APPLE II MAINTENANCE
APPLE II MAINTENANCE
INTRODUCTIONS

• Introductions
  • About Mike Willegal
  • Who are you?

• What systems

• What tools
APPLE II MAINTENANCE
OVERVIEW

• Cleaning
• Finding Vintage Components
• Maintenance
  • Enclosure
  • Motherboard
  • Power supply
  • Keyboard
  • Disk
WHAT SYSTEMS

- Focus on Apple II/IIplus
- Some aspects applicable to IIe
- Less on IIc & IIGS
- Useful for other vintage micros and electronics
WHAT TOOLS

- Screwdrivers
  - #1 phillips
  - #2 phillips
- Hex driver – motherboard nut
- Pliers - standoff
- Chip extractor
MORE TOOLS

• Multimeter
  • high impedance ohms function

• Soldering iron
  • temperature controlled tip

• Oscilloscope
  • minimum 2 probes
  • 100 MHZ or higher preferable
  • chip clips
  • leads with clips

• Schematics
MORE TOOLS (CONT.)

• Contact Cement
• Paint Brush
• Solder
• Resin
• Cleaners
  • Isopropyl Alcohol
  • Gojo
  • Windex
APPLE II/IIPLUS BASICS

• Base system made of up of
  • Enclosure – 3 piece plus speaker
  • Motherboard - 8.5”x14”
  • Power supply
  • Keyboard
  • Disk ][
CASE
CASE
MAINTENANCE

• Keep out of light
• Base held on with 10 Screws
• GoJo application followed by dishwasher (no soap) my preferred approach to dirt
• Holes can be repaired with Bondo
• Touch up paint manually matched
• Use contact cement to reattach headlock connectors or speaker
MOTHERBOARD
MOTHERBOARD CLEANING?

- If it works, don’t fix it
- Cleaning
  - Static is a concern
  - Compressed air
  - Soft paint brush
  - Isopropyl alcohol & lint free cloth
Motherboard Repairs

Pseudo-random chip swapping

- Wear and tear on sockets
- Doesn’t address non-IC issues
- Risk of introducing problems
- Apple service notes have guidelines about what causes typical faults
MOTHERBOARD REPAIR
REPAIR THROUGH DEBUG

• Check voltages

• Get video section working first
  • Work from output stage back toward DRAM

• Video working, but not booting
  • Work from CPU to memory, checking each bus signal

• Booting, but flakey
  • Memory or memory addressing likely culprit
  • Programmers PROM has memory test
  • Loadable memory tests are available (aptest)
MOTHERBOARD REPAIR
COMPONENT EXTRACTION

• Two options
  • Use rework station
  • Cut up and remove 1 pin at a time.
POWER SUPPLY
POWER SUPPLY

- Know what you are doing
- On/Off switches are still obtainable
- Rivets
  - Drill out with 1/8” drill bit
  - Make sure any metal pieces are removed before reassembling
  - Replace with aluminum pop rivet
KEYBOARD

- Datanetics keyswitches
  - Restore
    - Add isopropyl alcohol with eyedropper
    - Work vigorously
    - Repeat

- MM5740/AAE encoder
  - Static sensitive
  - Expensive, if you can find them
  - Littlediode.com occasionally has them
KEYBOARD

- Plugging in backwards
  - Will usually blow one of the 74LS04 inverters
  - Easy fix

- Worst case – I sell a kit to connect a PS/2 keyboard
DISK []

- **Speed**
  - Remove cover
  - Run Aptest on scratch disk
    - Adjust 10 pot

- **Head Cleaning**
  - Remove cover
  - Isopropyl alcohol and lint free swab
• The yellow arrow points to 9.1K resistor R-21 that controls a 2us delay between peak detection and read pulse output

• Later model drives, had this delay made adjustable by adding a 10k pot and reducing the value of the resistor to 7.2K

• Lift one leg of resistor and add 10K pot and adjust to 3us delay
• Lift one leg of resistor and add pot to adjust
- Red Book is presentation source
- Also found in
  - “Apple II Reference Manual”
  - “Understanding the Apple II”
- Be aware that HW changed as time went on
FIGURE S-2  MPU AND SYSTEM BUS
FIGURE S-3  REFERENCE OSCILLATOR AND SYSTEM TIMING
FIGURE S-4  SYNC COUNTER
Figure S-5 ROM Memory

ROM Memory Array

- F3
- F5
- F6
- F8
- F9
- F11

System Bus
See Fig. S-2

I/O SEL
F12-15
To H12
Peri I/O Mux
Fig. S-9

74LS138

74LS08

ROM Pinout Detail

+5V

A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10

DA0
DA1
DA2
DA3
DA4
DA5
DA6
DA7

Z1

20
21
22
23
24
25
26
27
5V

CHIP SELECTS
FROM F12

RA01
3.3K

CS2
CS1
CS3
GND

FIGURE S-5 ROM MEMORY
FIGURE S-7  RAM ADDRESSMUX
FIGURE S-8 4K TO 48K RAM MEMORY WITH DATA LATCH
FIGURE S-9 PERIPHERAL I/O CONNECTOR PINOUT AND CONTROL LOGIC
REFERENCES

“Understanding the Apple II” – Jim Sather

“Red Book” – Apple

“Apple II Reference Manual” – Apple

Forums: comp.sys.apple2

Forums: applefritter.com

My web site - www.willegal.net

Interesting electronics blog: www.eevblog.com