Add 3.5" Drives To The H/Z-90

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With the advent of the Zenith Z-181 and MS-DOS 3.2, the 3.5" disk drive becomes a potentially important peripheral. It offers potentially tremendous advantages to other Heath MS-DOS users, as well. These including: high density (720k bytes), low media profile, relatively safe transportation of software (hard, shuttered case), and a relatively low drive cost.

Shouldn't these advantages be available to all Heath users? Certainly. Consider the Z80-based H/Z-90 microcomputer. (The same procedure should work for an H-8 with an H8-37 controller.) I have two H-90s that have been nursed along from H-19 terminals to H-88s (tape drive) to H-89s (hard-sectored disk), and ultimately to H-90s using soft-sectored disks. With the latest versions of CP/M-80 and HDOS, these computers run 5.25", 80-track drives (96-tpi). The initial Tandon drives (TM100-4 and TM101-4) were tremendously expensive; About $400 a piece. The half-height TEAC FD55F goes for about $150 today.

3.5" Drives

A number of mail-order houses sell the Toshiba ND352 3.5" floppy drive with a 5.25" mounting kit for less than $150 (plus shipping and handling). I'll include the names of two companies of which I'm aware. However, there should be a number more by the time you read this: prices should drop with the competition.
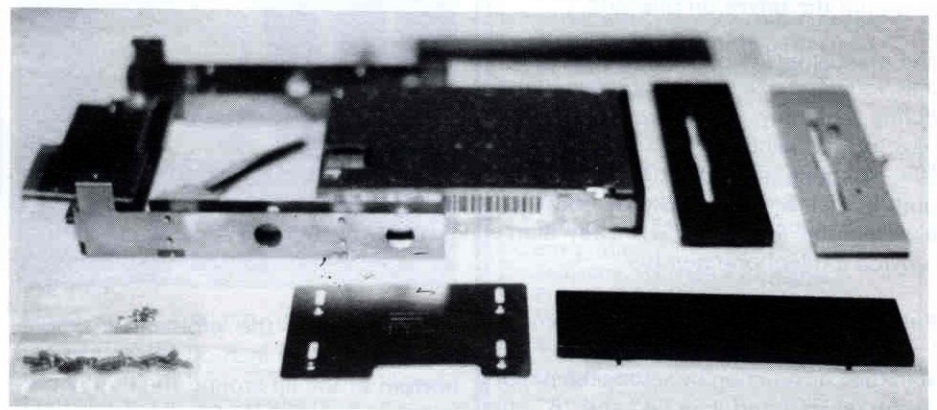
I purchased two kits and they arrived a little over a week later from the opposite coast via UPS Air. Each drive and kit is packed in separate boxes. I was impressed by the quality of the drives and mounting kits. (The drives are model FDD 4202, which I have been told may already be obsolete.) I was disappointed that there were no technical specifications en-closed, but I assume from the measurements taken later that there is some savings in power over the larger drives.

You should only need three tools to assemble the kits. These consist of a small phillips head screw driver (all screws are phillips head), a pair of tweezers (essential for changing jumper plugs and holding screws), and a knife or scissors to cut the thick plastic pages holding the parts. You may also need an additional screw driver to remove any existing drives.

The 3.5" drive sits eventually in a sturdy

metal bracket, so that it takes on the size and mounting hole positions of a half-height 5.25" drive. There is a PC card in the back of the bracket that mates to the data plug on the drive. The fingers on the other end of the card accept the standard 34-pin edge connector. A power cable adapter is also included. (The 3.5" drives have much smaller connectors.)

There is one jumper on the PC board that must be shifted to one position: "A", if you are mounting the drive in a new style AT and shifted to the other; "B", for the old style AT, PC or XT. The only other jumpeer to set is the drive selection plug in the drive. Here tweezers are essential. The access hole is too small for fingers.

In addition to the standard plastic 3.5" drive front plate (easily removable), the kit contains 5.25" face plates for both the regular PC (black) and AT (grey) type drives. In addition, you get a blank, snap in, half-height panel if your system previously used full-size drives. The blank panel will only fit a relatively narrow rim enclosure and will not fit the drive cutout in either the H/Z-90 computer or H/Z-77 disk drive case.

