

Adding An Internal Dual Disk Drive To The H-89 Series!

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Recently, I added a couple of internal Mitsubishi 4851 double-sided, double-density 48 TPI drives to my Z-90 computer. They are terrific! My Z-90 now uses the same type of drive and disks that the Z-100 and Z-100 PC computers use. This gives me: (a) very reliable 640 K internal disk space, and (b) use of the most common and inexpensive blank disks around. I can buy a box of 10 soft-sectored double-sided disks at my local Heath/Zenith Computers for about \$15. Compare that to the \$40 list price for a box of the single-sided hard-sectored my old faithful H-89A uses. (Lindley Systems sells both hard-sectored and soft-sectored disks at \$15 for ten. I've used them for several months now without any problem.) I think you'll want to consider these factors, plus a few others, if the idea of dual internal drives appeals to you.

There are several sources for internal dual disk drive setups. Prices for most (if not all) of them have dropped dramatically since the concept was first introduced. In some cases, the price reduction has approached 50 percent! I bought mine from PAYLOAD for about \$275. The kit included drives, mounting screws, second cable connector, "Y" power connector, and of course, instructions. I didn't get the shielded mounting case because I didn't need it. With mounting shield the PAYLOAD package costs \$312. Another vendor, QUIKDATA, sells the same drives in their setup package for about \$308. No mounting shield is included at this price. QUIKDATA includes a preconfigured data cable whereas PAYLOAD gives you the components to alter your current cable. H & H COMPUTER ENTERPRISES offers their DSM series of internal dual drive setups for \$340 (\$355 for hard sector). According to their literature, they include everything needed to install the drives.

Which vendor to buy from is an important consideration. The increased prices usually provide you with an easier setup. My setup, using the Mitsubishi drives (a very reliable, proven design)

was purchased at a rock bottom price. Installation was simple enough, but the instructions assumed a great deal of expertise. As Murphey would have it, I made almost every installation error possible, plus invented some new ones. The one error that I didn't make, was one I thought I did. I spent considerable time trying to correct something that wasn't wrong. Luckily, Charles Porter at PAYLOAD was very helpful. He sent me, at his expense, a new part, to help find my trouble. He researched Heath/Zenith manuals on a Saturday to verify the Z-89-37 jumper connections. Charles was, of course, unaware that I planned to write this article.

Table 1
My Z-89-37 Jumper Configuration

J1	170
J2	170
J3	1
J4	No Jumper
J5	No Jumper
J6	Jumper on
J7	No Jumper

Henry Fale at QUIKDATA has also helped me on other non-related problems, even though he didn't know me from Adam. For me, this kind of personal help is very important. I'll gladly pay more to get it. Another vendor consideration is: "Which brand drive do you want to install?". Both PAYLOAD and QUIKDATA sell the Mitsubishi drives. H & H doesn't list who makes their

drives. They've been shipping their drives since January 1983. According to their brochure, they've shipped well over 1,000 setups, with only one returned. Heath and Zenith seem to be using Shugart drives in the Z-100's. My local Heath/Zenith Computers and Electronics sells the Mitsubishi for add-on drives.

Now that you've decided on the vendor and brand drive you want, what else do you need to consider? Tracks Per Inch (TPI). Life is not simple. Almost every vendor offers their dual drive setups in both 48 TPI and 96 TPI versions. Both H-DOS 2.0 (with either HOS-5-UP or the HUG Soft-Sector Support Package) and Soft-Sector Heath/Zenith CP/M 2.2.04 will support dual-sided 48 and 96 TPI operation. If you have a Hard-Sector controller, then you can still get double-sided use out of the new drives. HUG's Hard-Sector Support Package for H-DOS has a double-sided SY: driver. Check your manual to see if your CP/M BIOS will support double-sided, hard-sectored drives.

