on the SENT and RECEIVED lines.

10. Slowly type a few more characters. They should appear on the SENT and RECEIVED lines as you type them.

11. When you are satisfied that the Communications card is talking to the Serial card properly, press <ESC>.

The test will display a status screen, telling you what revision PROMs are on each card and whether the cards are working properly.

If any of the PROMs fails the test, replace it. If the problem persists, replace the appropriate card. If the switch setting test doesn't work, replace the Serial card. If the communication test fails, replace the Serial card. If it still fails, replace the Communications card. After any of these actions, run the test again.

❑ SILENTYPE TEST

You would use this test if the customer complained about poor print quality or any problems in the operation of the Silentype.

This test checks the PROM and RAM on the Silentype Interface card and the various functions of the printer mechanism. You have the option at the beginning of the test of printing a printer alignment pattern instead of running the test.

Test

1. Install the Silentype Interface card in slot 1 and connect the Silentype to it.

2. Boot the Apple II Product Diagnostics diskette.

3. Use the <ESC> key to move the cursor to the CARD TESTS line on the main menu, then press <RETURN>.

4. Use the <ESC> key to move the cursor to the SILENTYPE TEST line on the card test menu, then press <RETURN>.

5. When given the option of aligning the print head, reply "N" (unless you are doing an alignment, which is beyond the scope of this lesson).

The test will check the PROM (firmware) and RAM on the Silentype Interface card and report the status of each. It will then check the margin switch on the Silentype and report its status.

6. The test will now exercise the carriage and paper drives, printing and variable intensity circuits, and bi-directional print function. It takes a few seconds after the screens appear before the tests actually start. Judge the printer's performance in each step according to the standards given by the diagnostic. Enter "Y" if it is acceptable or "N" if it isn't. If all of the tests pass, the test will return to the card test menu.

It would be redundant to list here what you should do if a part of the Silentype test fails, because a list of recommended corrective actions is provided by the test itself in the event of failure (including if you tell it that the result of one of the print function tests was unacceptable).

Apple Technical Procedures

Apple II

Section 3 – Troubleshooting

❑ CONTENTS

❏ APPLE II TROUBLESHOOTING CHART

Note: The Probable Causes are listed in the order of probable failure. It is recommended that Probable Causes are checked or replaced in the order listed.

Symptom   **Probable Cause**

- *Apple will not boot;*   1. RAM row E
  drive comes on   2. RAM on Language Card at location E2
                                 3. Motherboard

- *Programs run*   1. RAM
  erratically, often   2. Motherboard
  crash

- *No beep and no*   1. RAM row C
  message is displayed;   2. "F8" ROM at location F3 on the motherboard
  monitor has random   3. "F8" ROM on the Language Card at location E2
  characters on screen   4. Motherboard
  when the Apple is
  turned on; drive
  does not come on

- *Peripheral does not*   – Motherboard
  work properly

- *Keys fail to remove*   1. Keyboard Cable
  appropriate character   2. Keyboard Electronic
  from the keyboard   3. Keyboard Mechanical
  test on the Apple II   4. Motherboard
  diagnostic

- *AppleSoft or*   1. ROM
  Integer BASIC   2. Motherboard
  fails to operate
  or is erratic

Symptom	Probable Cause
• *Game I/O port malfunction (Check with diagnostic)*	1. Game Paddles 2. Motherboard
• *All video malfunctions (Graphics and Text)*	– Motherboard
• *Cassette Interface malfunction*	– Motherboard
• *Apple II system dead (No beep, no video, no power light)*	1. Power Supply 2. Motherboard
• *Apple II system dead (No beep, no video, power light on)*	1. Power Supply 2. Motherboard
• *Speaker malfunction*	1. Speaker 2. Motherboard
• *No video display*	1. Video Cable 2. Video Pot adjustment 3. Motherboard

❏ APPLE II CHIP SWAPPING CHART

Symptom	Location(s)	Defective Chip Type
• *Dead Apple System (Power On Light)*	A2	74LS00
	B1	74S174
	B2	74S86
	B13	74LS02
	C1	74LS153
	C2	74LS195
• *No RESET or No Response*	A13	555
	B5	74LS174
	B6	74LS257
	B7	74LS257
	B8	74LS174
	B11	74LS08
	C14	74LS32
	E11,12,13	74LS153
	F12	74LS138
	F13	74LS138
	F14	9334
	H1	74LS08
	H3,4,5	8T97
	H8	6502
	H10,11	8T28
	H14	74LS5251
• *Apparent ROM Problems*	F12	74LS13
	H1	74LS08
• *Apparent RAM Problems*	A2	74LS00
	B5,8	74LS174
	C14	74LS32
	D2	74LS20
	E2	74LS139
	E11,12,13	74LS153
	F2	74LS139
	H1	74LS08

Symptom	Location(s)	Defective Chip Type
• No Video (Speaker Does Beep)	A2	74LS00
	A8	74LS257
	A9	74LS151
	A10	74LS194
	B2	74S86
	B10	74LS74
	B13	74LS02
	C2	74LS195
	C11	74LS04
	D11,12,13,14	74LS161
• No Text Mode	A3	74166
	A5	1513
	A8	74LS257
	A9	74LS151
	A10	74LS194
	B2	74S86
• HIRES or LORES Problem	A0	74LS194
	A8	74LS257
	A9	74LS151
	A11	74LS74
	B4,9	74LS194
	B10	74LS74
	C11	74LS04
	C12	74LS257
	F14	9334
	H1	74LS08
	J1	74LS257
• Dark Screen	A2	74LS00
	B1	74LS174
	B2	74S86
	C1	74LS153
	C2	74LS195
• V or H SYNC Fails	C13	74LS51
	C14	74LS32
	D11,12,13,14	74LS161

Symptom	Location(s)	Defective Chip Type
• Wrong Page or Video Mode	B5,8	74LS174
	B11	74LS08
	B12	74LS11
	B13	74LS02
	C11	74LS04
	C12	74LS257
	E11,12,13	74LS153
	E14	74LS283
	F2	74LS139
	F14	9334
	H1	74LS08
	J1	74LS257
• Wrong or Bad CHRS	A3	74166
	A5	1513
	B5,8	74LS174
	B6,7	74LS257
• Bad Cursor	A3	74166
	B2	74S86
	B11	74LS08
	B13	74LS02
• Bad Graphics	A8	74LS257
	A9	74LS151
	A10	74LS194
	A11	74LS74
	B4,9	74LS194
• No Color	B12	74LS11
	B13	74LS02
	C13	74LS51
• Game Paddles Problem	F13	74LS138
	H13	558
	H14	74LS251
• Cassette Loading Problem	F13	74LS138
	H14	74LS251
	K12	741 OP AMP

