

DISK DRIVE PREVENTATIVE MAINTENANCE

by Dan Jerome in Collaboration with Kirk Thompson
(Concluded from the last issue)

[4] RUN TEST17 OR TEST37 AS APPLICABLE. Heath has provided two excellent programs that will reliably check out drives, but one must use them while in the HDOS Operating System, since there is no CP/M counterpart.

CAUTION: Both of these tests are done with the CPU board running at 2MHz. If you try these tests at 4MHz, you will get erroneous results. In addition, it is best to initialize a fresh disk for each drive to be tested and while in the INIT.ABS program, perform the media check. If there are any errors, write them down and feed this data back to the INIT program when appropriate. DANGER: Do not test a drive with a disk that has important programs on it, since some of the test programs will wipe the disk clean.

TEST17 came with the HDOS Version 2.0 System Disks. TEST37 came with the Heath soft sector controller. One should run the applicable test about every twelve months. It is a good idea to keep a log on each drive and write in the results of each test on the log. This will provide you with a drive history and will indicate if the drive needs service. If you desire to have the printer print out the test results, you can file that printout when test are complete.

These tests are adequately covered in the HDOS manual, so they won't be discussed in detail here. [Both HDOS 2.0 and the HDOS manual can be obtained through this newsletter; see this and issue #9's inserts for further information. -Ed.] However, different drives have the pot for adjusting spindle speed located in different locations:

- (1) SIEMENS 90K DRIVE: Adjust pot R7 located on the small circuit card to the right of the disk drive door, next to the drive belt. This is a square shaped pot.
- (2) SIEMENS 40/80 TRACK DRIVE: Adjust pot R37 located on the large circuit board at lower right. This is a square shaped pot.
- (3) TANDON 40/80 TRACK DRIVE: Adjust pot R4 located on a narrow and small circuit card attached to the rear of the drive. Resistor R4 is the only variable resistor on the board. It has a long, slender, rectangular shape.
- (4) If you have another type of drive, and have the service manual, it will normally call out which pot is the one to adjust. If you cannot determine for sure which is the correct pot, do not guess.

[5] PLANNING DRIVE GEOMETRY. Some people who use a drive that is mounted inside the H89 Computer experience grievous problems with both soft and hard disk errors. The reason for this is because not too infrequently the inside of the computer becomes too warm for accurate drive operation. This is especially true if it is summer and you work in a place that doesn't have air conditioning.

One solution to this problem is to install a 90k drive in the computer, and then assign this drive to

work on the hard sector controller. If things get too hot, you can always pop open the computer cover and temporarily disconnect the drive. This assumes that you do most of your computing on drives that are connected to the soft sector controller.

The best solution that I have discovered is to remove the drive from the inside of the computer and replace it with a black, plastic, disk holder. These items are furnished with the Heath H77 Drive Cabinet and Power Supply unit when you purchase the kit. If a disk holder is not available, fashion a wood or metal cover and attach it over the hole where the disk drive is normally mounted. You can design it in such a way that you do not need to drill holes in the computer front panel. That is, the cover can be laminated out of two pieces of material. The outer piece extending beyond the cavity in four directions and the inner piece being constructed so that it fits tightly into the opening. Then you can fasten it from the inside using common hardware. Further, if you have at least one external H77, or the equivalent, configure your system to mount one half height double-sided soft sector 40-track drive, one half-height double-sided soft sector 80 track drive, and one full size double sided soft sector drive in the cabinet. This will prevent troublesome heat buildup inside the computer, since the disk drive has been removed. The Heath H77 has been designed to throw off internal heat readily, so having three drives in one cabinet will be no problem.

Another viable solution is to increase the airflow over the computer power supply and disk drive area. Kirk Thompson decided to accomplish this task as follows:

(1) He removed the computer's top cover and laid out a pattern of 3/8 inch holes drilled into the cabinet's sidewall near the disk drive. These holes were set into a 7 x 4 array on one-inch centers. This was designed to provide positive air flow over the disk drive and power supply.

To supplement the first set of holes, he added a second 2 x 4 array of holes on the opposite side of the computer. This was designed to provide air circulation over the video board and around the CRT yoke. CAUTION: The material used to fashion the computer shell is very soft, and it is recommended you use hand tools whenever possible, instead of power tools. When you begin drilling the ventilation holes, go slowly and push the bit in and out until you break through. Then use a half-round file, or equivalent, to smooth the edges of the cut. To refinish the paint over the cut edges, purchase a small bottle of battleship grey enamel from a hobby shop.

(2) Instead of replacing the standard-issue Boxer fan with one that was of the same size, but provided more air moving capacity, Kirk decided to replace the fan with a larger and quieter Whisper fan. (This fan is made by Rotron and should be easily available in any part of the country.) He measured and cut a square hole in the upper right hand corner of the computer and mounted the fan with a grill [in

the hole]. Then he rewired the power connection. [I also taped over the exhaust vents in the upper shell. -Ed.]

This surgery passed the acid test. When running his computer system now, even with extended use, the computer runs considerably cooler. [I can even feel a draft around the new holes in the sides of the upper shell. -Ed.]

[6] MAINTAIN A CLEAN ENVIRONMENT. It has been proven by electronics industries that computer equipment will perform longer and more trouble free if it can be used in a clean environment. Human hairs, house dust, or even smoking in the area will shorten the life of the media.