Livingston Logic Labs' BIOS-80 V5 will support hard-sectored, double-sided 48 and 96 TPI drives. BIOS-80 is available from QUIKDATA for about \$40. QUIKDATA also sells a similar driver for H-DOS. H & H sells their setup with hard-sectored software for an additional \$15. The second operating system modification is \$25. Charles Porter, proprietor of PAYLOAD COMPUTER SERVICES, told me that a special shielded case for 96 TPI drives was necessary, while most 48 TPI drives could be mounted inside the '89 using the existing case. Most people with the dual drives, and those who repair the drives, recommend 48 TPI. If you use the existing case, you'll have to drill a couple of mounting holes, if you want to securely mount both drives. On my Z-90, I attached one drive using the existing mounting holes. I just slid in the other drive. It sits there nicely. If I get around to it, I'll remove the case, drill the holes, and mount the second drive.

As I see it, the advantages of going with either 48 or 96 TPI are:

48 TPI: Less expensive disks, more reliable operation (less loss of data), "compatibility" (many vendors can't supply software in 96 TPI format), less maintenance to keep the drives working, cheapest installation.

96 TPI: Lowest cost per byte of information, most online storage, fastest drives, able to use some large programs that require more disk space than available on 48 TPI drives.

Now that we've discussed some of the benefits of dual internal drives, let me tell you how I installed (and should have) mine. My Z-90 was equipped just as it came from the factory. It had the soft-sectored controller board (Z-89-37), no hard-sectored card, and one Siemens single-sided "Barn Door" drive. The package from PAYLOAD contained instructions, two drives, a "Y" connector, eight mounting screws, and a non-conductive brace plate. One of the drive's doors would not close. A burr was holding one of the sensor bars down. I fixed it by gently pulling up on the bar and rubbing the burr off with my finger.

I started off installation by configuring the new drives as described in the PAYLOAD instructions. You must configure "Head Load", "Drive Select" and "Terminator" options. "Head Load" was preset on my drives to HM, the PAYLOAD recommended position. Secondly, "Drive Select" simply labels one drive as system unit 0 (for drive SY0: under H-DOS, or A: under CP/M) and the other as system unit 1 (SY1: or B:). Selection is via a jumper. Much easier than cutting a program block as on the old Siemens. Next, remove SY0: or A: drive's terminator Integrated Circuit. That's all to configuring the new drives.

The second "big" task is to remove the Siemens drive and the disk drive data cable per instructions. I took the data cable out and attached a second drive connector about two inches in from the factory drive connector. You need a vice to do it right. It's easy to put the connector on wrong. The connector must be on "straight". If you look at the factory connector, you'll see how "little feet" each touch a separate wire in the cable ribbon. Use your vice and put on the supplied connector in the same way. It's simple to do. Just be careful to keep the connector straight so each foot is centered over the right wire. I did it right the first time. (This was the step I thought I had messed up.) The way I kept the connector straight was to line up the pin 0 and pin 34 "feet" on the same wires as the factory connection. Then, I checked the other 32 "feet" to see if they were centered on the wire. Finally, I held the connector in place with my hand while I pressed the connector on with my vice.

Table 2
Some Vendors Who Carry Dual Drive Setups

H & H COMPUTER ENTERPRISES, INC
P.O. Drawer H
Blacksburg, VA 24060
(703) 552-0599

PAYLOAD COMPUTER SERVICES
15006 Sun Harbor
Houston, TX 77062
(713) 486-0687

QUIKDATA COMPUTER SERVICES, INC
2618 Penn Circle
Sheboygan, WI 53081
(414) 452-4172

Once this is done, you are ready to connect the data cable to the drives and the controller board. Remove the old drive by unscrewing the mounting screws and disconnecting the power supply cable. Slide in the new drives. Then, connect the "Y" power supply, and connect the drives to the controller card. On the Z-89-37 board, you must connect to P4 at the bottom, rather than the "normal" position at P3. In order to use P4, you'll have to disconnect the cable going to the external disk drive connector at the back. The Z-89-37 connector at P3 doesn't seem to support more than one drive. The PAYLOAD instructions didn't mention this, although it's important. You configure the J jumpers on the Z-89-37 board as though the internal drives were external. See Table 1 for my jumper configurations. Also, be sure your precompensation is set for none. I had a WANGO drive attached to my Z-90 at one time, so my board was set for precompensation. The Mitsubishi drive's won't work at double-density or double-sided if the precompensation isn't set for "none". Now that this is done, all you have to do is test your drives with either H-DOS or CP/M utilities to verify they're working correctly. If they are, screw down the drives and close it up.

