

# Apple II Service Notes

## LEVEL 2 SERVICE NOTES

### Motherboard Page 1

A no reset condition when there is no cursor, no prompt, and no speaker beep as obvious symptoms. Check pin 40 of the 6502 for a high to low transition when the reset key is pressed. If no transition occurs check the following: Q5 (2N3904 near A13), 555 timer at A13, and the capacitor below Q5 (.1 microfarad). Usually, if Q5 is bad the APPLE will keyboard reset (but will not power on reset). If a transition occurs check the following points with an oscilloscope: Data Lines D0-D7 (pins 49-42 on I/O slots), Address Lines A0 to A15 (pins 2-17 on I/O slots), Read/Write (the write signal is active low) at pin 34 of the 6502, pin 5 of H5 (8T97), pin 9 (R/W in) of C14, pin 8 (R/W out) at C14. Look for low logic levels and missing (except AD7 and AD9 which are normally low) signals. The following IC's could be at fault.

<u>Symptoms</u>	<u>Probable Cause</u>
Low Data levels	B6,7-74LS257 H10,11-8T28 Bad ROM's
Bad Address levels	H3,4,5-8T97 Bad ROM's 6502
No R/W signal	H5-8T97 C14-74LS32 A2-74LS00 6502

With an oscilloscope check for the 1 MHz clock on pin 37 of the 6502. Also check B11 pin 1 (74LS08) for the 1 MHz clock. Check B11 pin 1 for a +5 volt level, C11 pin 13 (74LS04) for a +5 volt level, and C11 pin 12 for a low level. See schematic for further details. Check the following IC's.

<u>Symptoms</u>	<u>Cause</u>
No 1 MHz at 6502	C11-74LS04 B11-74LS08 RA01 (resistor pak)

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Check the following signals to make sure there is proper RAM addressing. Check the CAS bar signals at pin 15 of the RAM. The CAS bar signal at pins 4 (\$0-\$3FFF), 5 (\$4000-\$7FFF), 6 (\$8000-\$BFFF) from F2 (74LS139). Check the CS bar signal at pins 13 of the RAM and pin 7 of C1 (74LS153). Check the RAM SEL bar at pin 4 of the RAM, pin 6 of A2 (74LS00). Check inputs and outputs of D2 (74LS20) and pins 10 (\$8000-\$BFFF), 11 (\$4000-\$7FFF), and pin 12 (\$0-\$3FFF). See the schematic for complete detail and check the inputs and out puts of the following IC's.

J1-74LS257	H1-74LS08	F2-74LS139
C1-74LS153	C12-74LS257	D2-74LS20
C11-74LS04	C14-74LS32	A2-74LS00

Also check the Memory Select headers for continuity (except REV. 7 and above boards)

Check RAM pins 5, 6, 7 and 10, 11, 12 for RA0 (pin 10), RA1 (pin 11), RA2 (pin 12), RA3 (pin 7), RA4 (pin 6), and RA5 (pin 5) These are the RAM refresh, video addressing signals. Also check pins 7 and 9 of E11, 12, and 13 (74LS153's). Check the address and sync inputs to the 74LS153's (see schematic for pinouts).

If the system works with 16K RAM but not with 32K or 48K check RA02 and RA03 resistor paks. These located between E10 and E11 and D10 and D11. Check these with an ohm meter from pins 7 and 9 of E11, 12, 14 between ground and +5 volts. There should be a reading of about 500 ohms between pin 7 of E11 and ground, also, it should read the same for pin 7 of E11 and +5 volt buss (about 500 ohms). The readings should be the same for each of them (see schematic for more details).

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The following are some miscellaneous reset and reset related failures and probably causes.

<u>Symptom</u>	<u>Failure</u>
Intermittent Reset	C14-74LS32 A2-74LS00 E8 ROM
Random characters at keybd reset--	B11-74LS08 F1-jumper block
Chars. moving, appearing randomly on screen--	C11-74LS04
Continuous reset	B7-74LS257
Works w/16K RAM but not with 32K or 48K-	F2-74LS139 RA02, RA03
No speaker output	J13-74LS74
Beep, no prompt or cursor	E11-74LS153 E14-74LS283 F14-9334
No prompt/cursor	B3-555 timer
Split location cursor/prompt	C11-74LS04
No reset w/ROM card SW down	RA01
No reset with Disk Cd.	H2,H12-74LS138

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No video, no reset- check 14MHz. output from crystal (B2-74S86 pins 8 and 10). Replace crystal if no signal. If replacing crystal doesn't help change Q1 and Q2 (2N4258's) below crystal. If that does not solve the problem try the following IC's.