It is also well to obtain a dust cover for the computer and especially double-sided drives that you are using with it. Dust covers are still available from Heathkit/Zenith, according to the Minneapolis store. A cover for the H89/Z90 is available for \$25.00 plus shipping and handling, and if you like you can specify adding the "Heathkit" or "Zenith" logo. A cover for any H77/Z87 drive cabinet/power supply unit is also available for \$25.00. If you cannot secure one from your local Heathkit store, the Minneapolis store still has access to them by special order. I suggest calling them to prepare them for the mail order coming up.

Your disks should also be reinserted in their disk jackets and stored vertically when not in use. This will help keep house dust and dust that comes in from the outside off of them and keep them clean for a long time. Normally folks store disks in the inexpensive 10-up plastic disk boxes. One could use FLIP-N-FILE 15-up, or even long disk storage boxes with covers. If you don't have a local discount store that sells these supplies, there are several mail order companies that list them in their catalog, such as Lyben Computer Systems.

SOURCE NAME AND ADDRESS	TYPE OF SUPPORT
Floppy Disk Services, Inc. 39 Everett Drive, Bldg D Lawrenceville, NJ 08648 (609) 799-4440	Repairs Siemens Drives Parts are available separately
Heath/Zenith Computers And Electronics 101 Shady Oak Road Hopkins, MN 55343 (612) 938-6371	Computer and H77 dust covers with or without the Heath or Zenith logo
JDR Microdevices 110 Knowles Drive Los Gatos, CA 95030 (800) 538-5000	Small electronic parts, sockets, chips, etc
Lyben Computer Systems 1050 East Maple Road Troy, MI 48083 (313) 589-3440	All types of computer accessories; disks, boxes, mailers, etc
Quikdata Inc. Henry E. Fale 2618 Penn Circle Sheboygan, WI 53081 (414) 452-4172	Repairs Tandon drives Don't know if parts are available separately

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CONTACTS

(A Wanted/For Sale/Swap Column)

Joseph M. Tabbi (Tabtronics, Inc., P.O. Box 128, Geneseo, NY 14454, 716-243-4331) -- "For Sale: 1 H/Z 89 Computer with 64K Memory, Ram Disk, Soft Sector Controller Board 4 MHz Speed Module. Manuals and extensive Software included. 1 H/Z 89 Computer with all above less Ram Disk. 1 H77 Dual Disk Drive. Asking \$300.00 for each computer. The H77 Dual Disk Drive will be included with first computer sold."

Terry Hall (516 East Wakeman, Wheaton, IL 60187, 312-665-4594) -- Terry sent me a list for a slug of documentation for HDOS and CP/M he wants to get rid of, as well as magazine issues (**REMark**, **SEBHC Journal**, and **Staunch**), 8-inch SS/SD disks, and storage cases for 5-1/4 and 8-inch floppies. There's too much to include here, so I suggest writing to him.

Harold D. Harfoot (4430 S.W. 34th Drive, Ft. Lauderdale, FL 33312) -- "Need schematics on the Z67 8" Winchester and 8" DDDS floppy/have 2, plus a controller board and 2 Winchester drives to make a dual Winchester for the [TMSI] H1000."

Daniel M. Jerome (801 E. 132nd St., Burnsville, MN 55337) -- Dan is looking for Heath's #597-1973, "The HDOS Programmers' Guide," for keying in as part of the HDOS manual.

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THE MANDELBROT SET Fractal Graphics on the H89

by Lee Hart

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Back in October, 1985, the "Computer Recreations" column in **Scientific American** introduced me to the Mandelbrot Set; a simple little equation that magically produced the most incredibly complex creatures yet found in the world of mathematics. Graphs of the Mandelbrot Set don't look anything like the sterile world of normal mathematics; they instead evoke images of natural shapes; snowflakes, clouds, mountain ranges, and seashores.

We've all seen those astounding color photographs of computer graphics. Perhaps you've sighed, and said "Gee, I wish I could do that on my H89". Well, you may not have the color or graphics to do world-class imaging, but that doesn't mean you're left out in the cold. The H89 has no trouble creating the images, and can give you a preview of what they'll look like on a high-class display device or printer. And if you have a graphics board, you can put it to good use!

The Mandelbrot Set. The Mandelbrot set is just a set of numbers that satisfy an equation. The equation is deceptively simple. To see if a number C is a member:

```
10 iterations=1
20 let Z=C
30 while I<max and Z<2
40   Z=Z*Z+C
50   iterations=iterations+1
60 wend
```

```

70 if iterations=max
    then print C;" is a member of the Set"
    else print C;" escapes the set after";
        I;" iterations"

```

MAX is an arbitrary number, usually between 10 and 100. It keeps us from going into an infinite loop (if C=0, for example). Higher values of MAX take longer to compute, but produce more "interesting" results.

Ah, but there's a trick. C and Z are not normal numbers; they are "complex". A complex number is the sum of two parts; a "real" and an "imaginary" part. The real part is what we think of as a normal number. Real numbers can all be plotted somewhere on a straight line ranging from -infinity to +infinity.

Imaginary numbers were invented to represent values that can't be plotted on this line: the square root of -1, for example. In effect, they are at "right angles" to the real numbers. The suffix "i" is given to the imaginary part. For example, $2+3i$ is a complex number with a real part =2 and an imaginary part =3.