If you have a hard-sectored disk controller, then your installation is very similar. There's only one plug on the hard-sectored board for you to connect the disk drives to. There aren't any jumpers to set.

Needless to say, I'm very pleased with my new drive setup. The Mitsubishi drives are very, very quiet. They have a 6 Millisecond seek time, which is twice as fast as my fastest Siemens single-sided drive. My "new" Z-90 really provides the computer tool I need. Since my modest computer program needs are met by my current (or available) H-DOS and CP/M programs for the H-89/Z-90 series, I can continue to use my system. This increases the return on my monetary and time investment.

If you need more disk storage, especially to keep your "all-in-one" a true "all-in-one", consider getting an internal dual drive setup from your favorite vendor.

**Table 3
Other Vendors Mentioned**

LINDLEY SYSTEMS
21 Hancock Street
Bedford, MA 01730
(617) 275-6821



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Data Based Advisor, Aug. 84

"For its price, the best data base program we've seen."

User's Guide, Feb./Mar. '84

Versions available for CP/M-80 and MS-DOS (Specify computer model and operating system when ordering).

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280/250 SOFTWARE						
PART NUMBER	DESCRIPTION	LIST	PRICE	DESCRIPTION	CP/M	
H-89-1	ELECTRONIC TYPING	89.95	51.97	H-89-17-1	2770 EMULATOR	179.00
H-89-17-4	288 DEMO	19.95	22.00	H-89-17-5	2770 HARD	459.00
H-89-17-5	288 DEMO	19.95	22.00	H-89-17-6	GENERAL LEDGER	299.00
H-89-17-6	288 DEMO	19.95	22.00	H-89-17-7	PROPERTY MGT.	399.00
H-89-17-7	288 DEMO	19.95	22.00	H-89-17-8	GENERAL LEDGER	399.00
H-89-17-8	288 DEMO	19.95	22.00	H-89-17-9	ACCOUNTS PAYABLE	399.00
H-89-17-9	288 DEMO	19.95	22.00	H-89-18-1	INVENTORY CONTROL	499.00
H-89-18-1	288 DEMO	19.95	22.00	H-89-18-2	SALIS INVOICING	799.00
H-89-18-2	288 DEMO	19.95	22.00	H-89-18-3	SALIS INVOICING	799.00
H-89-18-3	288 DEMO	19.95	22.00	H-89-18-4	PROPERTY MGT.	899.00
H-89-18-4	288 DEMO	19.95	22.00	H-89-18-5	ACCOUNTS REC.	399.00
H-89-18-5	288 DEMO	19.95	22.00	H-89-18-6	ACCOUNTS REC.	399.00
H-89-18-6	288 DEMO	19.95	22.00	H-89-18-7	SUPPERCASC	199.00
H-89-18-7	288 DEMO	19.95	22.00	H-89-18-8	SUPPERCASC	199.00
H-89-18-8	288 DEMO	19.95	22.00	H-89-18-9	SUPPERCASC	199.00
H-89-18-9	288 DEMO	19.95	22.00	H-89-19-1	2770 HARD	459.00
H-89-19-1	288 DEMO	19.95	22.00	H-89-19-2	2770 HARD	459.00
