

Altair 8800b Turnkey, Foley Edition

This Foley edition of the Altair 8800b Turnkey computer is on loan to me from a vintage computing friend so that I could get it up and running again. The Foley edition is an Altair 8800b Turnkey computer modified to incorporate one or two of the Altair Mindisk drives into the main computer chassis. It was created as a product to sell through the Foley's department store chain. Following is a picture of the restored Foley computer running Altair Minidisk BASIC.



The Foley computer was announced in late 1977 and started shipping in mid 1978. Following is an article from the November 14, 1977 edition of "ComputerWorld" magazine:

HOUSTON – Foley's, a department store chain here, is taking credit for being the first mass merchandiser to stock computers since it now offers a \$4,995 Altair computer from Pertec Computer Corp. and a variety of software.

The Altair 8800b turnkey system with mini floppy disks will be sold for both business and home applications, according to Joseph Sternberg, Foley's divisional merchandise manager.

The applications programs that will be available from Foley's include a mailing list maintenance file, a small business check maintenance file, four games, a home check maintenance file and an auto log for car expenses.

A video demonstration of the Foley computer is available online at:
<https://www.youtube.com/watch?v=8awXRWHCd08>

Chassis Restoration

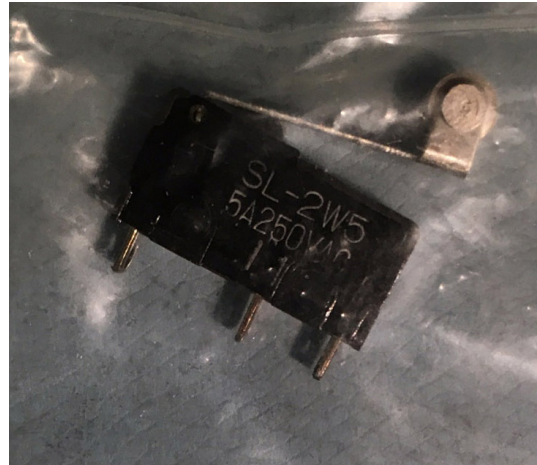
The computer was received completely disassembled. The motherboard, power supply board, turnkey switch, disk drives, disk power supply/buffer board, and the boards that plugged into the Altair bus were all removed from the computer chassis.

Power Supply

I first re-installed and tested the power supply board which provides +16 and -16 VDC. I then re-connected the large bridge rectifier attached to the rear panel of the computer and the 9500uf canister capacitor for the +8 VDC supply. All three supplies looked good driving a dummy load.

Turnkey Switch Assembly

Two switches are activated by the cam attached to the turnkey mechanism through a roller arm attached to each switch. Both switches were broken where the roller arm attaches to the switch. I replaced both switches and then completed re-assembly of the turnkey mechanism and cam. The roller arm must be bent up slightly just before the roller to ensure proper switch activation as the turnkey cam pushes against them. A picture of a replacement switch (still in plastic bag) is shown on the right. The roller arm has not been bent as required in this photo.



Front Panel Board

The front panel LEDs and switches are all present on a small PCB that mounts behind the front dress panel. Eight wires connect from this front panel board to a Molex connector on the Turnkey board. In this computer, an eight conductor ribbon cable was used for this connection, but the standard IDC connectors typically used with ribbon cables are not used on these boards. Instead, on the front panel PCB, the individual ribbon cable conductors are separated slightly and then soldered on 0.1" centers directly to the front panel board. At the Turnkey end of the cable, pins for a 0.156" Molex connector housing are crimped and soldered onto each conductor.

Because the 28 gauge wire is so thin, several conductors had broken at the front panel solder connections and a couple more were broken at the Molex connector. I cut the ribbon cable at the front panel end and re-stripped and re-soldered all eight connections. I then repaired the two broken connections at the Molex end of the cable. I taped the ribbon cable to the front panel to act as a strain relief to reduce cable movement at the solder connections to the front panel PCB. Even with these repairs, some front panel connections are still intermittent as the cable is moved. This entire cable assembly should be rebuilt from scratch.

Motherboard

I installed the motherboard with card guides and connected wiring from the motherboard to the power supply terminal block. The motherboard is a 10 slot board instead of the 18 slot board typically used in the 8800b computer. This shorter motherboard makes room for the drives on the left side of the Foley version of the computer.