Symptom	Location(s)	Defective Chip Type
• *Cassette Saving Problem*	F13 K13	74LS138 74LS74
• *Speaker Problem*	F13 K13	74LS138 74LS74
• *Keyboard Problem*	A12 B6,7 B10 C11 F13	74LS02 74LS257 74LS74 74LS04 74LS138
• *Peripheral Card in Slot Won't Work*	H2,12	74LS138

Apple Technical Procedures

Apple II / II Plus

Illustrated Parts List

□ CONTENTS

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Apple II/Apple II Plus, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.
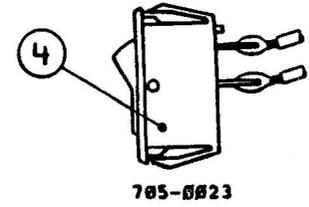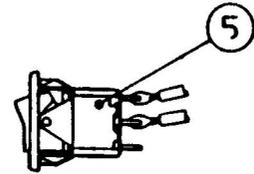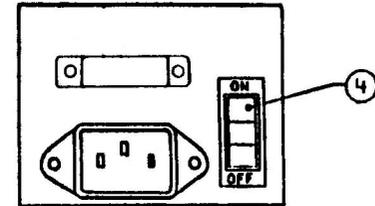
DETAIL B

705-0023

705-0065

SEE DETAIL A

SEE DETAIL B

MOUSE
BOTTOM VIEW
SCALE:NONE
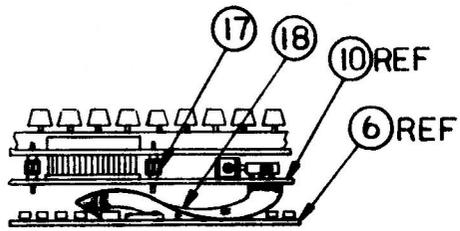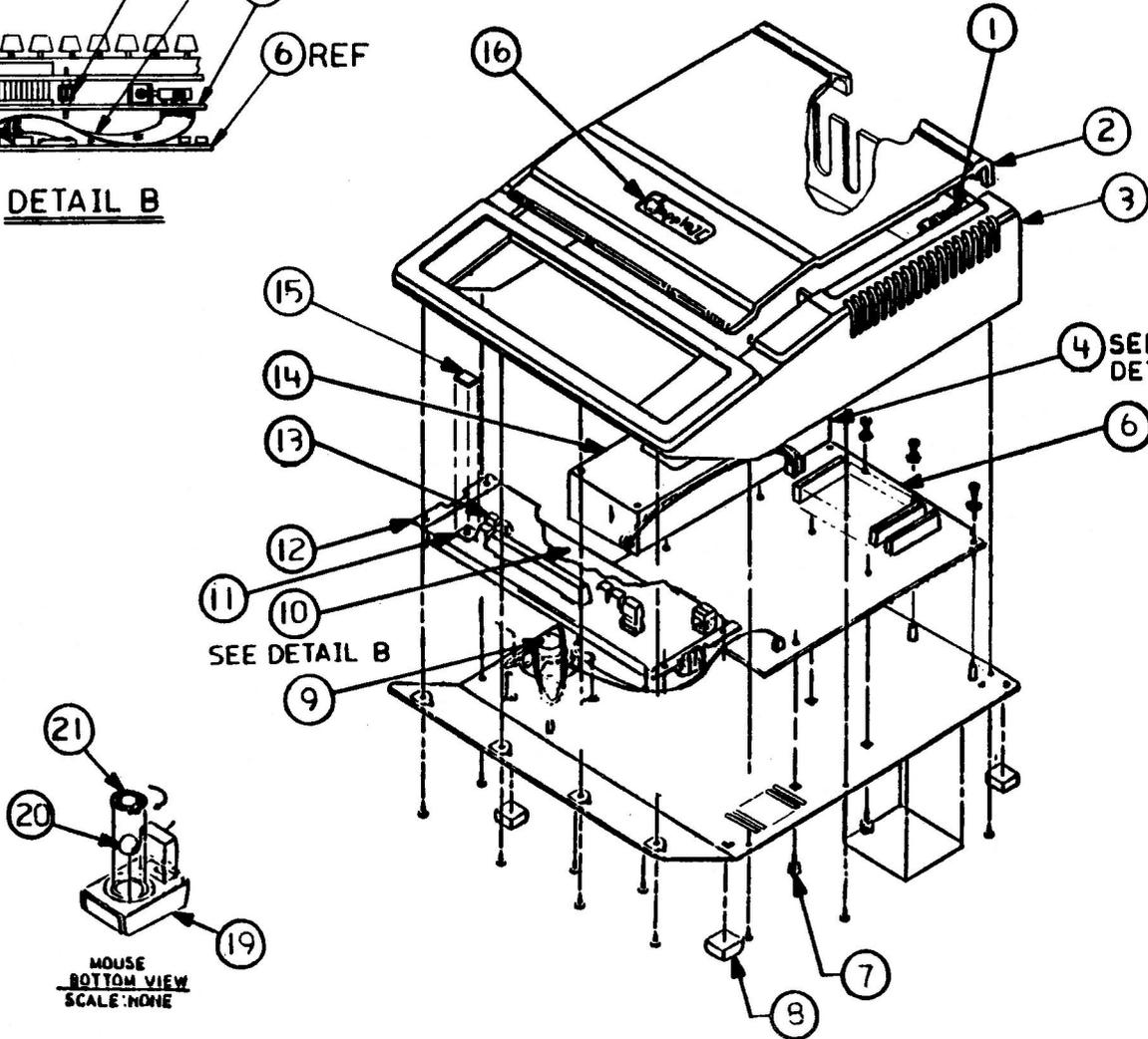
DETAIL A

FIGURE 1

❑ FINISHED GOODS ASSEMBLY (Figure 1)

Item	Part No.	Description
1	830-0002	Apple II/II Plus Hedlock Fastener
2	810-0359	Apple II Lid
3	810-0360	Apple II Housing
4	705-0023	Apple II/II Plus Switch, Power Supply, Rocker, Two-Pole
5	705-0065	Switch, Power Supply, Rocker, Three-Pole
6	661-91205	Apple II/II Plus Motherboard, RFI, w/RAM
	661-91207	Apple II Plus Motherboard, RFI, w/RAM
7	830-0003	Apple II/II Plus PCB Standoff Fastener
8	865-0001	Apple II/II Plus Rubber Foot
9	600-0009	Apple II/II Plus Speaker Assembly
10	661-91023	Apple II/II Plus Keyboard Elec Encoder
11	710-0007	Apple II/II Plus Lamp, Bi-pin, 5V, 115A
12	661-91073	Apple II/II Plus Alps Keyboard
13	605-0133	Apple II/II Plus Keycap Set—Sculptured
	605-0119	Apple II/II Plus Keycap Set—Nonsculptured
14	661-0455	Apple II Power Supply
15	815-0835	Apple II Power-On Lens
16	825-0036	Apple II Plus Nameplate
17	830-0081	Dual Locking Keyboard Spacer
18	590-0007	Cable, Apple II/II Plus Keyboard
19	661-0259	Apple II/II Plus Mouse Assembly
20	699-8001	Rubber-Coated Mouse Ball
21	815-0409	Mouseball Retainer

❑ POWER SUPPLY CHANGED

The new power supply is 1.5" longer than the older model. The new power supply is fully interchangeable with all previous II/II Plus power supplies and may be used in any Apple II/II Plus system.

