

SigmaSoft's Hard Disk for Your '8 or '89

Both CP/M and HDOS are supported. Prices start around \$800, including the controller.

Kenneth A. Patrick

Back in *Sextant* #18, September-October 1985, I had an article on SigmaSoft and Systems' Interactive Graphics Controller (IGC) ("A Look at SigmaSoft's Interactive Graphics Controller"). If you read it, you know how I feel about my H89. I like it, it's useful, and I want to make it even more useful.

I suspect there are several "K" of '89 and '90 owners (and H8 owners) who would agree with me. SigmaSoft's new Hard Disk Subsystem only reinforces my allegiance, and will do the same for all those smart enough to buy one for themselves.

SigmaSoft offers the subsystem in several versions, ranging from an internal 10-megabyte hard disk at \$795 to an external 40-MB system at \$1,350. (See Table 1 for a full list.) The external systems work with the H8, as well as with the '89.

I opted for the external 20-MB system. Past experience showed me I'd fill up whatever I bought, and 20 MB was the most cost effective unit I could afford.

Here's what you get for \$995:

1. Seagate ST-225 20-MB half-height hard-disk drive.
2. Western Digital hard-disk/floppy-disk controller card, the WD1002.
3. Elegant (color-matched to the '89) steel drive cabinet—which has room and power for a second drive!
4. Six-foot ribbon cable.
5. Parallel-interface card (16 ports) that fits in one of your H89's left-side (memory-expansion) slots.
6. SigmaROM replacement for your Monitor-90 read-only memory (ROM) chip.
7. SigmaSoft's support-software package for both the CP/M operating system and the Heath Disk Operating System (HDOS). This includes device drivers to

handle the hard disk and both hard-sectored and soft-sectored floppy-disk drives. It also includes various utility programs, a custom modification of CP/M's basic input/output system (BIOS), and parallel-printer device drivers for both operating systems.

(As it happens, I didn't pay the full price for my hard-disk system. I already had SigmaSoft's parallel-interface card in my machine to run my IGC board. Since the parallel card can do double duty, I got a \$95 credit on the price of the hard disk. If you already have an IGC with the 8-port parallel board, you can exchange it for the required 16-port card for \$45. If you buy the hard disk now and the IGC later, the credit will apply to that purchase.)

Let's talk about the hard drive first. Whether you get the 10-MB or the 20-MB Seagate, it is a hardy half-height unit that is fairly quiet (except on start-up). It comes with a one-year warranty against defects. SigmaSoft also offers a smaller LaPine 3½" system for internal mounting in your '89, and a half-height Seagate ST-251 unit for the top-of-the-line 40-MB system.

In testing the SigmaSoft board and software, I also used a Miniscribe drive from a Z100, a Tandon 30-MB drive, and

several others. We'll get to software later; suffice it to say that if you choose to use another brand of disk system (one that conforms to the Seagate ST-506 standard interface), SigmaSoft won't leave you in the cold.

The performance of the system will depend a great deal on the access times of the drive installed. The smaller Seagates have an average access time of 65 milliseconds, faster than most standard drives for the IBM Personal Computer. The Tandon blazed through my tests with an average of about 38 ms, and the big-ticket Seagate runs at 40 ms. (Drive performance is one of the few places where you can still get what you pay for.)

The color-matched drive cabinet has a handsome beveled front panel. SigmaSoft had the supplier match the '89's color scheme and paint texture exactly. There is an excellent 50-watt switching power supply. The drive and the Western Digital disk controller are both fitted into the cabinet and, as noted, there's room (and power) enough for a second drive. A single 34-pin flat ribbon cable connects the subsystem to the '89.

The Western Digital WD1002 controller card has a bonus: it can support up to four floppy-disk drives, plus three hard-disk drives. (CP/M can recognize up to

Drive	Capacity	Mounting	Price
LaPine Titan 10	10 MB	Internal	\$ 795
Seagate ST-213	10 MB	External	\$ 895
LaPine Titan 20	20 MB	Internal	\$ 895
Seagate ST-225	20 MB	External	\$ 995
Seagate ST-251	40 MB	External	\$ 1,350

Table 1. SigmaSoft offers a variety of hard-disk packages for the H/Z89. The external drives may be used with the H8 as well as with the '89. The Seagate ST-251 is the fastest, being a 40-millisecond drive; all the others are 65-ms drives. Both internal and external drives come with their own power supply.