Disk Drive and Buffer Board

The Altair Mindisk Drive is normally an external drive with one drive per external cabinet. The buffer board is inside the external drive cabinet and provides power for the disk drive and also serves as an interface between the drive and the computer. In the Foley configuration, the buffer board is mounted inside the computer cabinet along with the disk drive. The disk drive used is a Shugart SA-400 single sided, single density drive with 35 tracks.

The chassis for the Foley computer has a solid bottom panel instead of an open bottom with crossbars as used in other Altair computers. The solid bottom is required to mount the buffer board(s), the drive(s), and to serve as a heat sink for the buffer boards.

Turnkey Board Repair

Before installing the board set, it was visually apparent the Turnkey board had some problems that had to be fixed:

- The 5 volt regulator was blown apart, so I replaced it. I also replaced both tantalum capacitors for the regulator.
- The previous owner had replaced the -9v zener/transistor regulator with a 7908 and two diodes in the ground reference to generate -9.4v. I left this modification in place.
- I pulled C1 for the 1489 receiver for speeds above 300 baud as specified in the Turnkey manual.
- IC-B (7430 octal NAND) had visible swelling and a crack above the die. Pin 6 was shorted to ground. After replacing IC-B, the signal driving pin 6 still did not swing to proper voltages, so I replaced IC-V, the 7404 that drove pin 6 on IC-B, but the problem remained. I determined that additional 7430's on board had also failed, IC-E and IC-K. The previous owner had already replaced the 7430 at IC-T in the past. After all 7430's were replaced, the Turnkey board worked properly.
- I configured the Turnkey board for a turnkey system (generate MWRITE, read on-board sense switches). This is a rev 0 board without the "Kludge" mod. The 1K RAM is set at F800-FC00. The Turnkey PROM must be the version with stack at FC00.
- I modified the serial cable that runs from the Turnkey board to the DB-25 on the rear of the computer to configure the port as DCE. The final configuration is as follows:

DB-25	Turnkey Board	Notes
Pin 2	Pin 4	Orange, RCV in to 6850
Pin 3	Pin 10	Red, XMT out from 6850
Pin 4	Pin 6	Yellow, CTS in to 6850
Pin 5	Pin 9	Green, RTS out from 6850
Pin 7	Pin 8	Black, signal ground
N/C	Pin 9	DCD in to 6850 tied high by jumper P3-K3 on Turnkey

Minidisk Controller and Buffer Board Repair

I had previously tested the buffer board for the minidisk with an Altair FDC+. In the minidisk cabinet, power to the buffer board comes from the 28 VAC center-tapped secondary of the transformer. When connected to the 36 VAC secondary of the 8800b transformer, the buffer board gets extremely hot due to the extra 8 volts dropped. So in the Foley configuration, the buffer board power is connected to the +8 VDC and +16 VDC outputs of the 8800b power supply. Refer to the document, "Buffer Board Power" for more information.

The minidisk controller is a two board set just like the controller for the Altair 8 inch drives. The two controllers are very similar with only a few changes to handle the timing differences between the two drives and the start/stop operation of the 5.25 drive motor. Upon first test, the minidisk controller appeared to work fine as Minidisk BASIC booted and ran. The "Minidisk Test" program ("MDT") on the BASIC disk ran to completion without error.

However, additional testing with CP/M and the PC2FLOP utility made it clear there were still some problems to work out. Certain disk activities consistently took several times longer than they should, yet other disk activities always ran as expected. While debugging board operation and referring to the schematic, it became clear that the artwork on controller board #2 did not match the schematic. Further, these layout errors could clearly cause the symptoms I was seeing.

Board #2 of the controller set I have is rev 0. I spoke with a friend who also has a rev 0 minidisk controller. His board #2 was received with some mods on it already whereas my board #2 had no mods. We compared notes and the list of corrections I came up with were equivalent to the mods present on his board #2. These mods are documented in the folder "Minidisk Controller Mods."

With the mods in place on board #2, the mindisk system works exactly as expected.