Note: Although this power supply is similar to that shipped in the Apple IIGS, the two power supplies are not interchangeable.
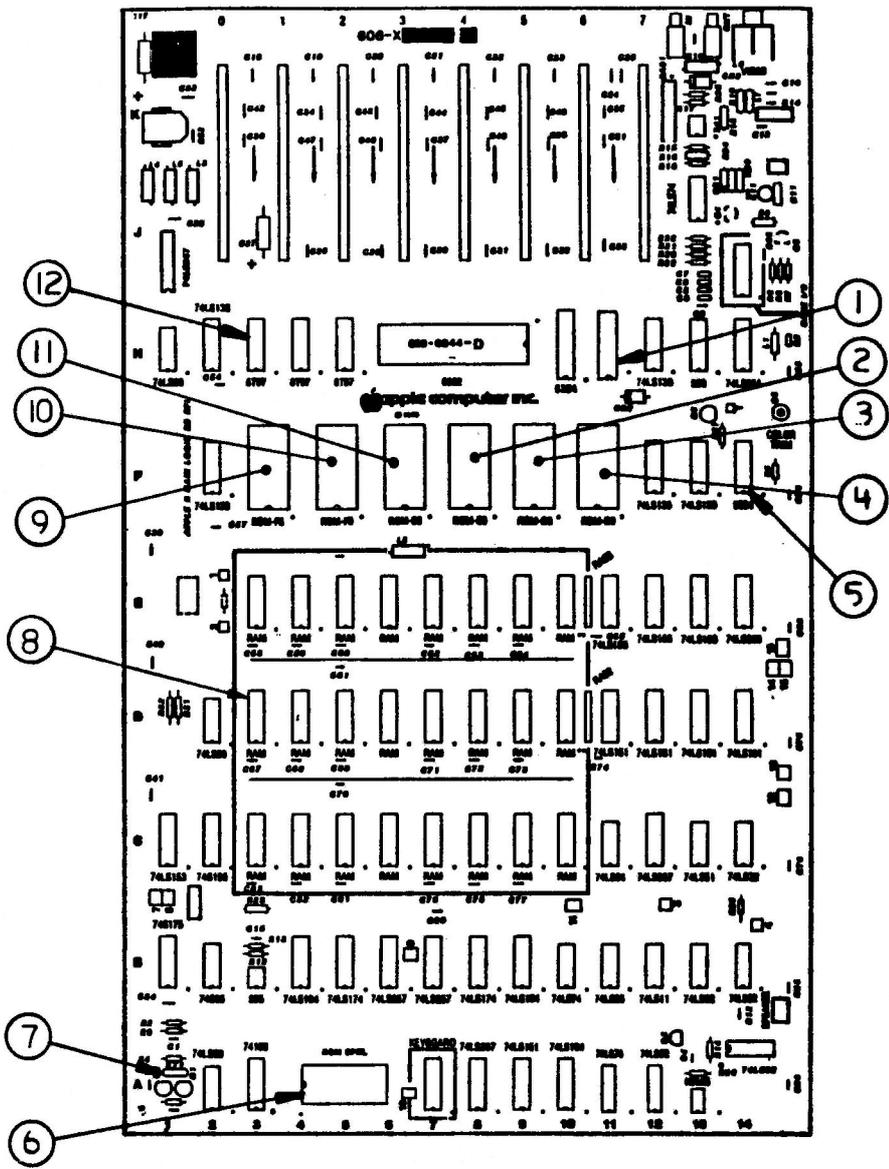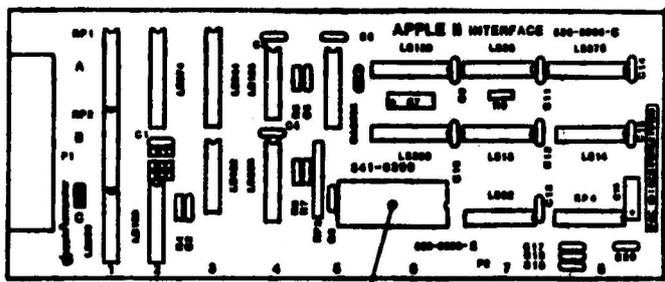
FIGURE 2
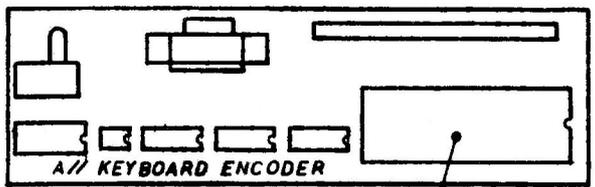
FIGURE 3

FIGURE 4

❑ MOTHERBOARD (Figure 2)

Item	Part No.	Description
1	315-0828	IC, TTL, 8T28, 3 STAT (on early AII Board)
2	341-0001	ROM 16K EO (Integer)
	341-0013	ROM 16K-1AS-EO (Applesoft)
3	341-0012	ROM 16K-1AS-D8 (Applesoft)
4	341-0016	ROM 16K-DO (Integer)
	341-0011	ROM 16K-1AS-DO (Applesoft)
5	302-9334	IC, 9334
6	341-0036	ROM, SPCL
7	197-0001	Crystal, 14.318630 MHz
8	334-0002	IC, RAM 16K
9	341-0004	ROM 16K F8 (Integer)
	342-0020	ROM Autostart F8 (Applesoft)
10	341-0003	ROM 16K F0 (Integer)
	341-0015	ROM-16K-1AS-FO (Applesoft)
11	341-0002	ROM 16K E8 (Integer)
	341-0014	ROM 16K-1AS-E8 (Applesoft)
12	315-0897	IC, TTL, 8T97, HI SP Hex 3-Stat Buffer

❑ PROFILE INTERFACE CARD (Figure 3)

1	341-0299	IC EPROM X-Meg ProFile Interface

❑ KEYBOARD ENCODER CARD (Figure 4)