Kenneth A. Patrick is not new to Heath/Zenith reviewing. He's surveyed several products within the pages of Sextant, and is constantly evaluating others at Tex-Matics Micro Systems, his retail store in Plano, Texas.

three 5¼" drives at a time; HDOS will support four.)

SigmaSoft's literature expounds on the value of Error Correction Coding (ECC), a feature of the WD1002 controller that makes it faster and more reliable than others on the market. But SigmaSoft has gone beyond the controller's built-in advantages. SigmaSoft's changes to the controller let it emulate all functions of Heath/Zenith's \$299 Z37 5¼" soft-sector controller. (SigmaSoft has considered 8" drive support, but so far there hasn't been enough demand.)

I already had the Z37 and two high-density (96 tracks per inch, up to 728 kilobytes) floppy drives. With the WD1002 alone, however, I have ample support for high-density drives to back up the hard system. (And right now, the going resale price on a used Z37 controller is about \$250; that \$250 might come in handy towards a *second* 20-MB drive.)

I described the parallel-interface card in my earlier article. To refresh your memory, though, here are its features:

1. There are 16 parallel ports, with addresses selectable by jumper.
2. Of those ports, two are Centronics standard and, with the supplied software, can drive parallel printers. Printer cables are an extra cost option.
3. Two multi-port connectors provide support for both the hard-disk subsystem and the ICC.
4. You get simple plug-in installation in one slot on the *left* side of the '89; all right-hand input/output (I/O) slots remain intact; and there is still room for the left-slot-mounted 16K memory board.

I was a beta test site

As you know from my previous article, I am a fan of SigmaSoft, as well as a fan of the '89. I've always been impressed by Clay Montgomery, who owns SigmaSoft and does the hardware design, and by Darron Shaffer, who writes most of the software. Also, we're neighbors, sort of. SigmaSoft is located in Dallas, and I have a Zenith Data Systems dealership just

outside the city.

So, it wasn't surprising when Clay asked me to be a beta test site for the new system. (In fact, I'd been harassing him about a hard-disk system for some time.)

I didn't even read the instructions to install my system. Installing the hardware for the external drive is straightforward: unplug one chip from the processor board, plug a cable into that socket, and connect the cable to the SigmaSoft interface board; a cable runs from the interface board to the '89's backplate. It's basically the same idea for an internal drive.

As a beta site, I opted to assemble my cabinet and drive several times, using different drives for testing purposes. And being familiar with the parallel card, I

You'll appreciate the numerous SigmaBIOS versions pre-compiled and ready for installation.

already knew which chip on the '89 to pull in order to install the cable.

SigmaSoft's attention to detail prevented me from hooking things up backwards by providing polarized connectors for the cables. You are, however, well advised to read the simple (and well-illustrated) instructions carefully while installing.

The last hardware change is to install the SigmaROM. This monitor-ROM replacement is really transparent to most users, except for the version sign-on at power-up and the new s: prompt. The changes affect only the boot operations.

SigmaSoft removed the ROM's support for the Z67 hard disk, and replaced it with support to boot from the new hard-disk subsystem. (If you choose to set the address of the parallel card at other than hexadecimal 00, or if you wish to boot

from a floppy drive on the WD1002, you must use the SigmaROM's s(substitute) command in order to change the boot port "on the fly.")

The software makes it tick

SigmaSoft knows what it takes to make hardware sell: software. You can sell the highest technology in the world, but if there is no software to drive it, it's just a paperweight on most users' desks.

The hard-disk subsystem comes with a full complement of HDOS and CP/M software (at no extra charge!). It made all the power I purchased readily available. (When I eventually had to read the manual, I found it covered each program and option in clear detail.)

In the following descriptions, I'll be referring to utility programs included in the software package. I am primarily a CP/M user, and the programs described are the CP/M versions. HDOS versions are also included, so aficionados can have it either way. (In many cases, HDOS users will find the CP/M terminology and command formats quite familiar. This is no accident: except for the SigmaBIOS, SigmaSoft developed all the software under HDOS and then transported it to CP/M.)