A2-74LS00	A10-74LS194	A9-74LS151
B1-74LS175	B2-74S86	B10-74LS74
B11-74LS08	C1-74LS153	C2-74LS195
C13-74LS51	C14-74LS32	D2-74LS20
C11-74LS04	D11, 12, 13, 14-74LS161	

### Symptoms

### Cause

Blank white screen-	A3-74166 B5,8-74LS174 F14,9334 6502
Blank dark grey screen	B10-74LS74
Screen goes blank when disk boots	B9-74LS194
Video goes blank during RAM test	B2-74S86
Videos wavers	C11-74LS04
Pulsating data, speaker clicks	H1-74LS08
Video distorted, reset OK	D2-74LS20
Top of video missing/distorted	B14-74LS02
Video pushed down/to right	C13-74LS02
Can't write to upper left screen	A9-74LS151
Top 3 lines HIRES gone	A11-74LS74
Rolling video	B14-74LS32, C11-LS04
Video all ????, scrolls	E11-74LS153
Inverse video, cursor not flash	B2-74S86
Inverse/incorrect prompt	F8 ROM
Split video 4 corners	B1-74LS175, C1-74LS153
Split location prompt	C11-74LS04, E14-74LS283
No prompt/cursor	B3-555 timer
Horizontal lines/junk chars.	B5-74LS174
Distorted color bars	A12-74LS02
Vertical bars/cold start	C12-74LS257 D12-74LS161 F14-9334 2513(char gen)
Vertical bars HIRES	B4-74LS194
Left margin vertical white bar	A3-74166
Graphics/color bars broken up	B4,9-74LS194
No page 2 HIRES	open trace B11-6 to R1-10
Black squares w/left to right moving chars.	B12,13-74LS11, 74LS02
No cursor	.1uf above 555 B8
Inverse flashes instead of steady inverse	B11-74LS08

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Smaller chars./vertical bars	B2-74S86
Moving chars	C11-74LS04
Random chars at reset	B11-74LS08
Part graphics/part text chars.	A11-74LS74
Entire screen !!!!!	2513
Junk chars/ after warmup	27 microhenry choke
Video shows only top halves of letters, you get 2 tops instead of a top and a bottom	H1-74LS08, char gen 2513(VC line to pin 13 2513 held low)

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### Miscellaneous Failures

<u>Symptom</u>	<u>Cause</u>
Unable to access disk LED on	B5-74LS174
Unable to boot disk	H2-74LS138, H3 8T97, H12-74LS138, C1-74LS153
Prompt/no cursor	B3-555 timer
Disk boots, screen goes blank	B9-74LS194
Goes into monitor, program dies after warm	E0 ROM, ROM card, I/O slot 0, H2,12-74LS138
Keyboard failures (keybd. OK)	B6,7-74LS257 B10-74LS74 C11-74LS04
Row D RAM bad, noisy speaker	H1-74LS08, J1-74LS257, D2-74LS20, Jumper blocks (except Rev. 7)
_ Row RAM bad-	same as above
Adds chars, and scrolls from bottom	B6,7 74LS257, F12-74LS138, B10-74LS74

## ROM CARDS

This will cover both Applesoft and Integer ROM Cards.

<u>Symptoms</u>	<u>Cause</u>
Apple won't reset	74LS09 INH bar line held low 74LS11 R/W being held 74S74 74LS244 Data lines being held
Won't go into FP	74S74 D0 ROM 74LS138
Won't go into INT.	see above
ROM fails test even when replaced w/good	74LS09, 74LS138
Apple resets with switch down but not up	Bad Switch

Serial Card

<u>Symptoms</u>	<u>Cause</u>
Apple won't power up	74LS109 74LS365 P8 Prom P7 Prom
Proms test bad after replaced	Q1,Q2-2N3906 & Q6-MPSU51
Switches test bad	74LS365
Not receiving	74LS125, Q7-2N3904
Not transmitting	74LS109, Q3-2N3906, Q4-2N3904

Communications Card

<u>Symptoms</u>	<u>Cause</u>
Apple won't reset	Prom P2 DP8304
Prom tests bad when changed	Q1,Q2-2N3906 Q3-MPSU51
Card will not respond to PR#/IN# command	MC6850 74C161 (A1 and A2) 74LS74
No RS-232 Output signal	Q4,Q5
No RS-232 Input signal	Q6