Other goodies included AT plastic side rails, one side mount plate with assorted screws and washers, and a 12-page manual. Ordering two kits gets you two side plates, which allow you to mount two drives together (one on top of the other), if necessary. These were important since by first mounting the drives together, you can use the existing holes in the H/Z-77 to mount the drives on one side.

The manual has two faults. First, it never tells you what size or type of screw to use during assembly. Secondly, on the last page of the manual, it tells you if all else fails, call their "Disk Drive Technical Support in Irvine, CA, weekdays between 9:00 am and 5:00 pm PST." They didn't provide a telephone number.

Putting It Together

Start the construction by setting the jumpers for drives 1 and 2, or "A" and "B" under CP/M-80. (HDOS should work, as well.) Next, attach the correct face plate, in this case, the black 5.25" one. After connecting the drive to the board in the bracket, it is necessary to firmly mount the drive by attaching four 3/16th inch long, 5-48 thread screws through the metal kit frame to the drive. (I'm guessing at the thread size; it is metric and somewhere

between a four and a six with more threads per inch than a 4-40.) There is a separate bag of six screws all of this same size. Use four of these. If you hold the screws with the tweezers, this should be a relatively easy task, otherwise, it's impossible. Next, be certain that two screws holding the PC board to the frame are tight.

The last hardware step in the two kit assembly process is to connect the side mount plates. Again, there are plenty of screws from which to select. Use the two smaller thread 5/16-inch long flat head screws included with each plate. (These and all the other screws used have the same metric thread previously mentioned.) The manual also contains a two page description on the software configuration required for PC/MS-DOS 3.2.

The next step was to connect the drives to an H/Z-90. My configuration has an internal single-sided, 48 tpi drive which is configured as "C". The H/Z-77 has two Tandon 96 tpi drives as "A" and "B". I removed "B" and hooked up one of the 3.5" drives in its place. (They both fit in one side/half of the case.) Note that because of the side mounting plates, that are now vertical, the drives will not fit through the plastic front cutout.
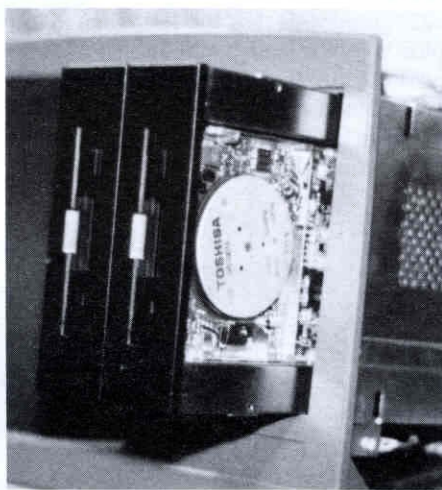
The solution to this problem is simple. File 1/16th of an inch off of the top and bottom of the lip around the floppy disk cutout on the H/Z-90. Mounting the drives in the H/Z-77 drive case is easily remedied without any case modifications by sliding the drives in from the rear.

At this point, I ran into my only problem with the hardware supplied. My mounting requirements called for four pan head, metric screws and flat washers, two sets for mounting the top of the drive package

and two for the bottom. There were only three screws. (There was an extra flat head of the size used for mounting the plates. Fortunately, each pair of AT plastic side rails came packaged with four screws, which attached to the same holes, and there were plenty to spare.

Next, connect the internal power and data cables to the 3.5" drive designated "B". Neither of the small drives has a removable resistor pack, so removing a pack is not a requirement. (The larger "A" drive was on the end of the data line and kept its resistor pack.)

The next step is to turn on the disk drive power supply and computer. BOOT the Z-90 from drive "A" under CP/M-80. Since both "A" and "B" were configured for 6msec track-to-track, 96 tpi drives, no installation of the high density disks were necessary. However, for anyone not already using high density drives, this is the first step. Call CONFIGFUR and say no to the standard configuration. Select "B" to change the drive specifications and save the changes in memory and on disk.

I next converted all my frequently used program disks over to the 3.5" format by first "FORMAT"ing my smaller disks. My directory command showed each to possess the same formatted, but empty 624k byte capacity that my 96 tpi, 5.25" disks have. You can get the full transfer of files by using DUP. Prices are dropping for 3.5" floppies, and if you shop around you should be able to pick up some quality brand names at bargain prices. The lowest price I've found is slightly under a dollar a piece for double-sided floppies.