The first step after hardware installation is to run the hard-disk formatting program, HDFORMAT. Owners of Z100s and newer machines will recognize this as similar to the PREP utility.

The drive is formatted according to several selectable specifications (number of heads, cylinders, sectors per track) and performance options (step rate, skew factor, etc.). SigmaSoft points out that having selectable specifications allows you to use any drive that follows the ST-506 standard.

I expected that the system would be busy for several hours in this phase, as is normal for most 20-MB systems. The HDFORMAT program made relatively fast work of it, finishing in less than 30 minutes. (HDFORMAT doesn't do quite as much testing as PREP, but I've always felt that Heath/Zenith was overly cautious. SigmaSoft points out that extra tests are generally not necessary because of the error-handling capability of the Western Digital controller.) When HDFORMAT was done, it had mapped out bad sectors and given me a clean disk ready for partitioning.

HDPART is used to divide the drive into smaller, more manageable logical drives called partitions. You can define up to 16 partitions, each of which can be in either CP/M or HDOS format. Each partition definition includes number of cylinders, partition name, and target operating system (HDOS or CP/M).

During HDPART, a simple partition table displayed the progress of the changes I made. The table included relative positions of each partition, size in

File Name	Supported Disk Controllers
SBIOS1.SYS	WD1002 only (hard and floppy)
SBIOS2.SYS	WD1002 and Heath H17
SBIOS3.SYS	WD1002 and Heath H37
SBIOS4.SYS	WD1002 and Heath H47
SBIOS5.SYS	WD1002, Heath H17, and Heath H37
SBIOS6.SYS	WD1002, Heath H37, and Heath H47
SBIOS7.SYS	WD1002, Heath H47, and Heath H17

Table 2. SigmaSoft supplies a number of SigmaBIOS files; these are pre-compiled CP/M BIOS configurations that support various combinations of disk drives used by the H/Z89.

kilobytes, and target operating system, plus space still not allocated.

The changes were not recorded on the drive until I said so, and I had several chances to change my mind before the big event. Before saving the revised table, I chose a partition that would always be booted by default if no name were specified.

Once HDPART writes the changes, you'll find it has initialized the changed partitions for the operating system specified. (Unlike formatting a floppy, initializing a hard-disk partition does not write some filler character to every byte on the disk. Rather, it is like an erasure of all the file entries in the directory.)

A note to HDOS users is in order. For its directory information, CP/M simply goes to a particular location on disk and starts reading or writing. CP/M partitions are ready for use immediately after HDPART is completed. However, HDOS partitions must be initialized, as always, using INIT.ABS. This will establish empty directory files (DIRECT.SYS, GRT.SYS, and RGT.SYS), and make the drive ready for use by HDOS. From that point on, the hard disk is accessed using the appropriate device driver as always. (CP/M folks may not know what I'm talking about, but if you don't use HDOS, don't worry about it!)

The next step was to get an operating system on each partition that was to be bootable. I needed to access the drive to begin loading software onto it. I did this using SigmaSoft's loadable device drivers (LDDs). Developed initially for the IGC and printer drivers, LDDs do under CP/M what HDOS device drivers do: they make extensions to the operating system in order to support new physical devices. (There's a small cost in memory.)

Using SigmaSoft's SET.COM utility:

```
SET HDC: HELP
```

I checked the options of HDC.DVD, the hard-disk LDD. Once I verified that it was set for the right port address, I used SigmaSoft's ASSIGN.COM utility:

```
ASSIGN D:=CPM1
```

to load the LDD and map access to a CP/M partition I had named earlier. CP/M's standard STAT.COM utility reported that I had just a little under 4 MB of space on drive D:.

(Note that using the hard-disk LDD is required only until the hard disk is made bootable. Its purpose is to allow you to transport SigmaBIOS modules to the hard disk; it's not required once you have a CP/M bootable system that uses SigmaBIOS.)

To configure CP/M for your memory size and drive controller, SigmaSoft includes a smart little program called MOVCPM.COM. It expects to find your serialized version of MOVCPMXX.COM on the installation disk; it just joins itself to that program to automatically generate a bootable hard-disk system in memory, ready

for SYSGEN to write it to disk.

