

Mostek AID-80F Computer

I obtained this computer from a friend that worked at Mostek in the early 1980's. The computers were sold/given to some employees after the computer was discontinued. I received the computer with working, bootable disks, but no documentation.

I have found very little information about this computer on the internet, so progress with this computer has been slow. But after three years – with three bursts of work during those three years – I've been able to learn, document, and support a great deal about this computer.

Hardware

The computer was sold by Mostek in the late 1970's as a Z80 development system, or as an OEM computer for custom applications. The computer runs a Z80 CPU at 2.458mhz along with 64K of RAM and 4K of PROM (four 2708's overlaying RAM at E000-EFFF). Two 8 inch, SSSD Shugart 800 drives are connected to a floppy controller based on the WD1771 controller chip. Five DB-25 connectors on the rear of the computer provide connection for multiple parallel ports and a single serial port. The card-cage uses 50 position (100 contacts) sockets as used with the S-100 bus, but based on the size of the boards and the power and ground connections, the boards are clearly not S-100 compatible.

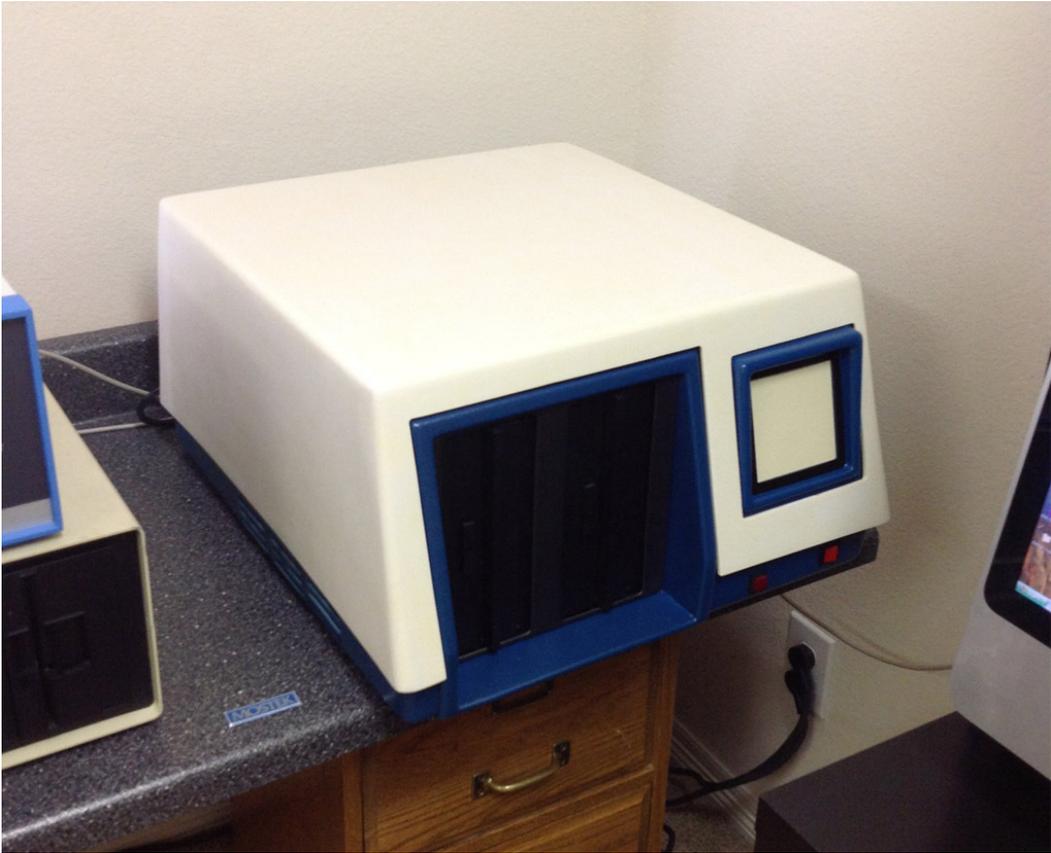
The removable cover is hinged in the back and raises in the front to allow access to the card cage, the drives, and the power supply. The cover appears to be very yellowed. After finding an ad for the computer from an old magazine, I realized how yellowed it is. I sanded the cover to restore the original color, however, the plan to restore a plastic-like sheen failed.



