MB68k-100 Assembly and Bench Check, A

The document outlines the board assembly procedure. The Troubleshoot Testing section also offers some optional inline assembly test steps. At the writing of this document, the MB68k-100 revision is B. For further historical details on assembly, see document '_First Piece Assembly and Test.doc.' For the board acceptance test procedure, see the 'MB68k-100 Motherboard Test Procedure.'

Documents:

1. This document, MB68k-100 Assembly and Bench Check, A.doc
2. Parts List, 68000 Motherboard BOM (current rev)
3. Schematic, MB68k-100 (current rev)
4. Acceptance Test Procedure, MB68k-100 Motherboard Test Procedure (current rev)

Tools:

1. 25-30W Soldering Iron or similar
2. Soldering Iron Tip Cleaner
3. #1 Size Phillips Screwdriver for TO-220 mounting hardware
4. 4-40 Nut Driver for TO-220 mounting and stand-off hardware
5. +5V or other suitable power supply for board test
6. 1' wire for use during test
7. Extra shorting jumper

Optional:

8. Improvised Underside Support Tool for supporting components while soldering

Assembly:

Estimated Assembly Time:

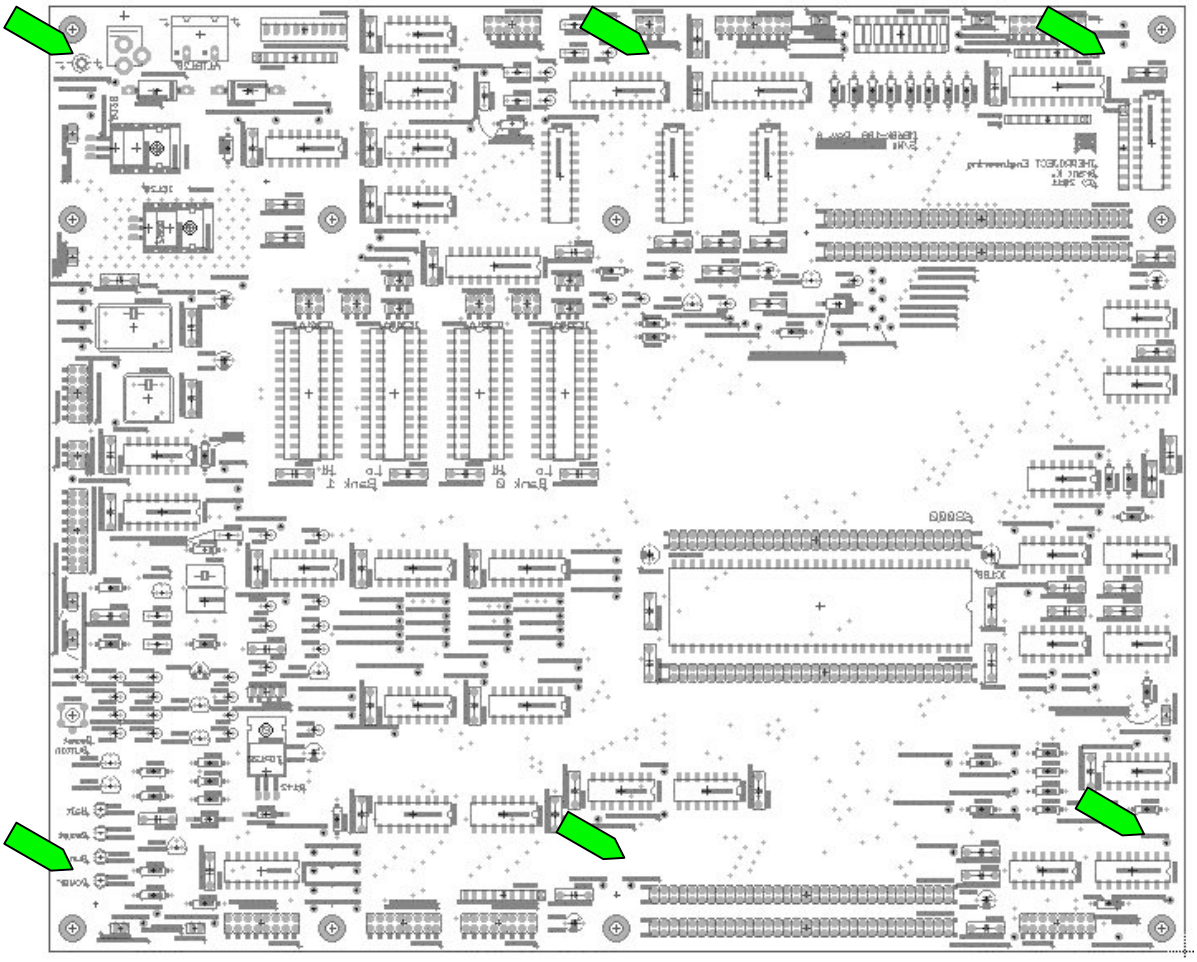
- Section Method: 20hr
- Part type method: 14hr