SigmaSoft even gets you around the tedious MAKEBIOS process needed to configure the BIOS to a particular disk-drive setup. If you've been irritated by that in the past, you'll appreciate the numerous SigmaBIOS versions already pre-compiled and ready for installation. (See Table 2.) I just placed a copy of my MOVCPM37.COM on the installation disk, ran SigmaSoft's MOVCPM, ran SYSGEN, and *Voilà!*—I had a bootable hard disk.

HDOS folks: after running INIT.ABS on each HDOS partition, use SYSGEN HD0: to get the first HDOS partition bootable. Then just re-boot the system from the hard drive, and propagate HDOS to other partitions as required. It really is as simple as having an ordinary Z37 or Z17 drive.


The SigmaROM allows you those standard features that Heath/Zenith's moni-

tor ROMs are noted for—such as being able to boot from a secondary device. I chose to leave my floppy drives (on the Z37 controller) as the primary boot device for other members of my household to use. (Some people just *cannot* adjust to change!) I chose my hard disk, therefore, as the secondary boot device. At the S: prompt, I just type B(OOT) SD<RET> and the hard disk boots in seconds.

I SYSGENed the other CP/M partitions with different versions of SigmaBIOS so that I would have full support available for a variety of drive combinations. On the primary CP/M partition, I use a SigmaBIOS with only hard-disk and WD1002 floppy support. This gives me good performance and maximum transient-program area (TPA).

The SigmaROM allows me to boot another partition (with Z17 support for

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reading distribution disks, for instance) by specifying the partition name when I boot:

B(OOT) SD:CPM2<RET>

Since support for new devices was in order, SigmaSoft wrote a new program, CONFIG.COM, to customize the new SigmaBIOS. You can specify step rates for the new 5¼" soft-sector drive support, and you also have all the standard features available from Zenith's CONFIGUR.COM.

Using ASSIGN.COM to specify drive letters as partition names gives me access to up to four hard-disk partitions at any one time. (In addition, the software support package includes an optional SigmaBIOS that provides up to six partitions.) I used CONFIG to give me a cold-boot auto

command line of

ASSIGN B:=CPM2,C:=TEST,D:=DEV

so that all my standard partitions would be available at boot-up.

Other software is included with the hard-disk system:

BRS.COM—actually, you get patches to your Zenith BRS.COM program, an elegant backup-and-restore utility well-documented in the Heath/Zenith CP/M manual. The patches allow you to use BRS.COM to back up files from any disk device to any other disk device.

DD.COM—a public domain sorted disk-directory program; it's worth its weight in gold once you've loaded up your hard disk with hundreds of files.

FDFORMAT—a CP/M floppy-disk in-

Partition	User Area	Usage
CPM (4M)	0	COMMAND.LBR, LRUN.COM, SD.COM, SWEEP
	1	Communications programs
	2	PL/I compiler and editors
	3	dBASE II distribution files
	4	Sensible Solution distribution files
	5	FORTTRAN distribution files
	6	COBOL distribution files
	7	Toolworks C and Viking C subroutines
	8	MBASIC, CBASIC, CB80, BASCOM, BI-80
9	WordStar, Benchmark	
DATA1 (4M)	0	Bootable, with Z17 BIOS support, backup programs, other special utilities
	1	Downloaded files, staging for uploads
	2	PL/I source modules, load modules
	3	dBASE .CMD files
	4	Sensible Solution .RUN, .SRR, source
	5	FORTTRAN source files
	6	COBOL source and COPY files, .COMS
	7	C source and .COMS
	8	BASIC source programs
9	Documents	
DATA2 (4M)	0	ZCPR2 source, SYST90, other system utilities
	1	Breakdown staging for .LBR files
	2	PL/I test files
	3	dBASE data base files (.DBF, .NDX)
	4	Sensible Solution data base files (.MS, .KS)
	5	FORTTRAN test files
	6	COBOL test files
	7	C test files
	8	BASIC test files
9	Novel (in work)	
DEV (4M)	0	Used for overflow, snapshot backups
HDOS (2M)		Bootable drive for HDOS
HDOS2 (2M)		Data drive for HDOS

Table 3. With the large amount of storage space available with a hard disk, you will want to consider how to organize your files. Here's the author's scheme for organizing files on his hard disk. CP/M's USER areas can serve much the same purpose as subdirectories under MS-DOS.

itialization utility like Zenith's FORMAT.COM; but it's specifically designed to format disks on drives plugged into the WD1002 controller.