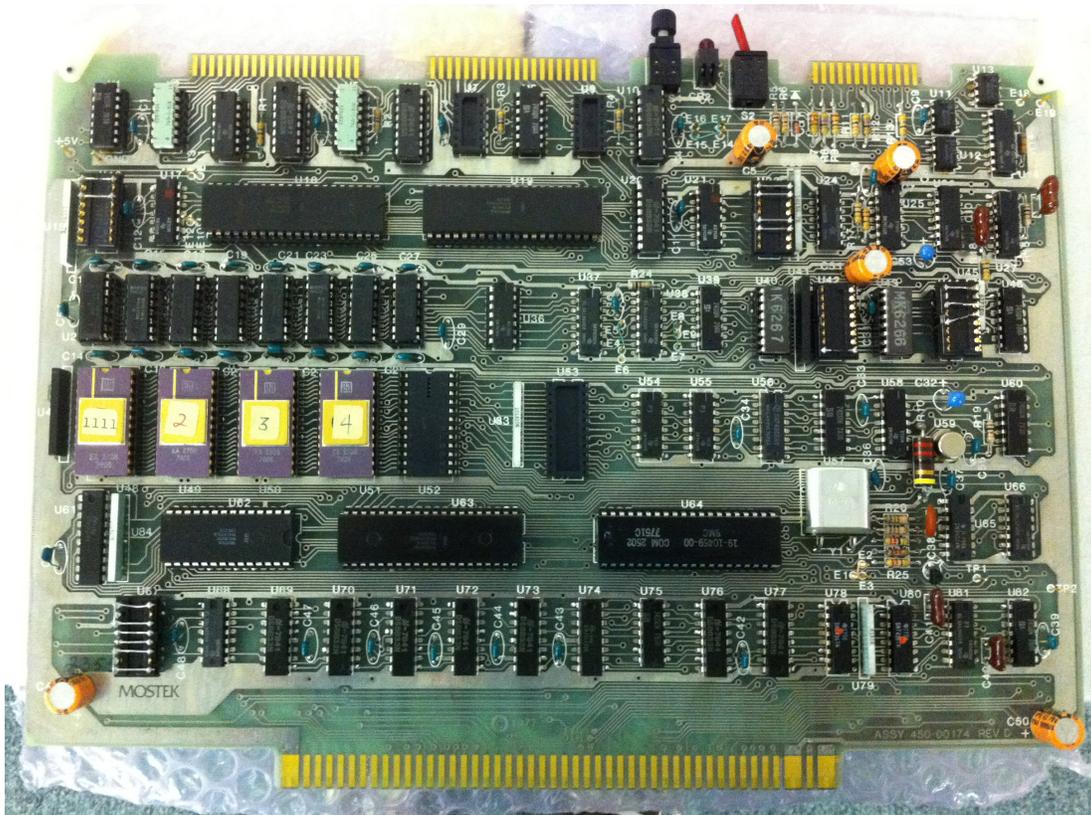
Front View



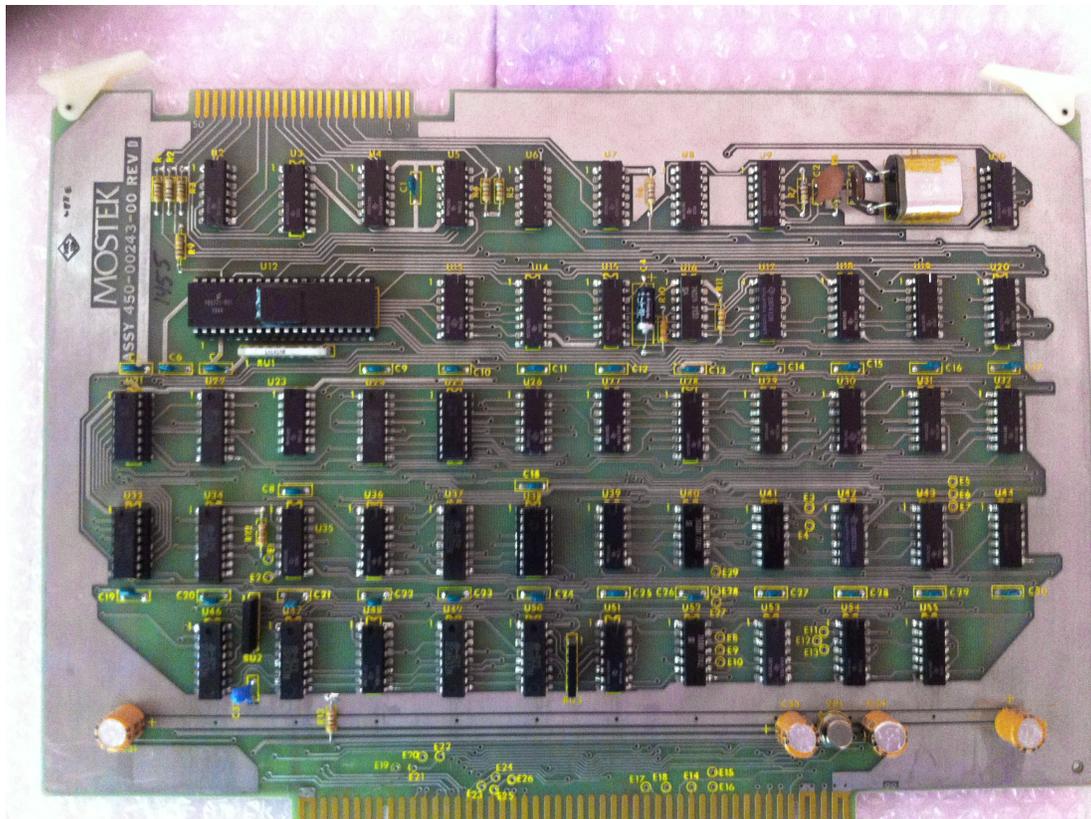
Rear View



Front View after Sanding



Z80 CPU Board



Floppy Controller

Mostek's AID-80F™ Industry's first Z80 and 3870 development system.

Mostek's AID-80F is the first software development/debug system that supports the industry's two leading micro-computer families: Mostek's Z80 and 3870. This means savings in hardware investment and engineering time whether designing 3870 single-chip or Z80 multi-chip systems.

The AID-80F uses Mostek's optional Application Interface Modules (AIM™-80 and AIM™-72) for real-time, in-circuit emulation of Z80s and 3870s. Other hardware features include up to 64K bytes of on-board RAM and floppy-disk storage up to two megabytes.

Application Interface Modules	AIM-80 (Z80)	AIM-72 (3870)
Features		
RAM-based emulation	✓	✓
Real-time execution	✓	✓
Breakpoint	✓	✓
Single-step	✓	✓
Disassembly format	✓	✓

Several unique software features give further flexibility. Simple commands and comprehensive error messages save valuable time. Changes can be made easily and programs re-assembled in minutes. Plus listings can be stored on the disk for

later printout if desired.

Mostek's AID-80F is available now for only \$5995. For a demonstration, call your nearest Mostek sales office. Or call or write Mostek, 1215 West Crosby Road, Carrollton, Texas 75006. Telephone 214/242-0444. In Europe, contact Mostek Brussels, telephone (49) (0711) 701045.

MOSTEK.



Software

The disks that came with the computer boot the computer into a CP/M like operating system called M/OS-80. The O/S is booted by pressing the reset button on the front panel, then pressing RETURN on a console terminal connected to the computer's serial port. The monitor PROMs auto-baud the console serial port based on the RETURN character and then boot the disk.

My friend used the computer for word processing and for playing games. Not surprisingly, WordStar was found on the disks along with MBASIC and an entire disk of typical BASIC games. As these programs are designed to run under CP/M, it is clear that M/OS-80 provides some level of upward compatibility from CP/M.

Despite the similarity with CP/M, many of the intrinsic commands and common utilities are not the same as CP/M. After a bit of digging, I discovered the commands and utilities provide by M/OS-80 are virtually identical to CDOS from Cromemco. I was able to proceed further by using CDOS documentation. I later learned the connection between M/OS-80 and CDOS, see the "M/OS-80 History" section to learn more.