1	331-0931	IC Keyboard Encoder
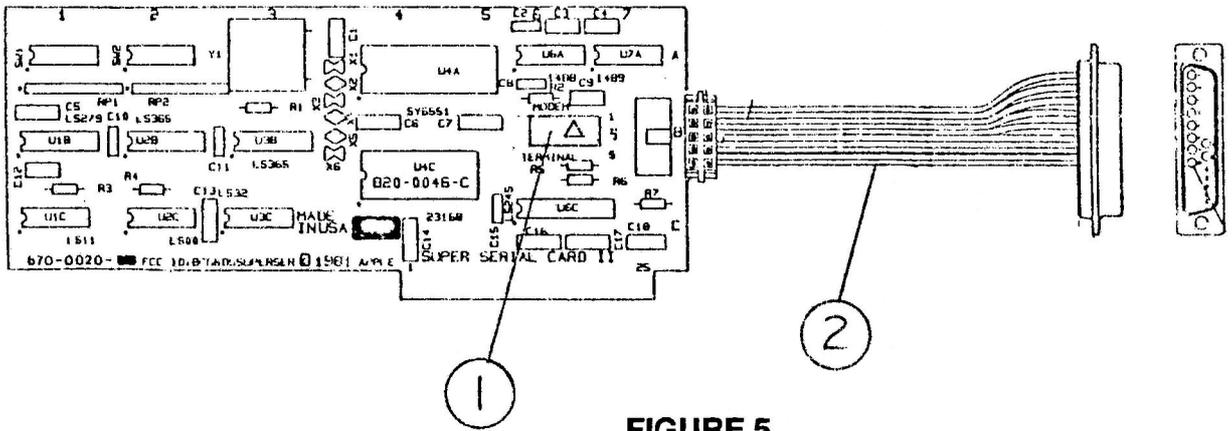
FIGURE 5
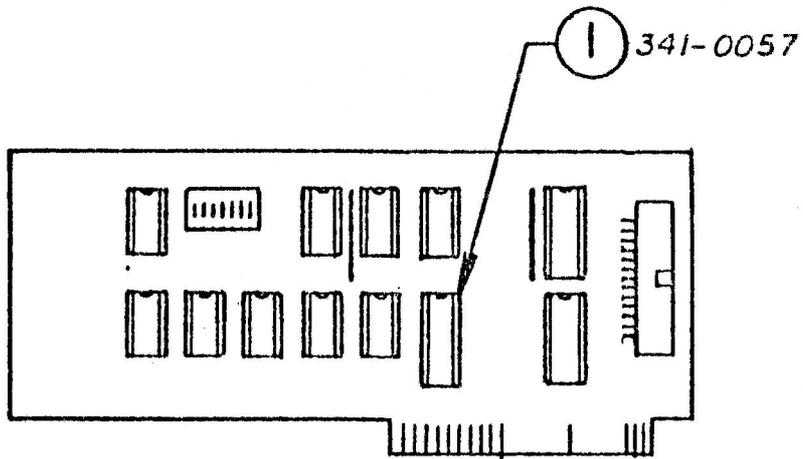
FIGURE 6
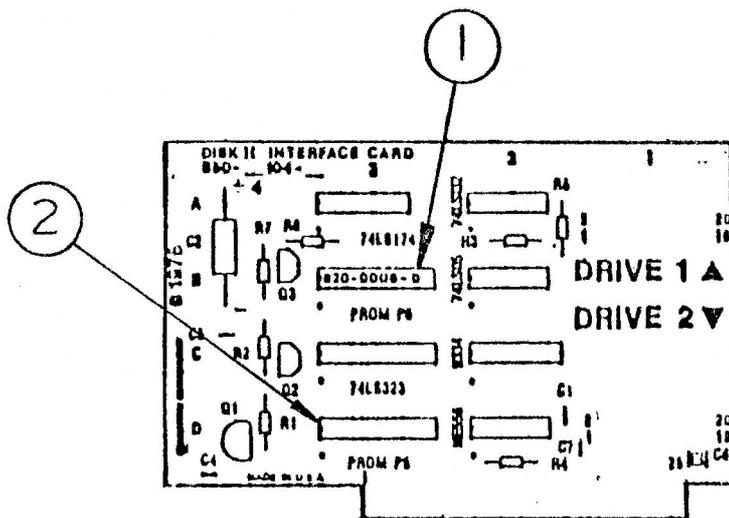
341-0057

FIGURE 7

❑ SUPER SERIAL CARD (Figure 5)

Item	Part No.	Description
1	600-0008	Configuration Block SSC
2	590-0021	Cable Assy Super Serial

❑ PARALLEL PRINTER BOARD (Figure 6)

1	341-0057	ROM, Parallel Printer Boards

❑ DISK CONTROLLER CARD (Figure 7)