HDUMP—a special disk sector-dump/edit utility designed to access the hard disk, including sectors normally blocked from operating-system access. Using HDUMP, it is possible to change any byte on any sector of the drive, even if the drive is logically corrupt. It's even possible to rebuild a lost superblock (which defines the partitions on the drive).

HDPARK—a program to place the heads of the hard-disk drive in a "safe" position for transportation of the drive without damage.

LOADD—a program to read and install SigmaSoft LDD modules.

MAKE—a CP/M utility that allows the directory entry of a file to be changed, so that you can effectively move the file to another USER area without actually copying the file itself.

UPC—LDD support for a Centronics-standard parallel printer.

A new way of thinking

Having all this disk space causes my thought processes to boggle at times. Sure, I've had a Z100 with 30 MB running at the store for years now, and would be lost without it. But at home, I've worked with floppy disks for over four years. I always knew which disk had which utilities, which disk had PL/1 on it, and so forth. Once I had the hard disk running, it was inevitable that I would try to load *all* my software onto it.

I ran into several problems. First, not all my software would fit on the hard disk. You can say all you want about the capacity, but more than 125 728K floppy disks just won't fit on a 20-MB drive. Second, even after gleaning and deciding, I found that the number of files made my directory a nightmare. (With a 1,024-file maxi-

mum, DIR was a mess!)

Having used high-capacity disks a lot, I had already availed myself of tools that wouldn't really be necessary with small disks. Few single-user systems, for instance, make use of CP/M's ability to set up USER areas. There's little point to setting up an ordinary 5¼" disk with separate directory areas that can't readily access each other.

But I had found USER areas valuable for organizing my 728K storage disks. (If you stop and think about it, after all, hard-disk subdirectories under the Microsoft Disk Operating System can be thought of as nestable USER areas with names instead of numbers.) I already knew the advan-

Compile times are improved by a factor of five or more over floppy performance.

tages of improved utilities such as the DD.COM and SD.COM directory programs, and the SWEEP file-management program.

To get real value from all my new space on disk, it appeared that I had to make more use of USER areas. Using MAKE.COM, I moved things around to different USER areas according to function. (See Table 3.) Even with that organization, I found that file-access time was degraded because of the large number of directory blocks used on the primary CP/M partition.

In addition, I found I had several copies of many programs, one copy for each USER area on which the program was needed. To improve my system, it was obvious I needed one of the public domain enhancements to CP/M's console

command processor (CCP).

I finally chose ZCPR2, primarily because it took no additional space from my TPA. Also, it required no BIOS changes. (So I'm lazy; sue me!)

ZCPR2 gave me the features I needed to support my new-found storage:

1. When you change USER areas, the prompt identifies which USER area is current. For example, if you're logged on to drive B:, USER 7, the prompt looks like:
B7>
2. ZCPR2 lets you establish a search PATH for program files. If you call a program that does not reside on the current USER area, it will search for the program along that PATH through other USER areas. Keeping frequently used programs in the designated location means that only a single copy of each program is required throughout the hard-disk system.
3. Switching between USER areas is simplified. You can merely type A14: to switch to drive A:, USER 14.
4. If a program is not found anywhere on the specified PATH, a designated .COM file can be run. ZCPR2 will provide to the .COM file the name of the originally called program. I designated LRUN.COM, which will search for the file in a compressed library, then load and execute it.

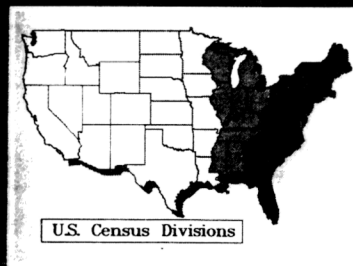
Being able to automatically use LRUN lets me put all my utilities in a single COMMAND.LBR file on USER 0. It uses a single directory block, and compresses those little utilities into an efficient space (40% less than normal). Moreover, my directory is not cluttered with programs I know are in the COMMAND.LBR.