H-89-19-2	288 DEMO	19.95	22.00	H-89-19-3	2770 HARD	459.00
H-89-19-3	288 DEMO	19.95	22.00	H-89-19-4	2770 HARD	459.00
H-89-19-4	288 DEMO	19.95	22.00	H-89-19-5	2770 HARD	459.00
H-89-19-5	288 DEMO	19.95	22.00	H-89-19-6	2770 HARD	459.00
H-89-19-6	288 DEMO	19.95	22.00	H-89-19-7	2770 HARD	459.00
H-89-19-7	288 DEMO	19.95	22.00	H-89-19-8	2770 HARD	459.00
H-89-19-8	288 DEMO	19.95	22.00	H-89-19-9	2770 HARD	459.00
H-89-19-9	288 DEMO	19.95	22.00	H-89-20-1	2770 HARD	459.00
H-89-20-1	288 DEMO	19.95	22.00	H-89-20-2	2770 HARD	459.00
H-89-20-2	288 DEMO	19.95	22.00	H-89-20-3	2770 HARD	459.00
H-89-20-3	288 DEMO	19.95	22.00	H-89-20-4	2770 HARD	459.00
H-89-20-4	288 DEMO	19.95	22.00	H-89-20-5	2770 HARD	459.00
H-89-20-5	288 DEMO	19.95	22.00	H-89-20-6	2770 HARD	459.00
H-89-20-6	288 DEMO	19.95	22.00	H-89-20-7	2770 HARD	459.00
H-89-20-7	288 DEMO	19.95	22.00	H-89-20-8	2770 HARD	459.00
H-89-20-8	288 DEMO	19.95	22.00	H-89-20-9	2770 HARD	459.00
H-89-20-9	288 DEMO	19.95	22.00	H-89-21-1	2770 HARD	459.00
H-89-21-1	288 DEMO	19.95	22.00	H-89-21-2	2770 HARD	459.00
H-89-21-2	288 DEMO	19.95	22.00	H-89-21-3	2770 HARD	459.00
H-89-21-3	288 DEMO	19.95	22.00	H-89-21-4	2770 HARD	459.00
H-89-21-4	288 DEMO	19.95	22.00	H-89-21-5	2770 HARD	459.00
H-89-21-5	288 DEMO	19.95	22.00	H-89-21-6	2770 HARD	459.00
H-89-21-6	288 DEMO	19.95	22.00	H-89-21-7	2770 HARD	459.00
H-89-21-7	288 DEMO	19.95	22.00	H-89-21-8	2770 HARD	459.00
H-89-21-8	288 DEMO	19.95	22.00	H-89-21-9	2770 HARD	459.00
H-89-21-9	288 DEMO	19.95	22.00	H-89-22-1	2770 HARD	459.00
H-89-22-1	288 DEMO	19.95	22.00	H-89-22-2	2770 HARD	459.00
H-89-22-2	288 DEMO	19.95	22.00	H-89-22-3	2770 HARD	459.00
H-89-22-3	288 DEMO	19.95	22.00	H-89-22-4	2770 HARD	459.00
H-89-22-4	288 DEMO	19.95	22.00	H-89-22-5	2770 HARD	459.00
H-89-22-5	288 DEMO	19.95	22.00	H-89-22-6	2770 HARD	459.00
H-89-22-6	288 DEMO	19.95	22.00	H-89-22-7	2770 HARD	459.00
H-89-22-7	288 DEMO	19.95	22.00	H-89-22-8	2770 HARD	459.00
H-89-22-8	288 DEMO	19.95	22.00	H-89-22-9	2770 HARD	459.00
H-89-22-9	288 DEMO	19.95	22.00	H-89-23-1	2770 HARD	459.00
H-89-23-1	288 DEMO	19.95	22.00	H-89-23-2	2770 HARD	459.00
H-89-23-2	288 DEMO	19.95	22.00	H-89-23-3	2770 HARD	459.00
H-89-23-3	288 DEMO	19.95	22.00	H-89-23-4	2770 HARD	459.00
H-89-23-4	288 DEMO	19.95	22.00	H-89-23-5	2770 HARD	459.00
H-89-23-5	288 DEMO	19.95	22.00	H-89-23-6	2770 HARD	459.00
H-89-23-6	288 DEMO	19.95	22.00	H-89-23-7	2770 HARD	459.00