1	341-0028	IC, PROM STATE MACHINE P6A
2	341-0027	IC, PROM, P5A
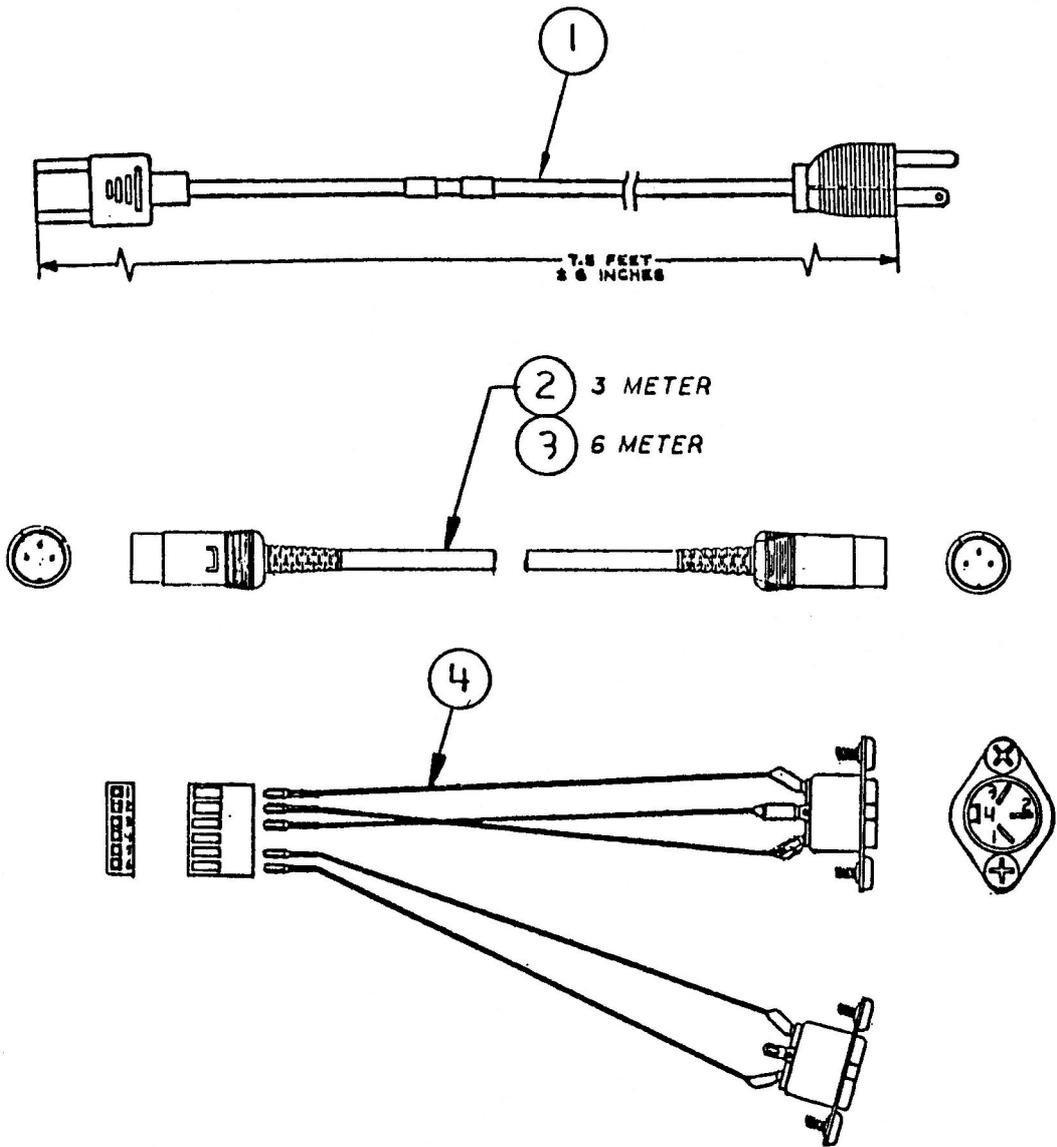
FIGURE 8

❑ CABLES (Figure 8)

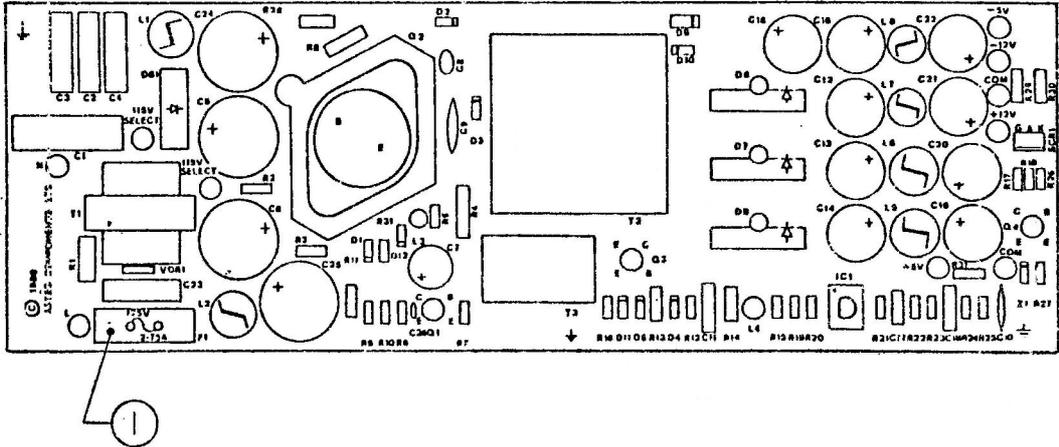| Item	Part No.	Description
1	590-0003	Power Cable, AC
2	590-0127	School Bus External Cable (3 meter)
3	590-0133	School Bus External Cable (6 meter)
4	590-0126	School Bus Internal Cable

FIGURE 9

❏ POWER SUPPLY FUSE (Figure 9)

<u>Item</u>	<u>Part No.</u>	<u>Description</u>
1	740-0001	Fuse, Power Supply, 1A, 250V

The following keyswitches are illustrated in the Apple II product section, Appendix A:

705-0015	Alps Short-Stem Keyswitch
705-0070	Alps Long-Stem Keyswitch
815-0772	Straight Adapter

⚹ Apple Technical Procedures

Apple II

Appendix A – Apple II
Keyboard and Keyswitch Replacement

❑ CONTENTS

Note: There are two basic types of keyboards for the Apple II: the Datanetics and the Alps. Among the Alps keyboards, there are two types: long stem and short stem. Only the Alps long stem keyboard is currently supported by Apple Computer.

The following procedure will identify Apple II keyboards. If you only want to identify a keyswitch, go to Figure 2, page A.3. To replace a keyswitch, go to **Section 3, "You Oughta Know"**.

❏ IDENTIFICATION OF A DATANETICS OR ALPS KEYBOARD

Procedure

1. To identify a keyboard, expose a keyswitch by carefully prying off a keycap with a screwdriver or knife blade.

2. Before identifying the keyswitches, here are some important distinguishing features you should know: a) Only Alps short stem keyswitches have adapters, small plastic pieces that fit on the stem to make it longer. b) Alps long stem keyswitches are capped directly with the keycap. c) Datanetics keyswitches have a square collar on the middle of the stem. Refer to Figure 1 below for the differences between the Apple II keyswitches.
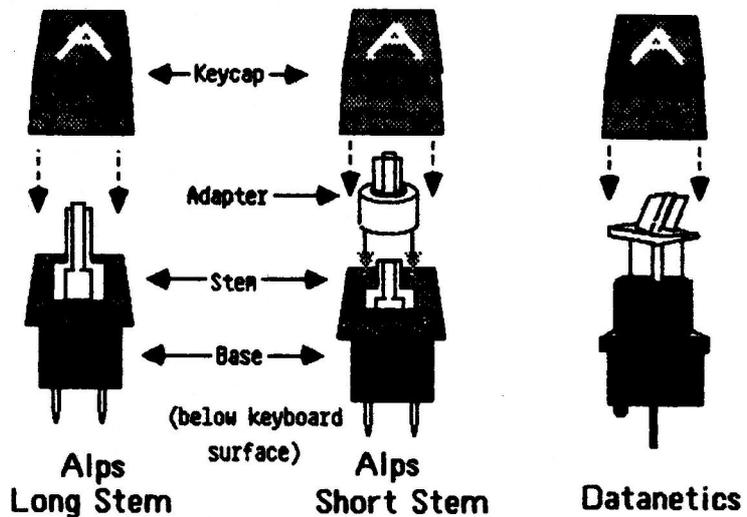

FIGURE 1

3. Now find the keyswitch on Figure 2. Then find the service part number of the appropriate keyboard in the right hand side of the table.

4. If you cannot identify the keyswitch using Figures 1 and 2, then remove the keyboard and look for the name "Datanetics" on the PCB.*

   • If you locate the word "Datanetics" on the PCB, replace the keyboard with an Alps long stem.