Complex numbers are usually plotted on graph paper with the real part on the horizontal axis, and the imaginary part on the vertical axis. They can be added, subtracted, multiplied, and divided like ordinary numbers, but the process is a little more (excuse the pun) complex. Given two complex numbers $a+bi$ and $c+di$:

addition:
 $(a+bi) + (c+di) = (a+c) + (b+d)i$

multiplication:
 $(a+bi) * (c+di) = (ac) + (ad)i + (bc)i + (bd)ii$
 $= (ac-bd) + (ad+bc)i$

Remember that i is the square root of -1, so $i*i=-1$. The "size" of a complex number is its distance from the origin $0+0i$. Since the imaginary axis is at right angles to the real axis, trigonometry says:

$$\text{size of } (a+bi) = \sqrt{a^2 + b^2}$$

Now we can rewrite the above program to use complex arithmetic. Variables C and Z are broken into their respective real and imaginary parts, $C=Cr+Ci$ and $Z=Zr+Zi$.

```

10 iterations=1
20 Zr=Cr: Zi=Ci
30 while iterations<max and sqrt(Zr*Zr+Zi*Zi)<2
40   Ztemp=(Zr*Zr)-(Zi*Zi)+Cr: Zi=2*(Zr*Zi)+Ci:
      Zr=Ztemp
50   iterations=iterations+1
60 wend
70 if iterations=max
    then print Cr;"+";Ci;"i is a member of the Set"
    else print Cr;"+";Ci;"i escapes the set at";
        I;"iterations"

```

This is the classic solution used in many articles on fractals and the Mandelbrot set. Note the temporary variable Ztemp since we can't change Zr until Zi is calculated, and the large number of floating-point operations in the while-wend loop; this makes the program *slow*. If we don't do better than this, it will take all day!

We can eliminate the SQR() operation by squaring both sides of the comparison; $\text{sqr}(x)<2$ is the same as $x<4$. Also, $Zr*Zr$ and $Zi*Zi$ are computed in two places per loop; let's save multiplications and eliminate the temporary variable.

```

10 iterations=1
20 Zr=Cr: Zi=Ci: Zr2=0: Zi2=0
30 while iterations<max and Zr2+Zi2<4
40   Zr2=Zr*Zr: Zi2=Zi*Zi
40   Zi=2*Zr*Zi+Ci: Zr=Zr2-Zi2+C
50   iterations=iterations+1
60 wend

```

This is nearly twice as fast. We gain a bit by defining iterations as an integer variable, but that's the best we can do in BASIC.

Plotting the Set. A Mandelbrot plot is really a graph of the number of iterations needed for a range of points ($C+Ci$) to exceed a size of 2. The real part (Cr) is plotted on the horizontal axis; the imaginary part (Ci) on the vertical axis, and the number of iterations is the color or intensity.

Attached is an MBASIC program to display any selected part of the Mandelbrot set on your H19. The screen is used as an 80x24 graph, with each point having 13 levels of intensity (gray scale). This is done by choosing a set of graphic characters based on the number of pixels they illuminate.

Once you have found an interesting region, it can be printed. Since printers typically have higher resolution than the screen, printed images take longer but look better.

Running the Program. The program begins by prompting you on the 25th line for an upper limit for Ci ("Top= "). Enter any floating-point number between +2 and -2, then RETURN. Likewise, select a lower limit on Ci; and the lower (left) and upper (right) limits on Cr, the real part. Finally, choose a maximum number of iterations. You can accept the defaults by just hitting RETURN.

The program then computes and plots the number of iterations for every point ($Cr+Ci$) between the selected upper/lower/left/right limits. Be patient; a typical display may take 10 minutes or more. If you think that's bad, a Z-100 or PC-clone usually takes HOURS to generate such plots! They don't have the luxury of two CPU's; one to calculate data while the other one displays it.

When finished, the cursor returns to the 25th line. The previous limits become the new defaults, and are shown on the 25th line. Enter a new set of limits to zero-in on an interesting region, or control-C to exit.

When you find an interesting region, print it [the routine is for an Okidata u92 -Ed.] by specifying a negative number of iterations. Since printing is at a higher resolution, it takes much longer; as much as several minutes per line. The printed image is rotated 90 degrees, so it has the same proportions as the screen.

The program is easily adjusted for the horizontal, vertical, and gray-scale resolution of your screen and printer. This makes it easy to adapt to graphics boards and higher-performance printers. It keeps track of the highest and lowest number of iterations

found in a plot, and scales the gray-scale values accordingly. If the number of iterations is too low to use all gray-scale values, the program will suggest a higher value in the defaults for another try.

For your first run, display the entire Mandelbrot set by accepting the defaults; top=2, bottom=-2, left=-2, right=2, 13 iterations. You'll get a white screen with a ragged "hole" in the middle. Traditionally, the blank regions are points that are members of the Mandelbrot set, at least for 13 iterations.

The border of this region is called the "fractal edge". It has the interesting property of being infinitely long. No matter how much you magnify it, it never smooths out. It's like looking at a map without a scale; is it the outline of a continent, or a glop of mud in a puddle?

Let's investigate the upper left corner. Use top=1, bottom=0, left=-2, right=-1 to expand this region to fill the screen. Is that a hole at the lower left? Zoom in with top=.5, bottom=.25, left=-1.5, right=-1.2. No, it's a bay. Magnify and center it with top=.45, bottom=.35, left=-1.3, right=-1.2. Now we can see there are river tributaries flowing into it. We are now viewing 1/1600th of the original area, yet the fractal edge is as complicated as ever.

Since no point in this region takes less than 5 iterations, not all 13 levels of gray are in use. The program thus suggests 17 iterations for the next try. Accept the defaults to display this region again at higher resolution. OK, let's print it; run with the defaults, but specify "-17" iterations.