The PROM monitor can be entered by following the boot steps above, but with no disk inserted. The monitor displays "DSK ERR" due to the failed boot, and then displays a dot as its command prompt. By trial and error, I found a few monitor commands to display memory content, fill memory, etc., but I knew there had to be more to this PROM than these simple functions since the monitor occupies 4K of PROM space.

After finally finding some documentation about the system (see "Documentation," below), I learned the 4K monitor is a debug monitor called DDT-80 (not to be confused with DDT in CP/M). The monitor provides typical memory modify, examine, fill, and compare functions, but also adds the ability to set breakpoints, examine and modify register states, and single step a program. The monitor also allows saving and loading files to/from disk. The disk layout and directory format used by DDT-80 is the same as Mostek's FLP-80DOS disk operating system. FLP-80DOS was the original O/S used on these computers until it was abandoned for the more powerful, and CP/M compatible, M/OS-80.

Documentation

About two years after getting the computer, I was able to purchase a collection of about 100 Mostek computer manuals via eBay. Most of these manuals were for Mostek's MDX hardware (STD bus), but some were for the Mostek development systems, boards, and software, including the AID-80F computer. The following manuals in the collection document the AID-80F computer and its components:

- AID-80F V2.0 Microcomputer Development System (computer system overview)
- M/OS-80 Flexible Disk Operating System (operating system manual)
- DDT-80V1.3 and ASMB-80V1.0 (DDT-80 portion documents the PROM monitor)
- SDB-80 Software Development Board (main CPU board)
- FLP-80E Flexible Disk Drive Controller Board (floppy disk controller)
- RAM-80BE Memory Expansion Board (RAM board)

The floppy and RAM board manuals end with “E” on the part number. These are not the exact same boards as present in the AID-80F computer (the equivalent board used in the AID-80F does not have the E suffix). However, even though the “E” suffix boards have a different form factor and bus connector, the remainder of the schematic – including jumper configuration, theory of operation, etc. – appears to be identical to the board version used in the AID-80F.