1. General
    a. Resistors are installed reading the color bands from left to right, top to bottom
    b. Capacitors are orientated with component markings toward the left, downward or away from nearby tall components
    c. Bending header pins on opposite corners *slightly* aids in locking in place during soldering
    d. Bending pins on IC sockets flush with the back of the board works well to hold the sockets in place during soldering
    e. Note orientation of Resistor Array components
2. Mark board
    a. Write build configuration into the appropriate field on PCB
    b. Write serial number into the appropriate field on PCB
    c. Document board's serialization in build log
3. Stand-offs
    a. Install H170-H179 stand-offs on component side to protect components while board is inverted during soldering
    b. Install stand-off, nut
    c. Tighten with nut driver until firm + 1/8 turn
4. Power Input
    a. A1TB120 terminals are to face outward.
    b. Q120, bottom-up: screw, board, transistor, bushing, lock, nut
    c. VR120, bottom-up: screw (upside-down), board, sink, pad (trimmed inward from each long side), transistor, bushing, lock, nut. Alternatively the PT5101A switching regulator may be installed.
    d. For VR120 as PT5101A, use 100µF capacitor for C121.
    e. Install the TVS120/TVS121 with engineering discretion, only when using +5V input directly. It will otherwise limit input supply voltage to the regulator.
5. Indicators
    a. LED cathode is the larger post as seen within the interior of the component.

Name	**Color**	**Indication**
Power	White	+5V system power present
Halt	Red	68000 /HALT signal is asserted
Reset	Yellow	68000 /RESET signal is asserted
Run	Green	68000 is actively addressing, signaling that the microprocessor is running

6. Clock circuits
    a. When installing crystal X110, remember to install spacer underneath.
    b. R119 short; C119, R115, C115 open
7. Discrete Voltage Supervisor/Ext Run Ctrl
    a. Q142, bottom-up: screw, board, transistor, bushing, lock, nut
8. Onbd Mem Banks, since they are located on the interior of the board and other surrounding components can interfere with support tools during soldering
9. Install remaining components
10. Install SRAM chips into sockets
11. Jumper defaults
    a. See board's user's manual
12. Inspect for solder bridges and missed joints, and for missed components
13. HW Ent Gen
    a. Do not install D320 or C322. These components are tested for suitable operation of the Hardware Entropy Generator before installing.
    b. HW Ent Gen test
        i. Install program ROMs for TstExamp
        ii. Connect an oscilloscope between TP_HW_ENT and TP_CLK_TERM_GND. Set to 2ms/div, 1V/div with negative trigger at 2.5V. Move the trigger point delay to the left of the screen.
        iii. Hold the board in reset.
        iv. Determine suitability of random output. As a guideline, the waveform shall appear at 5V, with negative-going pulses occurring at least twice per second on average at a minimum. The signal shall also demonstrate additional negative-going pulses in frame at least once every few seconds. Occasionally, the transition downward will not transition upward again in frame.
        v. Release reset to execute TstExamp. Select the Hardware Entropy Generator test (Int 4 via A1CON340, pin 6 pulled to +5V).
        vi. Change the oscilloscope time scale to 10µs. Both long and short pulses shall be observed. The long shall be around 12µs, and the short around 3µs. Verify some variation in the regularity of the waveform.
        vii. Also use EntOut test application, which collects high speed sampling data of the HW Ent Gen. The data is output as a 2400, N, 8, 1 serial data stream of '0' and '1' characters from the Digital Output as TTL, using 20.48MHz /2 system clock.
14. Perform board acceptance test

15. Install bumper feet
(Reverse view – solder side)



16. Update build log on board's construction

Included Documentation Package:

The following documents are bound and included as a documentation package.