Program Details. Lines 340-510 sets up the characters to represent the 13 levels of gray-scale. 3 of them are obvious; black (space), white (reverse video space), and the 1/2-dot fill (graphics "i"). The rest are simply chosen by the number of pixels they illuminate.

This is a judgment call; use whatever looks good to you. For instance, the Superset has 1/4-dot and 3/4-dot halftone fill characters. They could be used for better appearance. You can also change the number of gray-scale elements by just adding or removing elements from the table, and adjusting the variable GRAY accordingly.

The variables HORIZ and VERT in lines 180-190 set the vertical and horizontal resolution of your screen. If you have a Northwest Digital "Graphics-Plus" board, its text mode can display up to 49 lines of 132 characters. Add a PRINT statement to enable this mode, and change HORIZ=132-1 and VERT=49-1 accordingly.

If you have a graphics board, there are two ways to put it to work. Either plot individual dots, or plot groups of dots as halftone "cells".

Individual dots gives the highest resolution, but there's no gray scale and is very slow. Set HORIZ and VERT to your resolution (512x250 for example), and set GRAY=1. Put the commands to plot a dot "on" and "off" in the display array at D\$(0) and D\$(1). This command should also advance the graphics cursor to the next address. Line 270 should also be changed to do the graphics equivalent of a carriage return-linefeed combination. I found I got much better results by creating a variable to save the value of "I" from the last point, and plot a dot

"on" only if it changed, and "off" if the same. This produces "contour" maps, with a border around regions of equal iterations.

A better solution is to define a D\$() array to fill a rectangular cell with various fill patterns or colors. Set XMAX and YMAX to the number of horizontal and vertical cells this yields. For instance, try a 4x4 cell with GRAY=15 and D\$(n) defined to illuminate 0 thru 16 pixels. This plots much faster, and gives a more interesting display.

The printing routines are shown for my Okidata u92 printer, using its downloadable font capability. Lines 760-800 set the printer for 17 characters per inch and 18 lines per inch, for a 132x200 resolution. Lines 810-950 then initialize letters "A"- "M" with a selection of halftone fills. For example, "A" is the fewest dots, "B" has more, etc.

These lines will have to be changed if you have an Epson or other printer. If your printer doesn't have downloadable fonts, then use its all-points-addressable graphics mode. Typically, they print a 1-dot wide by 7-dot high "cell". Initialize the P\$() array for 8 elements having from 0 to 7 dots "on", and set GRAYP=7. Set HORIZ and VERT in lines 760-770 to whatever resolution this yields. Be warned that it will take HOURS to finish a page!

Where Do You Go From Here? There's always room for improvement in speed. Microsoft BASIC is no speed king, but it has the floating-point math required. Compiling it with BASCOM would help tremendously, I'm sure.

Are there ways to optimize the program that I've missed? I avoided GOTOs for clarity, but it actually ran a little faster when I used pretzel logic IF-THEN-GOTOs.

How about writing it in another language? Could C/80, Forth, or Turbo Pascal do it quicker? How about machine code; are subroutines for the floating-point math available?

Fractals are a fascinating way to print pretty pictures. They have also revolutionized computer games. Instead of a sterile maze that must be laboriously created and eats up memory space, you can generate a natural-looking universe that is just computed on the fly as needed.

Imagine an adventure game in which the maze goes on forever, because the dungeon is really the 10th iteration of the Mandelbrot set. A "room" is a point somewhere in the set, and you compute whether there is a door, wall, cliff etc. in each direction by the value of I in that direction.

Games can display a fractal landscape of mountain ranges, seacoasts, etc. Maybe you're sailing a pirate ship along the coastline, looking for villages to raid or ships to plunder. Or you're flying a fighter up a twisting canyon, looking for your target. The possibilities are endless!

Listing

```
10 REM Display/Print Mandelbrot Set on Heath H89,
   (c) 1988 by Lee Hart
20 WIDTH 255: DEFINT I: E$=CHR$(27): PRINT E$;"x1";
   E$;"w": GOSUB 370
30 TOP=2: BOTTOM=-2: LEFT=-2: RIGHT=2: IMIN=1: REM
   initial defaults
40 REM
50 REM ----- GET BOUNDARIES TO PLOT -----
```


Micronics Technology
Suite 159, 54 Dalraida Road
Shipping Address: 410 Bellehurst Drive
Montgomery, AL 36109

Voice: (205)-244-1597
BBS: (205)-244-0192

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Micronics Technology has the H-89 upgrades you need. Increase your operating speed to 4 MHz and disk space to 20 Mega bytes.

SPEED MOD - Software selectable speed, 2 or 4 MHz. The assembled and tested version includes a Z80A, speed card, and software. The kit includes all parts and software, you supply the solder. The software supports Heath, Magnolia, and CDR CP/M systems, plus Heath HDOS. Assembled and Tested: \$34.95

WIN89 - 20 Mega Byte disk drive for the H-89. The hard disk drive is bootable (3 times faster than H-37). The drive is configured for two 8 meg drives and one 4 meg drive. Source code is provided for the BIOS changes and most utilities. The WIN89 adds a PC buss to your H-89 so you can take advantage of the low prices for PC hard disk drives. The interface card mounts on the memory side and is compatible with Heath, Magnolia, and CDR CP/M systems. The Standard ST-225 is 20 meg hard disk with an average access time of 65 ms. The ST-125, available for slightly more, has an average access time of 28 ms. HDOS support will be available by March 89. ZCPR is provided to help manage your increased disk space. We also sell the interface card with software separately. You supply the hard disk drive.