   • If you do not locate the word "Datanetics" on the PCB, then go to step 5.

5. Check to see if you find an adapter on the keyswitch. If there is an adapter, then the keyboard is an Alps short stem. If there is not an adapter, then the keyboard is an Alps long stem. Verify this by checking Figure 1.

* Datanetics keyboards and keyswitches are no longer supported and replacement parts can no longer be ordered.

Keyswitch	Keyboard
A. Alps Long Stem 705—0070 Alps Long Stem ("Extended")	Service Part Number of Keyboard: 661—91073
B. Alps Short Stem Adapter 705—0015 Alps Short Stem (Uses adapter 815-0182 with non-sculptured keycaps; uses adapter 815-0772 with sculptured keycaps) 815—0182 12° adapter used with short-stem keyswitches and non-sculptured keycaps 815—0772 Straight adapter used with short-stem keyswitches and sculptured keycaps (3—D View)	Service Part Number of Keyboard: * 661—74025 * 661—91021 * 661—91075
C. Datanetics Keyswitch (Obsolete) Reset (Obsolete)	Service Part Number of Keyboard: * 661—74024 * 661—91020

* These Keyboards are no longer available

Apple II

FIGURE 2

<i>Apple Technical Procedures</i>

Apple II

Appendix B – Apple II
Power Supply Switch Replacement

☐ CONTENTS

❏ INTRODUCTION

Note: These procedures are for gold-case power supplies only. Do not attempt to repair silver-case power supplies; replace them with gold-case power supplies.

If an Apple II cannot be turned on (or off), the most probable cause is a power supply problem. You can test this by substituting a known-good power supply in the customer's Apple II; if the problem disappears, you have isolated it to the customer's power supply.

The most common cause of power supply problems is the switch. If the switch cannot be moved, or if it offers no resistance to movement, the switch is probably causing the problem. While you are replacing the switch, you can also check the fuse. The switch and fuse are the only Level 1 replaceable components.

WARNING: *Power supplies store dangerous high voltages and should always be disconnected before being serviced. Even after they are disconnected, power supplies may hold a dangerous voltage. ALWAYS EXERCISE CAUTION IN REPAIRING POWER SUPPLIES: NEVER PROBE INSIDE A POWER SUPPLY UNNECESSARILY.*

Note: This repair is optional at Level 1. With the reduction in the price of the power supply exchange module, it may be more economical, depending upon your equipment and experience, to swap out defective power supplies.

Older model silver-case power supplies lack self-discharging circuits and should not be repaired in any case; always exchange them for gold-case supplies.

❏ REQUIREMENTS

Materials Required

Soldering iron (25 watt) and 63/37 rosin-core solder
Needlenose pliers
X-acto knife
Four-inch diagonal cutters ("dikes")
Heat gun
Wire stripper (preferably automatic)
Pencil eraser
Hemostats
Portable power drill, with approx. 13/64 inch (.2" or 5mm) diameter bit
Vise large enough to hold power supply
Safety goggles
1/8 inch center punch or 16 penny nail
Hammer
Small or medium Phillips screwdriver
Small flatblade screwdriver
Insulated fuse-puller or equivalent

Replacement Material and Components

Fuse, 1 AMP, 250 Volt

1. **For power supplies with a large, two-terminal switch,**

   a) Switch, Power Supply, Rocker, Two Pole (Figure 1, switch A)
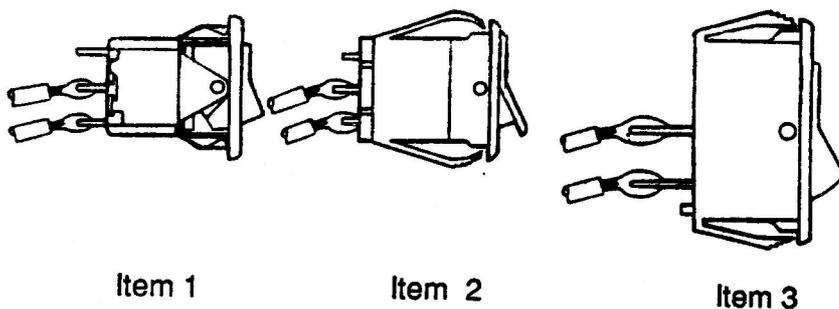
   b) Shrink tubing, 1/4 inch internal diameter

Item 1   Item 2   Item 3

FIGURE 1

2. **For those with small, three-terminal switch,**

   a) Switch, Power Supply, Rocker, Three Pole
      (Figure 1, switch B)

   b) Shrink tubing, 1/8 inch internal diameter

See Figure 1 for the three types of switch usually
found in Apple II power supplies. The small, three-pole
switch (Figure 1, switch B) is now obsolete and should
be replaced with a new Switch, P.S., Three Pole (Figure
1, switch C). The large, two-pole rocker switch,
(Figure 1, switch A) must be replaced by another two
pole, rocker switch, (Figure 1, switch A).

❏ PROCEDURE

BEFORE YOU DO ANYTHING ELSE, take two 3/4
inch pieces of shrink tubing (1/8 inch internal
diameter if working with small switch, 1/4 inch i.d.
for large switch), and place or tape them onto the
new switch, so that you won't forget to install them
before soldering the new switch to the power
supply leads.

1. **REMOVE THE POWER SUPPLY FROM THE
   APPLE II**

   a) Power off the Apple II and disconnect the power
      cord from the power supply.

   b) Unplug the power supply from the motherboard.

   c) Unscrew the power supply from the Apple II
      baseplate and carefully remove it from the
      Apple II.

2. **REMOVE THE COVER (BOTTOM PLATE) FROM THE POWER SUPPLY**

    Note: Some technicians prefer to pry the switch out of the case without removing the cover. If the switch is obviously bad and you choose not to open the case, go directly to step 3.

    a) Locate the two rivets that hold the bottom plate onto the power supply (Figure 2, #1).
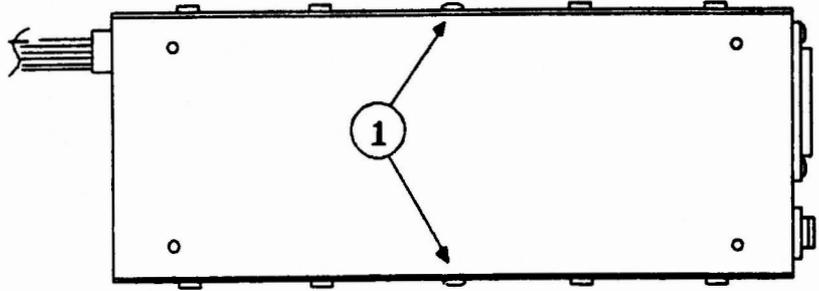
Bottom View of Power Supply

FIGURE 2

    b) Clamp the power supply down firmly in the vise, so that one of the rivetted sides is facing up.

    c) Insert the 13/64 inch bit into the drill chuck and secure it. Put on safety goggles to protect your eyes from metal shavings.

    d) Position the drill bit in the center of the rivet, making sure the drill is aimed straight down into the rivet head. Holding it firmly so that it doesn't slip off the rivet, turn it on at a low speed and drill until the head of the rivet comes off. Do not drill all the way through the rivet or enlarge the hole in the case. Be careful not to scratch the case.