Performance of the drive system is flawless. The throughput of my work has improved many times over. Although I used my RAM disk frequently before, I now use it little, since the hard disk rivals the RAM disk's performance. Compile times are improved by a factor of five or more over floppy performance. Word-

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By the way, you can now get SigmaSoft's package with ZCPR3 installed. This will give you a number of enhancements over ZCPR2, and it will save you the hassle of installing it yourself.

Support

SigmaSoft shows strong confidence in their hardware and software. The warran-

ty is straightforward, they listen to their customers, and the documentation gives ample information about what's going on beneath the surface.

The manual includes a copy of Western Digital's OEM manual for the controller board. A complete parts list (including recommended suppliers) is also included, as are descriptions of SigmaSoft's control blocks (superblocks).

At 10 characters per inch, both the repair-service information and the warranty fit on a single page, and both are simple. The minimum standard repair fee is a ridiculous \$15. You can't beat that with a stick!

As I mentioned, you can even get a hard disk ready for internal installation in your '89! SigmaSoft uses the rugged LaPine 3½" drives, and includes a booster power supply to ease the load on the one in your '89.

Qualified programmers may wish to modify some of the SigmaSoft programs. The source code for the SigmaBIOS is available for \$95. (Consultation time is invariably required when any changes to a CP/M BIOS are made.) Source code for the utilities is also available. (Modifying the CP/M utilities will require the HDOS assembler.)

New things in the works include some unannounced goodies. And SigmaSoft has always had a very reasonable software upgrade policy.

It's no fun reviewing if you can't complain!

Beefs? I found lots of software bugs. However, you can discount this beef because I was a beta site, and my function as such was to find those bugs. And, although there are still a couple of points that I think could be improved, the bugs have been long since fixed.

Regarding points for future improvement, I'd like to see HDPART.COM allow specification of the number of directory blocks for each partition for either operating system. And those of us who need to squeeze out maximum working-memory area would appreciate a SigmaBIOS with hard-disk support *only*, without WD1002 floppy support.

Also, the drive letter assignments using SigmaBIOS are hard-coded and arbitrary; they assume you'll use the WD1002 floppy interface, which may not be the case. (I despise referring to my first Z37 floppy drive as H:.)

It fits

When I reviewed SigmaSoft's IGC, I raved about it as one of the best productivity tools you could buy for your '89. The Hard Disk Subsystem surpasses even IGC. You'll have all your standard software at your fingertips, lots of space for growth and development, high-speed disk access, Z37 soft-sector floppy support, two parallel printer ports, six extra parallel ports (usable for IGC or whatever), great software, and professional support.

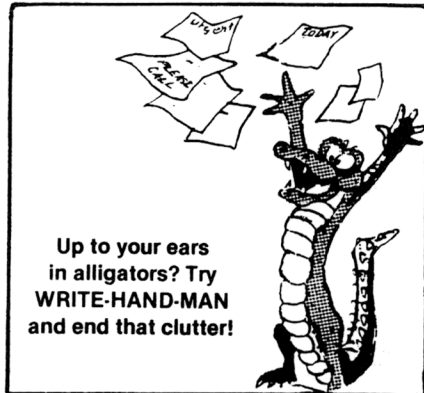
It's clearly the best money you can spend for computing performance if you already have an H8 or an '89. The price is in line with expansion systems for the IBM compatibles. Parts and repairs should be no problem, since all components are off-the-shelf. And doing a PL/1 compile at 4 MHz, a Z151 with a hard disk is now outperformed by my H89!

I wish I could use exclamations like "Wow!" or "Shazam!" to describe my feelings about the system. I had it for several months as a beta test site, including several releases of software, a controller update, a buggy interface card, and several kinds of hard-disk drives. Now that the software has settled down to stability in its release form, I've had a chance to use it with confidence for a while.

It's become like a comfortable shoe. Fact is, the only excitement would be if I had to give it up. I can't imagine going around barefoot again.

Additional Information

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