The M/OS-80 manual has been scanned and is on the DeRamp.com website. This manual includes information about DDT-80. The other manuals have not yet been scanned.

M/OS-80 History

While doing internet searches in an attempt to find something about M/OS-80, I ran across the resume of Rich Roth. Rich worked on the development of CDOS at Cromemco and then later on the development of M/OS-80 for Mostek. This explains the similarity between CDOS and M/OS-80.

After about a year of exchanging emails, Rich forwarded me a large collection of floppy disks containing M/OS-80 source code, utility source code, manuals, etc. Unfortunately, after being stored in a garage in Massachusetts for 35+ years, most of the disks generated read errors and quickly coated the drive heads with oxide. I have, however, archived some of the M/OS-80 source code.

Initial Restoration Efforts

My first priority was to archive the disks that came with the computer to a PC. I wrote a disk to PC archive utility and a PC to floppy restore utility (FLOP2PC and PC2FLOP) which transfer disk images to/from a PC over a serial port using the XMODEM protocol. Unfortunately, since I had no information about the disk controller at this time, I had to rely on M/OS-80 for disk I/O for these programs. This meant at least one bootable M/OS-80 disk had to be available in order to create other disks from archive images.

The disk image transfer programs require direct access to the serial port hardware to implement file transfer. Since M/OS-80 seemed to be somewhat CP/M compatible, I followed the warm boot vector from page zero and it pointed to a BIOS jump table as used in CP/M. I was able to follow the console I/O vectors and find the I/O address of the serial port and the bits used to test for receive data and transmit ready status.

The BIOS jump table also had the CP/M specified entries for low-level disk I/O so I was able to use these entry points for doing disk I/O for the file transfer utilities.

After transferring disk images of all floppy disks to a PC, I was able to mount the disks and view their content using the SIMH (AltairZ80) emulator. The disk image was readable under CP/M when mounted as an IBM standard SSSD 8 inch disk. This means M/OS-80 was not only somewhat CP/M compatible, but also used the same disk layout as CP/M for 8 inch SSSD disks.

Having the serial port hardware information also allowed writing file transfer utilities PCGET and PCPUT to transfer individual files between M/OS-80 and a PC.

Second Stage of Restoration

Software

In order to allow restoration of a “cold” computer with no bootable media, the disk image restore utility (PC2FLOP) must be able to write a disk without requiring an operating system. I also wanted to write a CP/M 2.2 BIOS for the computer so it could run CP/M as well as M/OS-80. With the additional information provided in the documentation I found on eBay, and from the M/OS-80 source code I was able to retrieve from some of Rich Roth’s disks, these goals were now much more realistic.

Looking at the M/OS-80 source code, I determined that M/OS-80 called disk I/O routines in the PROM on the CPU board to do its physical disk I/O, though that interface mechanism was not clear at all from the M/OS-80 code. Knowing that a WD1771 disk controller is used on the floppy controller board, and now knowing the port addresses and theory of operation of the floppy controller board from the FLP-80E manual, I was able to disassemble enough of the 4K monitor PROM to document the disk driver functions provided by the PROMs. I was also able to determine the boot track layout expected by the boot function of the PROMs. Refer to the disassembled monitor PROM .asm file for detailed information.

Using calls into the PROM disk driver, I created versions of PC2FLOP and FLOP2PC that run without requiring an operating system. I also created a CP/M 2.2 BIOS that also utilizes the PROM disk driver to port CP/M 2.2 to the AID-80F. Finally, I wrote a version of COPY.COM that provides disk copy, verify, and format functions.

Hardware Restoration

I removed the Shugart 800 drives from the computer in order to refurbish the drives. This included cleaning, minor lubrication, new head load pads, head cleaning, radial alignment, and index alignment. Alignment was done using an Altair 8800 computer, an Altair FDC+ disk controller, and the Altair-based disk exerciser/alignment utility, AFEXER.COM. See the Altair section of the Downloads directory at DeRamp.com.

Jumpers on the Shugart drives for the Mostek computer are configured such that:

- 1) Drive Select enables stepper power but does not load head
- 2) Head Load is separate signal on pin 18
- 3) The front panel LED on drive comes on with head load
- 4) -5v input supply selected (bypasses negative regulator)

Installed Jumpers: DS, A, B, C, Y, T2, T1*, T3-T6*, 800, L (*last drive only)

On a side note, the jumper settings above are exactly as needed for operation as an Altair drive when using the Altair FDC+.