Assembled and Tested with ST-225	\$419
Assembled and Tested with ST-125	\$479
Interface Card	\$175
External Option	\$125

Coming Soon! SmartWatch for the 89! We will soon finish the code the 89 version of the SmartWatch. The price will be only \$39. We also sell DateStamper, file time and date stamper, for \$45.

Perfect Money (\$19.95) - Calculate all your loan costs, number of payments, or any other loan variable. Also handles balloon payments.

Paycheck (\$39.95) - Provides an optimized data base environment to handle your payroll. Prints checks, handles federal and state taxes, tips and much more.

MT Accountant (\$19.95) - Organizes your financial records by account and date. You can edit, delete, add, or browse through each record in the database. Reports subtotal each account, maintain a running subtotal, and print the grand total. You specify which accounts are credits and debits.

Perfect Printer (\$19.95) - Electric typewriter program for your computer. Uses your printers special features and has both immediate and buffered modes. Available for HDOS and CP/M!

ORDER by writing to the above address or calling the above number (6-8 PM M-F, 9-12 Sat, or leave a message). We accept checks, VISA, and MC. Shipping is \$2 except for the WIN89 (\$7). Alabama residents add 8% tax. You can also call our 24 hr BBS at 205-244-0192 (300/1200/2400 8N1). Ask for our free catalog. The BBS features a CP/M file section with UNARC, a program to uncompress files using the popular ARC format. I will gladly add an HDOS section if folks upload the files.

CP/M PUBLIC DOMAIN SOFTWARE

PATCH
(By William Rink)
(Provided by Bob Corbett)

A full-screen file/memory editor written in Turbo Pascal. Can be configured for the H/Z-19/89 terminal, but cursor movement while editing expects WordStar's CTRL-keys. Care is needed during use because the bytes beyond the logical end of a file are not cleared or zeroed on the screen. Features editing in both hex and ASCII. No source code included. Supplied as an .LBR file with the latest version of NULU to extract files from the library. Requires a Z80 and 50K. This package occupies one (1) hard-sector disk.

More from STUDIO COMPUTERS
For both HDOS and CP/M

MATH WIZ
(Written by Ron Clifford)

A mathematics tutor program for elementary and junior high students. Performs ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION while tracking the number of correct answers. Displays a percentage score. Requires an H/Z19/89/90 terminal, MBASIC, and 48K for HDOS, 56K for CP/M.

For HDOS only

CTRL 'P'atch
(Written by Ron Clifford)

Assembly language and/or disk-dump-utility patches for the H24 and H44 printer device drivers under HDOS 1.6 and 2.0 to emulate CP/M's CTL-P switch for sending characters to the printer as well as the terminal screen. Also includes a "secured video mode" (as ACM files), toggled by CTL-K, to prevent display of sensitive information (such as passwords) on the screen while they are being keyed at the terminal. The driver must be LOADED for these patches to be effective. Requires the distribution HDOS 1.6 and 2.0 drivers and either a disk dump utility (such as PATCH.ABS, DUMP.ABS, or UDUMP.ABS) or an editor and the HDOS assembler. Some assembly language experience recommended.

OTHER SOFTWARE

Z80/8080 Assembler for HDOS
(By John A. Curtis)

An assembler for HDOS 2.0 that permits use of Z80 op-codes, though Zilog's mnemonics are not supported. Pseudo op-codes and assembler directives are compatible with the HDOS assembler. Includes full source code and XRF utility. Covers 2-1/2 hard-, two single-sided soft-, or one double sided soft-sector disk(s).

BASGEN Program Generation System
(By James Czebiński)

An MBASIC package for HDOS which can be used to automatically write MBASIC code for file maintenance (FIELD statements, indexing, file I/O, and data handling) and screen functions (cursor addressing, data display, reading data from the screen, and defining fields). Requires HDOS MBASIC and H/Z-19/89 terminal. Occupies one hard-sector disk.

DIAGNOSTIC SOFTWARE

H/Z-37 Floppy Controller Test Software
(Written by Heath Company)

Menu-driven diagnostic disk specifically for Heath's soft-sector controller. Reproduces most of the routines in TEST37 and includes a disk formatting option (required before testing is performed). Expects the soft-sector controller in Heath-standard expansion slots. The operating system on this disk is a modified HDOS, but is invisible to the user when booted. The tests will consume about 3 hours per drive! An inexpensive alternative to buying HDOS 2.0 if you're only interested in the diagnostic. Requires one expendable soft-sector disk for testing. **Not** for hard-sector drives! The material here may **not** be combined with other software on the same disk because of the non-standard operating system. Available in either hard- or soft-sector formats.

H/Z-17 Floppy Controller Test Software
(Written by Heath Company)

A configured HDOS system specifically for testing the hard-sector controller. Includes INIT (for formatting disks), the TEST17 diagnostic program, and sufficient on-disk documentation to use the software. If interested in hardcopy reports, let me know which printer you have and I will **attempt** to provide a driver. No intimate knowledge of HDOS is required. The tests will consume about 1 hour per drive. An inexpensive alternative to buying HDOS 2.0 if you're only interested in the diagnostic. Requires one expendable hard-sector disk for testing. **Not** for soft-sector drives! Other files could be placed on this disk if necessary. Available in either hard- or soft-sector formats.