1. MB68k-100 User's Manual
2. Schematic
3. Layout
4. 68000 Motherboard BOM
5. MB68k-100 Assembly and Bench Check
6. MB68k-100 Motherboard Test Procedure
7. TemplateShell source code listing

Troubleshoot Testing:

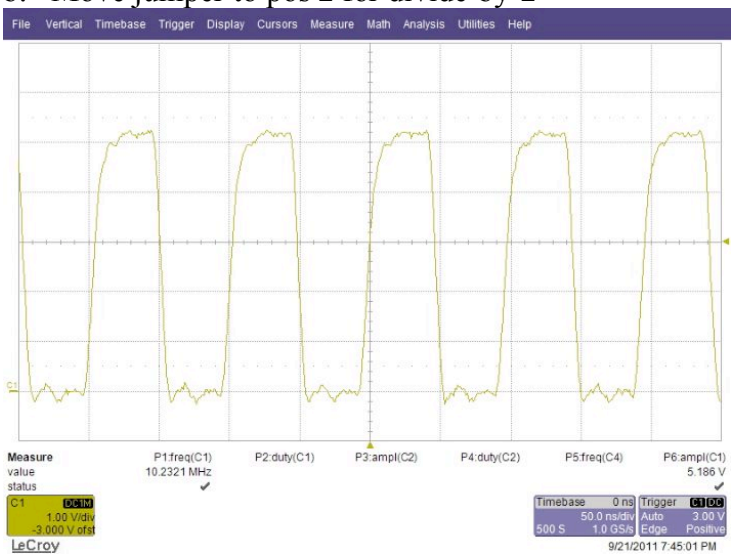
All soldered components are installed, but chips and jumpers are not for this testing.

1. Power
    a. With A1JP130 installed, verify the Power LED light is illuminated.
2. Discrete Voltage Supervisor
    a. Waveforms captured in ARCP_*.jpg
3. Discrete Clock
    a. Measure clock output at A1JP112 – pos 3, XCLK_RAW

4. Clock Symmetry Enforcer
    a. Install A1JP110, pos 2
    b. Install IC110, IC111

5. Clock Frequency Divider
    a. Install A1JP111, pos 3 for divide-by-4

b. Move jumper to pos 2 for divide-by-2



c. Switch A1JP112 to pos 4 for Sym Discrete Clock

6. Discrete Voltage Supervisor
    i. Install A1JP140, 141, IC506
    ii. Observe Reset and Halt lights on power up
    iii. Verify Reset and Halt lights on pressing reset button
    iv. Transition thresholds
        1. Transition with voltage falling: 4.914V
        2. Transition back up: 4.917V
    v. ~20mA @ 5V
7. Microprocessor
    a. Installed jumpers on Pintercept and 68000
    b. Connect /AS, pin 6, to /DTACK, pin 10
    c. Move A1JP112 to pos 4 for Discrete Crystal Clock / 2
    d. Measure /AS on oscilloscope (but this relies on random execution)

8. Install
    a. Auto /DTACK Feedback
        i. A1JP250 install positions 1 and 8 for /CS0 and /CS7
    b. Block Address Decoder
    c. Peripheral Address Decoder
    d. Pull SVS_ADDR low by IC182.7 to IC182.13
    e. A1JP260 pos 1 for Auto /DTACK
9. Install
    a. SVS
    b. Wait State Generator
    c. Data Strobed Flow Control
    d. On-Board Address Decode Logic
        i. A1JP280 pos 1 for /CS0
        ii. IC280, 281, 282, 283
    e. On-Board Program EPROM
        i. IC360, 361
        ii. Install SIDwaves
        iii. Jumpers
            1. A1JP360, 1-2
            2. A1JP361, 2-3
            3. A1JP362, pos 3
            4. A1JP363, pos 3
10. Bus Error Timer
    a. IC330
    b. A1JP330 pos 1 for 32 clock cycles
    c. A1JP331
11. On-Board Output Latch
    a. IC290, 291; DZ290; A1JP290
    b. Observe SIDwaves counting
12. SRAM in Bank 0 (64kB)
    a. A1JP350, 1-2; A1JP351, 2-3; A1JP352, pos 2; A1JP353, pos 3
13. Clock Synchronization Register

a. IC310, 311
b. A1JP310, all 3

14. Interrupt Logic
    a. IC505, 340-345
    b. 340mA @ 5V and A1JP112 pos 4

Troubleshooting Tips:

1. Ensure 68000 chip is fully inserted into the socket
2. Inspect for weak solder joints or bridges
3. Verify all jumpers are installed, include jumpers required for specific applications (beyond defaults)
4. Verify input power quality

Document Revision History:

Revision	Date	Author	Change Description
A	2/12/12	GJK	Initial release