        Note: If the rivet is loose and turns with the drill, place the center punch in the hole in the rivet head and hit it with the hammer. This will spread the rivet head so it will grip the hole.

    e) Hold the center punch on the rivet and hit it with the hammer until the rivet falls through into the case.

f) Repeat steps d and e for the rivet on the opposite side of the case. Remove the power supply from the vise.

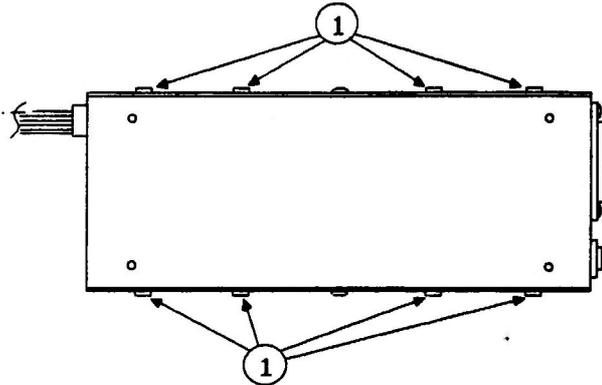g) Remove the eight screws (four on each side) that hold the bottom plate on (Figure 3, #1).

FIGURE 3

h) Pry up the bottom plate and set it aside. Be careful not to scratch the case.

i) Turn the power supply over and shake it to remove the rivet fragments. **MAKE SURE YOU FIND BOTH RIVETS.** If you can't find them, loosen (but do not remove) the screws that hold the p.c. board in place and shake until the rivets come out, but to avoid possible shock hazard, NEVER USE YOUR FINGERS TO PROBE INSIDE THE POWER SUPPLY; shake the rivets out of the case.

If you loosen the PCB screws, be sure to retighten them afterwards.

j) Check the fuse (located near the switch and the power cord plug; usually marked F1 on the p.c. board). If it has blown, use an insulated fuse puller, machinist's scribe or other **INSULATED** tool to pry up one end; then you can remove it with your fingers. (Handle it by its metal ends.) Replace it with another fuse (1 Amp, 250 Volt) and test the power supply on a known-good system. If the second fuse blows also, do not attempt further repair. Replace the power supply with an exchange module and send the defective power supply back to Apple.

3. REMOVE THE OLD SWITCH

a) **If you have removed the cover,** clip off the two locking tabs (Figure 4, #1) on top of the switch (use diagonal cutters); then push the switch out with your fingers. (If that doesn't work, push the lower locking tabs out of the way with a screwdriver and try pushing again.)

If you left the cover on, pry the switch out of the case (use screwdriver, assisted by needlenose pliers). Take care not to scratch the case.

b) Strip the shrink tubing (Figure 4a, #2) off the leads (i.e., wires) (use X-acto knife), taking care not to damage the insulation on the leads.

c) De-solder the leads from the switch terminals and discard the switch. (To de-solder, tin the soldering iron [i.e., put a drop of fresh solder on it] and heat the solder joint, while tugging on the switch with your free hand. When the solder melts, pull the lead free.) **HINT:** The leads are very short. If you are working with the cover on, a pair of hemostats, loosely clamped onto the leads, can simplify your job by keeping the leads steady and preventing them from falling back into the case.
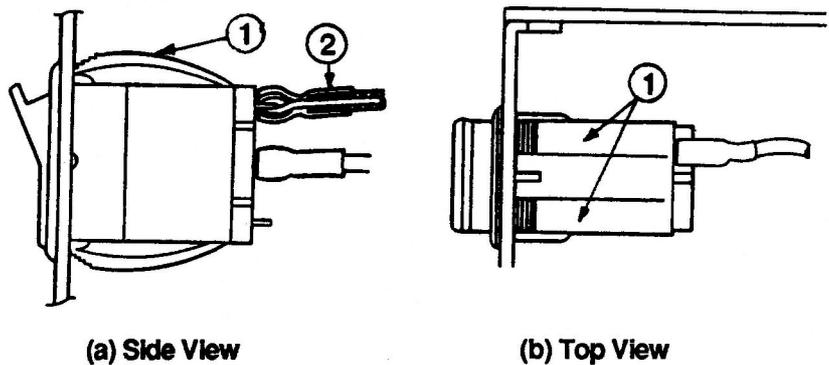
(a) Side View   **(b) Top View**

FIGURE 4

4. **CLEAN AND PREPARE THE LEADS**

   a) Clean excess solder from the leads (use soldering iron: either tap it off or draw it off onto the iron).

      Note: IF THE LEADS ARE VERY SHORT AND AWKWARD TO WORK WITH, REMOVE THE COVER FROM THE POWER SUPPLY, AS IN STEP 2 ABOVE. IF THEY ARE TOO SHORT TO CONNECT TO THE NEW SWITCH, REPLACE THE POWER SUPPLY.

   b) Clip off any badly frayed part of the ends of the leads. (Cut off no more than necessary.)

   c) Strip wires to obtain 1/4 inch of stripped wire on each lead. Twist ends to prevent fraying.

   d) Tin the end of each lead.

   e) Slip a one-inch piece of heat-shrink tubing on each lead, and slide it back as far as possible (to prevent heat damage while you are soldering).

   f) Shape the end of each lead so that it will fit through the terminal of the new switch (use needlenose pliers).

5. INSTALL THE NEW SWITCH

a) **THREE-TERMINAL SWITCH:** Thread either lead through the hole in either outside terminal and crimp it with the pliers, so that the lead forms a loop around the end of the terminal (Figure 5). Attach the other lead to the middle terminal in the same way.

- The open terminal will now mark the "ON" side.Orient it toward the top of the case. (See Figure 6.-next page- If you are working with the cover off, the case will be upside down.)