H-89-23-7	288 DEMO	19.95	22.00	H-89-23-8	2770 HARD	459.00
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H-89-23-9	288 DEMO	19.95	22.00	H-89-24-1	2770 HARD	459.00
H-89-24-1	288 DEMO	19.95	22.00	H-89-24-2	2770 HARD	459.00
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H-89-24-6	288 DEMO	19.95	22.00	H-89-24-7	2770 HARD	459.00
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H-89-29-8	288 DEMO	19.95	22.00	H-89-29-9	2770 HARD	459.00
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H-89-30-2	288 DEMO	19.95	22.00	H-89-30-3	2770 HARD	459.00
H-89-30-3	288 DEMO	19.95	22.00	H-89-30-4	2770 HARD	459.00
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H-89-30-8	288 DEMO	19.95	22.00	H-89-30-9	2770 HARD	459.00
H-89-30-9	288 DEMO	19.95	22.00	H-89-31-1	2770 HARD	459.00
H-89-31-1	288 DEMO	19.95	22.00	H-89-31-2	2770 HARD	459.00
H-89-31-2	288 DEMO	19.95	22.00	H-89-31-3	2770 HARD	459.00
H-89-31-3	288 DEMO	19.95	22.00	H-89-31-4	2770 HARD	459.00
H-89-31-4	288 DEMO	19.95	22.00	H-89-31-5	2770 HARD	459.00
H-89-31-5	288 DEMO	19.95	22.00	H-89-31-6	2770 HARD	459.00
H-89-31-6	288 DEMO	19.95	22.00	H-89-31-7	2770 HARD	459.00
H-89-31-7	288 DEMO	19.95	22.00	H-89-31-8	2770 HARD	459.00
H-89-31-8	288 DEMO	19.95	22.00	H-89-31-9	2770 HARD	459.00
H-89-31-9	288 DEMO	19.95	22.00	H-89-32-1	2770 HARD	459.00
H-89-32-1	288 DEMO	19.95	22.00	H-89-32-2	2770 HARD	459.00
H-89-32-2	288 DEMO	19.95	22.00	H-89-32-3	2770 HARD	459.00
H-89-32-3	288 DEMO	19.95	22.00	H-89-32-4	2770 HARD	459.00
H-89-32-4	288 DEMO	19.95	22.00	H-89-32-5	2770 HARD	459.00
H-89-32-5	288 DEMO	19.95	22.00	H-89-32-6	2770 HARD	459.00
H-89-32-6	288 DEMO	19.95	22.00	H-89-32-7	2770 HARD	459.00
H-89-32-7	288 DEMO	19.95	22.00	H-89-32-8	2770 HARD	459.00
H-89-32-8	288 DEMO	19.95	22.00	H-89-32-9	2770 HARD	459.00
H-89-32-9	288 DEMO	19.95	22.00	H-89-33-1	2770 HARD	459.00
H-89-33-1	288 DEMO	19.95	22.00	H-89-33-2	2770 HARD	459.00
H-89-33-2	288 DEMO	19.95	22.00	H-89-33-3	2770 HARD	459.00
H-89-33-3	288 DEMO	19.95	22.00	H-89-33-4	2770 HARD	459.00
H-89-33-4	288 DEMO	19.95	22.00	H-89-33-5	2770 HARD	459.00
H-89-33-5	288 DEMO	19.95	22.00	H-89-33-6	2770 HARD	459.00
H-89-33-6	288 DEMO	19.95	22.00	H-89-33-7	2770 HARD	459.00
H-89-33-7	288 DEMO	19.95	22.00	H-89-33-8	2770 HARD	459.00
H-89-33-8	288 DEMO	19.95	22.00	H-89-33-9	2770 HARD	459.00
H-89-33-9	288 DEMO	19.95	22.00	H-89-34-1	2770 HARD	459.00
H-89-34-1	288 DEMO	19.95	22.00	H-89-34-2	2770 HARD	459.00
H-89-34-2	288 DEM					