The next step is to turn the system "Off" and do away with the 5.25", 96 tpi disk drives. In my case, I left initially "C" as the internal drive (a single-sided, 48 tpi, 5.25" drive) and mounted the 3.5" drives externally. This means that "C" is still compatible with the Heath soft-sectored standard for easy transfer of software from original master disks, as well as to and from friends' machines.

Mounting Internally

At this point, the system is operational. However, I believe that a number of H/Z-90 users would prefer to use the 3.5" drives internally, and the prospect of doing it intrigued me. Assuming the H/Z-90 case drive opening has been enlarged, mount the drives. Use the same screws used to mount the drives in the case that the H/Z-77 case requires.

When using the H-88-9 metal case don't use the flat metal washers supplied with the drives. Do use the original black plastic washers to isolate the drives from the case. The screws are not long enough to fit through both and attach to the drives.

The other steps are explained below. They include adding a Y power cable extension, adding another 34-pin data connector to the data cable, and "possibly" reversing the cables to P3 and P4 on the Z-89-37 soft-sector controller board.
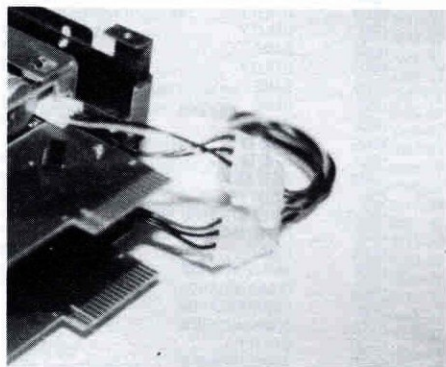
The first step is relatively easy. Your local Heath/Zenith Computers & Electronics Center should have a power supply Y adapter (Part No. MG-6083). I bought one for about $8.00. If they aren't available, check some of the electronic hardware magazines. The price may be cheaper, but the delivery is slower.

The second part you'll need is a 34-pin data edge connector. These are also fairly common. I had one left over from another project, which I attached to the data cable about 2-1/2 inches from the present drive connector.

To do the assembly, I put the connector on a work bench. Place the cable on the connector. Check the connector position carefully to see that pin numbers, key and orientation agree with the other drive edge connector. Next, put on the retaining clip as far as possible by hand. Check the position of the connector to the cable again. Put a flat plate (metal or wood) on top of the clip, and holding it in place, strike the plate with a hammer several times until the clip clicks into place to secure the connector to the cable. The sources for this connector are the same as for the Y power connector.

For the last step, there are two ways of designating "A" and "B" as the internal drives. One way calls for the reversal of the data cables on the soft-sector controller end. The internal drives must be connected to P4 "not P3". Be certain that jumper J6 is made and not J4, J5 or J7. The alternative method calls for leaving the internal drives on P3, but J4 "and J5" must be jumpered and "not J6 or J7". This is the route I took. (You'll need another .1 inch spaced jumper. Buy extras, they're easy to lose.)

The purpose for the switch in cables and/or jumpers is the logic controlling the flow of data "from" the drives. All signals to the drives are brought out to both connectors. However, data from the drives, the WRPT, INDEX, TRK0 and RDATA lines are not. They are fed into a quad tri-state multiplexer, a 74LS257. Which set of inputs are read from P3 or P4 is a function of the positioning of the jumper(s).

No Noise

At this point, you're ready to go. I checked my system for noise generation prior to making the conversion. (Do this by operating radios and televisions near the H/Z-90 before the disk conversion.) I couldn't detect any noticeable differences from the interference previously experienced when there was a 48 tpi drive in the high density H-88-9 enclosure.

Finally, eliminating noise is important because the system must meet FCC specs. The original H-89 upgrade (and disk-based computer) was not designed for high density disk drives. Thus, came the H-88-9 upgrade kit. However, when I tried the same test using the original H/Z-88 to H/Z-89 disk mounting case, the noise results were about the same. (Also, there did not appear to be any failure in computer operation.) If you get noise check your grounding.

Toshiba 3.5-inch drive suppliers:

Jade Computer Products
4901 W. Rosecrans Avenue
Box 5046
Hawthorne, CA 90250-5046
(800) 421-5500   (Continental U.S. and Hawaii)
(800) 262-1710   (Inside California)
(213) 973-7077   (In Los Angeles)

JDR Microdevices
110 Knowles Drive
Los Gatos, CA 95030
(800) 538-5000

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