Updates to Previous Releases
(See fuller descriptions in issue #9)

HDOS 2.0 MANUAL
(Written by Heath Co.)
(Keyed by Daniel Jerome)

Dan has finished keying the following chapters of the HDOS 2.0 manual:

Chpt	Subject	H/S Disks	Cost
Three	DEBUG	1	\$6
Four	EDIT	1	\$6
Five	ASM	2	\$12
Six	BASIC	2-1/2	\$12

There is considerably less supplementary material added by Dan and his SMUGH "team" than in Chapters One and Two. Still in the queue are two addendums for the assembly language programmer. The cost of these is independent of format. Please specify whether you want disk (and which format) or hardcopy (if you have no printer).

Placing an Order

Except where otherwise indicated, your cost for this software depends on what you supply:

Formatted disk(s) and self-addressed, stamped return mailer \$2.00 per disk
Formatted disk(s) without mailer .. \$4.00 per disk
No disk(s) or mailer \$6.00 per disk

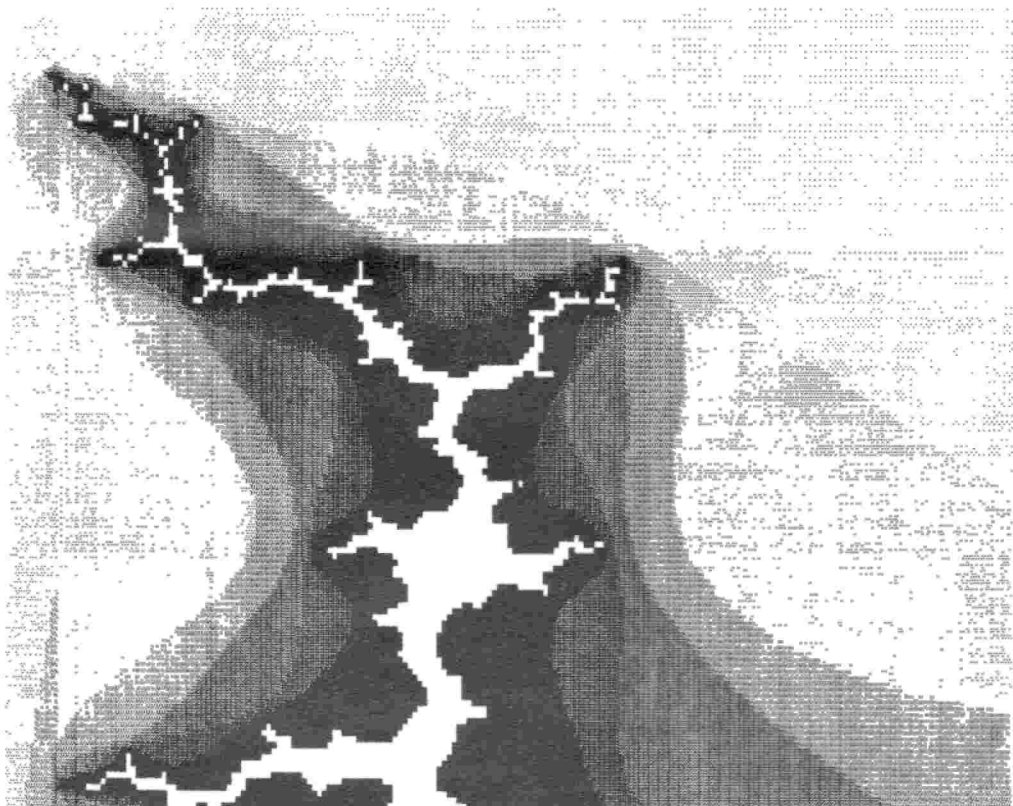
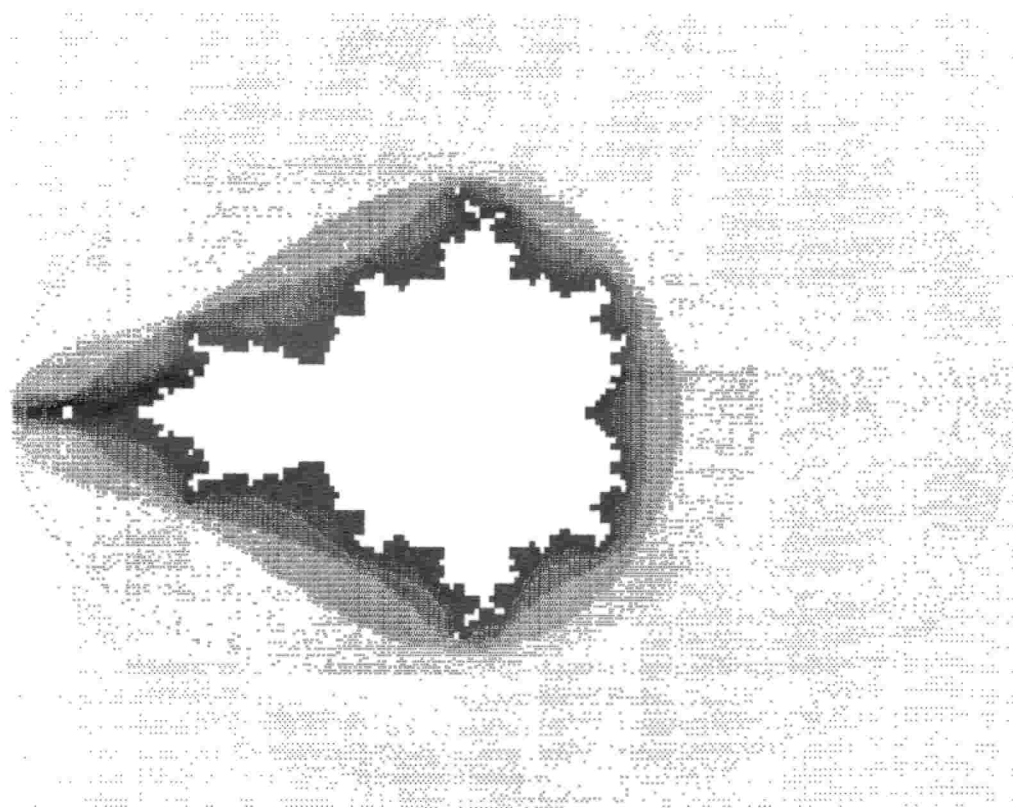
Disk formats available are standard (SS/SD) hard-sector and 40-track (48 tpi) soft-sector, single- or double-sided, for both HDOS and CP/M. Please clearly indicate the format you are supplying or require. If you desire soft-sector, I will pack multiple items onto one disk for the single-disk charge. I will **not** subdivide a disk. Send orders to:

Kirk L. Thompson / **The Staunch 8/89'er** / #6
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52358

These figures, printed on his Okidata, were provided by Lee Hart to accompany the article in this issue. They are photoreduced from the original 8-1/2 x 11.

FIGURE 1 (immediately below): The entire Mandelbrot set using the default limits -- top=2, bottom=-2, left=-2, right=2.

FIGURE 2 (bottom): River valleys -- top=0.45, bottom=0.35, left=-1.3, right=-1.2, 17 iterations.



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```

70 IMAX=IMIN+GRAY
80 GOSUB 320: INPUT; "Y8$", I$: IF LEN(I$)>0 THEN
  TOP=VAL(I$)
90 GOSUB 320: INPUT; "Y85", I$: IF LEN(I$)>0 THEN
  BOTTOM=VAL(I$)
100 GOSUB 320: INPUT; "Y8E", I$: IF LEN(I$)>0 THEN
  LEFT=VAL(I$)
110 GOSUB 320: INPUT; "Y8V", I$: IF LEN(I$)>0 THEN
  RIGHT=VAL(I$)
120 GOSUB 320: INPUT; "Y8m", I$: IF LEN(I$)>0 THEN
  IMAX=VAL(I$)
130 GOSUB 320: PRINT "H";: IMIN=ABS(IMAX)-1
140 IF IMAX>0 THEN IMIN=IMAX-1 ELSE IMAX=-IMAX: GOTO
  760: REM -iterations=print
150 REM
160 REM      ----- DISPLAY MANDELBROT SET -----
170 REM
180 HORIZ=80-1: REM horizontal resolution of display
  device
190 VERT=24-1: REM vertical resolution of display
  device
200 FOR CI=TOP TO BOTTOM STEP (BOTTOM-TOP)/VERT
210 FOR CR=LEFT TO RIGHT STEP (RIGHT-LEFT)/HORIZ
220 I=0: ZI=CI: ZR=CR: ZI2=0: ZR2=0
230 WHILE I<IMAX AND ZI2+ZR2<4
240 ZI2=ZI*ZI: ZR2=ZR*ZR: ZI=2*ZR*ZI+CI:
  ZR=ZR2-ZI2+CR: I=I+1: WEND
250 IF I<IMIN THEN IMIN=I: RANGE=GRAY/(IMAX-IMIN)
260 PRINT D$((I-IMIN)*RANGE);
270 NEXT CR: PRINT CHR$(13);E$;"8";
280 NEXT CI: GOTO 70
290 REM
300 REM      ----- DISPLAY STATUS LINE -----
310 REM
320 PRINT E$;"Y8 Top=";TOP,E$;"Y8 Bottom=";BOTTOM,
  E$;"Y8 Left=";LEFT;
330 PRINT E$;"Y8 Right=";RIGHT,E$;"Y8 iterations=";
  IMAX;E$;: RETURN
340 REM
350 REM      --- INITIALIZE DISPLAY GRAY-SCALE ---
360 REM
370 GRAY=12: REM subscript of last entry in display
  array
380 DIM D$(GRAY+1)
390 D$(0)=E$+"p "+E$+"q": REM brightest
400 D$(1)=E$+"p "+E$+"q"
410 D$(2)=E$+"p "+E$+"q"
420 D$(3)=E$+"p "+E$+"q"
430 D$(4)=E$+"p "+E$+"q"
440 D$(5)=E$+"p "+E$+"Fw"+E$+"G"+E$+"q"
450 D$(6)=E$+"Fi"+E$+"G"
460 D$(7)=E$+"Fw"+E$+"G"
470 D$(8)="#"
480 D$(9)="#"
490 D$(10)="#"
500 D$(11)="#"
510 D$(12)="#" : REM darkest
520 REM
530 REM      --- INITIALIZE PRINTER GRAY-SCALE ---
540 REM      (for Okidata Microline u92)
550 REM
560 GRAYP=12: REM subscript of last entry in printer
  array
570 DIM P$(GRAYP+1)
580 P$(0)="A"
590 P$(1)="B"
600 P$(2)="C"
610 P$(3)="D"
620 P$(4)="E"
630 P$(5)="F"
640 P$(6)="G"
650 P$(7)="H"
660 P$(8)="I"
670 P$(9)="J"
680 P$(10)="K"
690 P$(11)="L"
700 P$(12)="M"
710 RETURN
720 REM
730 REM      ----- PRINT MANDELBROT SET -----
740 REM
750 WIDTH LPRINT 255
760 HORIZ=132-1: REM horizontal resolution at 16
  characters/inch
770 VERT=200-1: REM vertical resolution at 18
  lines/inch
780 LPRINT CHR$(29);: REM select 16 characters/inch
  horizontal
790 LPRINT E$;"%9";CHR$(7);: REM 18 lines/inch
  vertical
800 LPRINT E$;"2": REM enable load special
  character set
810 F0$=CHR$(0): F1$=CHR$(1): F2$=CHR$(2):
  F4$=CHR$(4): F5$=CHR$(5)
820 FA$=CHR$(10): FB$=CHR$(11): FD$=CHR$(13):
  FE$=CHR$(14): FF$=CHR$(15)
830 LPRINT E$;"%AA";F0$;F0$;F0$;F0$;F0$;F2$;F0$;
  F0$;F0$;F0$;F0$;
840 LPRINT E$;"%AB";F0$;F0$;F1$;F0$;F0$;F0$;F0$;
  F0$;F4$;F0$;F0$;
850 LPRINT E$;"%AC";F0$;F0$;FA$;F0$;F0$;F0$;F0$;
  F0$;F5$;F0$;F0$;
860 LPRINT E$;"%AD";F0$;F0$;FA$;F0$;F0$;F0$;F5$;
  F0$;F0$;F0$;FA$;
870 LPRINT E$;"%AE";F0$;F5$;F0$;F0$;FA$;F0$;F0$;
  F5$;F0$;F0$;FA$;
880 LPRINT E$;"%AF";F4$;F0$;FB$;F0$;F4$;F0$;F1$;
  F0$;FE$;F0$;F1$;
890 LPRINT E$;"%AG";F5$;F0$;FA$;F0$;F5$;F0$;FA$;
  F0$;F5$;F0$;FA$;
900 LPRINT E$;"%AH";FB$;F0$;F4$;F0$;FB$;F0$;FE$;
  F0$;F1$;F0$;FE$;
910 LPRINT E$;"%AI";FF$;F0$;FA$;F0$;F5$;F0$;FF$;
  F0$;FA$;F0$;F5$;
920 LPRINT E$;"%AJ";FF$;F0$;F5$;F0$;FF$;F0$;FA$;
  F0$;FF$;F0$;F5$;
930 LPRINT E$;"%AK";FF$;F0$;F5$;F0$;FF$;F0$;FF$;
  F0$;FA$;F0$;FF$;
940 LPRINT E$;"%AL";FF$;F0$;FF$;F0$;FF$;F0$;FF$;
  F0$;FF$;F0$;FF$;
950 LPRINT E$;"%AM";F0$;F0$;F0$;F0$;F0$;F0$;F0$;
  F0$;F0$;F0$;F0$
960 REM
970 FOR CR=RIGHT TO LEFT STEP (LEFT-RIGHT)/VERT
980 FOR CI=TOP TO BOTTOM STEP (BOTTOM-TOP)/HORIZ
990 I=0: ZI=CI: ZR=CR: ZI2=0: ZR2=0
1000 WHILE I<IMAX AND ZI2+ZR2<4
1010 ZI2=ZI*ZI: ZR2=ZR*ZR: ZI=2*ZR*ZI+CI:
  ZR=ZR2-ZI2+CR: I=I+1: WEND
1020 IF I<IMIN THEN IMIN=I: RANGE=GRAYP/(IMAX-IMIN)
1030 LPRINT P$((I-IMIN)*RANGE);
1040 NEXT CI: LPRINT
1050 NEXT CR: LPRINT CHR$(12): LPRINT CHR$(24)
1060 GOTO 70