TWO-TERMINAL SWITCH: Clean the terminals of the switch with an eraser; then tin them. Then thread one lead through each terminal and crimp it with pliers, to form a loop around the end of the terminal as in Figure 5.
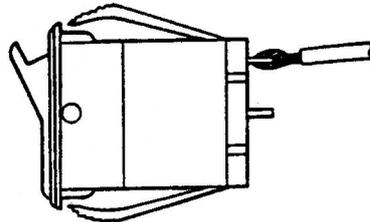

FIGURE 5

- Make sure that "ON" (marked on the switch) is toward the top of the case. (If you are working with the cover off, the case will be upside down: see Figure 6.)
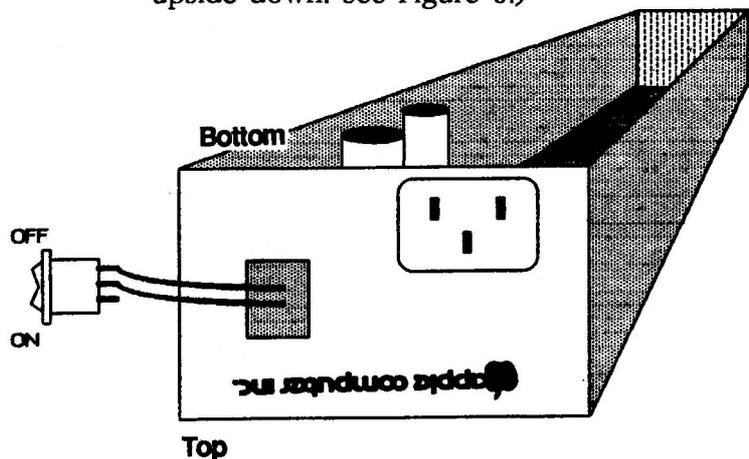

FIGURE 6

b) Solder the leads to the terminals. To avoid damaging the switch, do not apply the soldering iron to the switch for more than 20 seconds.

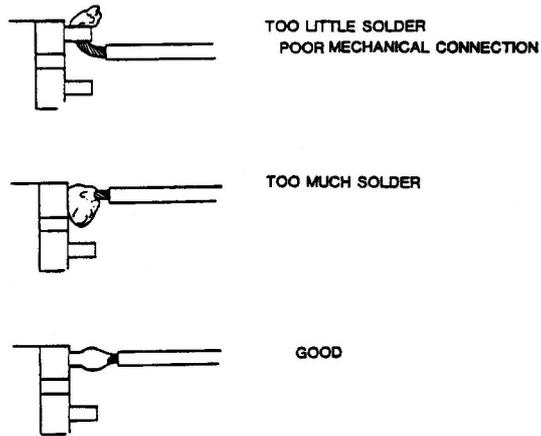c) Check your solder joints. (See Figure 7 for examples of good and bad solder joints.)

TOO LITTLE SOLDER
POOR MECHANICAL CONNECTION

TOO MUCH SOLDER

GOOD

FIGURE 7

d) After the solder has cooled, slip the shrink tubing down both leads, making sure that it covers both terminals completely and overlaps the insulation on the leads. Heat the tubing with the heat gun until it has shrunk to a tight covering around each terminal and lead.

e) Make sure the "ON" side of the switch (the open terminal of the three-terminal switch) is toward the top of the case, and push the switch into its slot in the case until it seats itself firmly. (See Figure 8.)

Top

apple computer inc.

ON

POWER

OFF
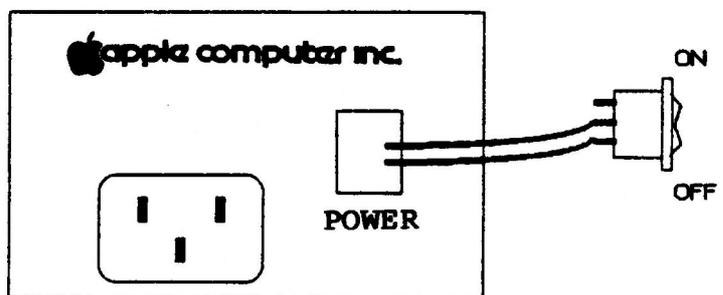
Bottom

FIGURE 8

6. **REPLACE THE COVER**

   a) If you removed the cover, turn over the power supply and shake it to remove loose objects, metal shavings, etc. Inspect visually for excess solder droplets, etc., and remove any you find. (A brush, vacuum or air gun might be helpful.)

   b) Replace the cover and fasten it with the eight screws. DO NOT REPLACE THE RIVETS.

7. **TEST THE REPAIR**

   a) Plug the repaired power supply into the motherboard of a known-good Apple II (NOT the customer's).

   b) Make sure the power supply switch is set to "OFF". Connect the power cord to the power supply, then to the wall.

   c) Turn on the power supply. If the power light goes on and the Apple II tries to boot, the repair was successful. Replace the power supply in the customer's Apple II and return the system to the customer.

If the repair was not successful, swap power supplies for the customer and send the customer's power supply to Apple.

❏ CHECK LIST

Use this checklist as an on-the-job reminder. For detailed explanations of any steps, refer to the procedures on the preceding pages.

1. Equipment ready?
   a) Switch
   b) Medium flatblade screwdriver
   c) Needlenose pliers
   d) X-acto knife
   e) Four-inch diagonal cutters ("dikes")
   f) Heat gun
   g) Shrink tubing
   h) Wire stripper (preferably automatic)
   i) Soldering iron (25 watt)/63/37 rosin-core solder
   j) Hemostats
   k) Small or medium Phillips screwdriver
   l) Drill with 13/64 inch (5mm) bit
   m) Safety goggles
   n) Center punch or 16-penny nail
   o) Hammer
   p) Eraser
   q) Fuse-pulling tool (insulated)
   r) Fuse

2. Remove power supply.

3. Open case and check fuse. (Optional)

4. Pry out switch.

5. De-solder and prepare leads.

6. **Put shrink tubing on leads.**

7. Solder leads to new switch. (See Figure 8 for orientation of 3-pole switch.)

8. **Position shrink tubing over solder joints-apply heat.**

9. Pop switch in.

10. Shake out case (if open).

11. Replace cover; do not replace rivets.

12. **Test on Apple II (NOT THE CUSTOMER'S).**

Apple Technical Procedures

Apple II/II Plus

Appendix C – Apple II/II Plus
Language Card

☐ CONTENTS

☐ INTRODUCTION

There are two versions of the Language Card for the Apple II Plus.

• The original version was installed in slot 0, and the cable replaced the RAM at location E3 on the logic board. This version worked with both the Apple II and the II Plus.

• The new version is installed in slot 0 with no cable connection necessary.

New Version

The new version of the language card

• Has only three IC's on the board

• Has no cable connection from the card to socket E3 on the logic board

• Does not have the Autostart ROM built-in

To correct the differences

• A RAM has been enclosed with the new language card. Install the RAM at coordinate E3.

• If the ROM at location F8 is 341-0004, the customer may want to have the Autostart ROM (341-0020) installed. The Autostart ROM must be installed to maintain the same functionality provided by the old language card.