Parallel Card

<u>Symptoms</u>	<u>Cause</u>
Apple won't reset	74LS74 P1 or P9 Prom
Drive won't boot	74LS74
After PR#n command prompt doesn't return	Q2-MPSU51
Prom tests bad after replacement	Q1-2N3906, Q2-MPSU51
Wrong data being printed	74LS174 74LS298
Not acknowledging data received	74LS74 at B2
Not generating Data ready strobe	74LS74 at B2

## KEYBOARD

### Old Style-single board model

<u>Symptoms</u>	<u>Cause</u>
Key doesn't work (example-no A)	Keyswitch bad
Series of letters don't work (for example "9", "6", "5" or "Q", "ESC", "A", "Z", "1")	Encoder (331-5740) bad traces or feed throughs
No control function	Keyswitch U1 (7400) R1 (4.7K Ohm)
No shift chars.	U4 (7400)
No output at all	Cable bad 5740 (encoder)
No keyboard strobe	encoder U1 (7400) check pin 3
No output/wrong output	U2 (7404) encoder
Encoder not being clocked	U4 (7400) pin 3 on encoder
Repeat key does not work	U3 (555 timer)
Characters repeat	Encoder
Wrong characters	Encoder
Characters repeat after unit warm	Encoder

## New style keyboard (two part)

<u>Symptoms</u>	<u>Cause</u>
No keyboard output	Encoder (331-0931)
No Data Strobe (no keybd output)	B3 (74LS00) B4 (74LS00) C6 (.1 microfarad cap)
Incorrect data out	Encoder B5 (74LS04) B3 (74LS00)
No output	Cable
P, Return, and : keys repeat	Change R10 to 3.0K ohm 1/4 watt resistor. See Apple Service Bulletin #15

Language Card

<u>Symptoms</u>	<u>Cause</u>
Apple won't reset	74LS09 --> D0 ROM fails
Works w/Pascal but won't load Basics correctly	74LS09 --> will run Integer, but not Applesoft
No reset	74LS175 74LS08 Autostart ROM RAM Bad
RAM tests bad	RAM Bad cable  74LS09
Not bank switching	74LS86 74LS00 74LS09 74LS08 74LS74 74LS175 74LS20

When repairing Language Cards the most common failure is it just won't work, won't load Pascal or Basics. It is difficult to give symptom "X" and say that IC "Z" is the cause. Each IC has more than one function and all are interrelated.

## Disks Page 1

### Disk Drive

<u>Symptom</u>	<u>Cause</u>
Apple won't power up (dc)	74LS259 74LS323 74LS05
Drive motor on	74LS125 (analog) 74LS174 (controller)
Won't boot	P5 (controller) Q1 (analog) P6 (controller) 74LS125 (analog) Q2 (controller) 74LS132 (controller) 74LS259 (controller)
Write current on	CA3146 (analog) 74LS125 (analog) CR3 (IN4148-analog) 74LS05 (controller) ULN2003 (analog) P6 (controller)
No drive motor motion	motor control bd. (10K pot)
No stepper motion	ULN2003 (analog) cable
No motor speed displayed by test	MC3470 (analog) 74LS125 (analog) 74LS174 (controller) 74LS132 (controller)
Motor speed OK, displayed speed high (+1200)	74LS05 (controller) CA3146 (analog)
Write protect always on	Cable 74LS323 (controller) P6 (controller)
Unable to test (Rd/Wr error)	74LS05 (controller) ULN2003 (analog) P5 or P6 (controller)

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<u>Symptom</u>	<u>Cause</u>
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Diskette not initialized (test#4)	
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	P5 (controller) CA3146 (analog) Adjust comparator (TP7) Load button
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Data error (checksum)	
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	P6 (controller) Adjust TP7 (comparator) 74LS132 (controller)
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Motor spins on pwr. up	
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	74LS125 (analog)
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Won't boot (diskette OK)	
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	P5 (controller) Alignment 74LS259 (controller)
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Won't boot (wipes diskettes)	
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	74LS125 (analog) CA3146 (analog) 74LS05 (controller)
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Drive does not run at all	
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	Q1 (analog) P5 (controller) 74LS259 (controller) 74LS132 (controller)
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Apple does not reset	
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	P5 (controller) 74LS259 (controller) 74LS05 (controller) 74LS323 (controller) NE556 (controller)
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Boots, gives I/O error for inside tracks/unable to read/unable to write when copying	
	Head alignment

The unchangeable chip on the drive board is an MC3470