Final Board Set Installation

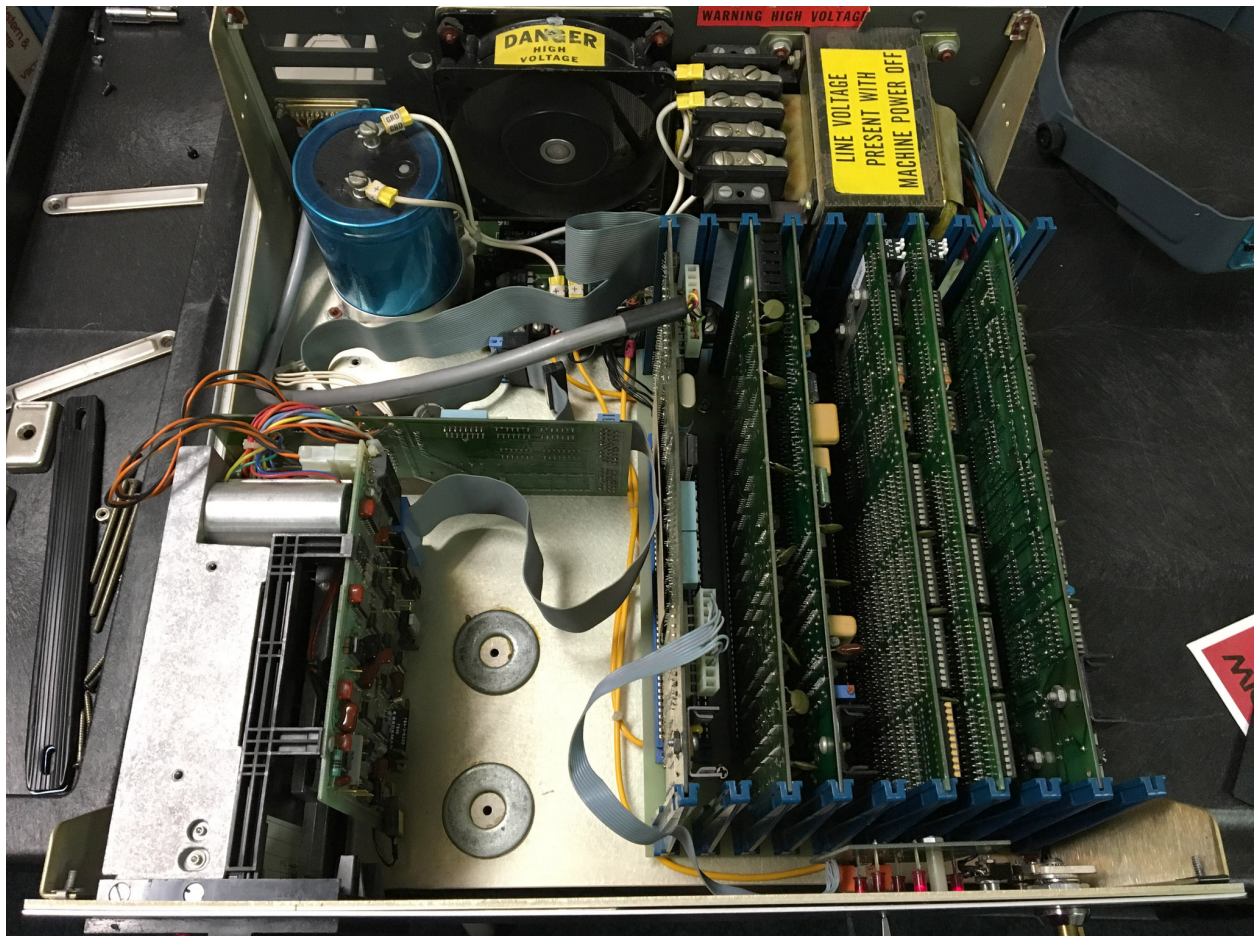
With all boards working, I installed the following board set in the Foley computer. This configuration is typical of what would have been in a Foley computer in 1978.

- MITS 8800B CPU Board, Rev 0
- MITS 16K Static RAM (two boards for 32K total)
- MITS Mindisk Controller (two board set)
- MITS Turnkey Module (Rev 0, no "Kludge" mod)

Operational Foley Turnkey Chassis.



Internal view. Chassis is configured to accept two drives and two buffer boards.



Internal rear view showing the buffer board.

