

## Altair FDC+ Firmware Version 1.3

This firmware update adds a new drive type to the FDC+ that supports a 1.5Mb floppy drive under CP/M using high density 5.25" floppy drives like the Teac 55-GFR or 8" DSDD drives.

Additional updates in version 1.3:

- For drive type 4 (5.25" HD floppy as 8" Altair), the motor shut-off delay has been increased from one second to five seconds to be more consistent with the typical shut-off delay used with 5.25" drives.
- For drive type 4 (5.25" HD floppy as 8" Altair), the default stepping rate has been decreased from 10.5ms (Altair drive rate) to 3ms (native rate of 5.25" HD floppy drives). This is quieter and better for the drive. The stepping rate can still be changed using the FDC+ on-board monitor.
- Previously, drive type 4 (5.25" HD floppy as 8" Altair), did not implement the trim erase timing of the Altair drive since 5.25" drives do not have an external trim erase input. However, to be more consistent with the Altair drive which inhibits the "ok to move head" status during the trim erase period, this same behavior has been incorporated for drive type 4.
- Previously, drive type 1 (Shugart as Altair 8") did not implement the trim erase timing of the Altair drive since the Shugart drives do not have an external trim erase input and a tunnel erase delay is not required since the Shugart drives use a straddle erase head. However, to work better with non-Shugart drives for the drive type 1 selection, trim erase timing and suppression of the "ok to move head" status during trim erase has been incorporated.

### 1.5Mb Floppy Drive Option

Many FDC+ owners use high density 5.25" floppy drives with the drive type 4 selection on the FDC+ (5.25" HD floppy as 8" Altair). This duplicates operation of the Altair 8" drive as far as all Altair software can tell and provides the same 308K of formatted storage as the original Altair 8" drive. However, since a number of FDC+ owners use their Altair computer and floppy drives for CP/M more than they use it for Altair BASIC or Altair DOS, I figured it might be useful to get more capacity out of the HD floppy drives than the Altair drive provides. With the new drive type selection, each disk provides about five times the capacity of the Altair drive with a total of 1,525,760 bytes of formatted space. Because the drive and controller appear different to software than the original 8" Altair drive, original Altair software will not work with the new drive, however, I have created a version of CP/M that supports the new drive type. See the "CP/M for the 1.5Mb Floppy Drive" section below.

The 1.5Mb capacity was achieved by:

- 1) Using 8" double-density transfer rates with MFM encoding and write pre-compensation instead of single density FM.
- 2) Creating a firmware based MFM data decoder to duplicate the hardware PLO and data separator typically required to decode MFM data streams.
- 3) Using both sides of the disk.

- 4) Using one sector per track to eliminate wasted gap space.

The Altair computer has a hard time keeping up with even the original single density transfer rate, so changes had to be made in the way data is exchanged between the FDC+ and the CPU so that the Altair can keep up at twice that speed for the double density data rate.

Because the disk layout and interchange of data between the CPU and the FDC+ are different for the 1.5Mb drive than for a normal Altair drive, the standard disk boot loader PROM cannot read the boot loader from track 0 of the 1.5Mb disk. To avoid having to install an additional boot loader PROM for the 1.5Mb drives, the FDC+ looks for Altair-style access from the CPU, and if detected, returns a standard Altair sector from FDC+ memory that contains the code required to boot the 1.5Mb drive. The Altair boot PROM thinks it just loaded sector zero, track zero from an Altair disk, so the PROM jumps to the code it just “read from disk” and the boot process continues.

When using a 5.25” HD floppy drive, the jumper settings for 1.5Mb operation are the same as used for drive type 4 (5.25” HD floppy as 8” Altair). Note that it is important to use “High Density” diskettes intended for use with HD floppy drives. These diskettes have different magnetic characteristics than single and double-density diskettes. For 8” DSDD drives, the drive jumper settings are similar to that for drive type 1 (Shugart 8” as Altair). Double sided media must be used since the index hole is in a different location for double-sided disks than for single-sided disks.

## **CP/M for the 1.5Mb Floppy Drive**

I created a CP/M 2.2 BIOS to support the new 1.5Mb floppy drive. Disk images and utilities for creating and archiving disks are available at [https://deramp.com/downloads/altair/software/1.5mb\\_floppy/](https://deramp.com/downloads/altair/software/1.5mb_floppy/). Use the PC2FLOP utility found in the “Disk Image Transfer” folder to write a bootable 1.5Mb disk. If you have the option for a 19,200 or 38,400 baud port (e.g., the 2SIO modified for 19,200 baud or the 2SIOJP set for 38,400 baud), that will reduce transfer time of the disk image significantly. Do not select a rate faster than 38,400 baud.

The disk image is sized for a system with at least 48K of RAM. MOVCPM is present on the disk to resize CP/M for more RAM as needed. The COPY.COM utility allows you to duplicate the disk. COPY also provides disk verify and format options, but formatting is not required if you use COPY to duplicate a disk. The PCGET and PCPUT utilities on the disk can be used to exchange files between the disk and a PC. The FLOP2PC utility on the disk can be used to save a complete disk image to a PC for backup.