[If you would like this program on disk, send me one
with a self-addressed, postage-prepaid mailer. I'll
transfer it for you at no charge. -Ed.]

```

QUESTIONS and ANSWERS

Q -- Why in the world does an 8080 assembler work with my Z80 computer?

A -- Because the numerical opcodes used by the 8080 are the same in the Z80. Aside from a subtle distinction or two, the Z80 responds well to the 8080's instructions. The Z80 chip actually has **more** opcodes than the 8080 chip, and the 8080 assembler does lack those extras, but that's a problem of capability, not compatibility!

=====

NEW DEVELOPMENTS IN HDOS 3.0.

By Richard L. Streeter, D.D.S.

Some of you already know that about a year ago I developed a modification to HDOS 3.0 which included what I felt was an improved operating system environment for the HDOS 3.0 user. I had become quite familiar with Soft Shop's SYSMOD and SUPER SYSMOD and missed some of the features with which I had become familiar. About the same time I released this modification, I was contacted by Richard Musgrave (a principal co-author of HDOS 3.0) enquiring about my changes. He asked for the source code for my mods to really see what I had done and offered to share his code in return. I immediately sent him my code on 5 disks and anxiously awaited his reply. Well after quite a few months wondering what had happened, I received his answer.

In my mailbox were three disks containing the new HDOS 3.0. Actually he didn't supply any source but rather supplied the old HDOS 3.0, a revised SYSCMD.SYS, and a new PIP.ABS in object code. Also he supplied a plethora of support programs in the form of utilities which range in usefulness from peculiar to indispensable. (It is nice to see that the fun has not disappeared from computers as it seems to have done with big blue.) Also, and I feel most importantly, he included quite a few TASKS. While I still continue to wait for his promised source code, I was very happy to hear from him with this much more useful HDOS 3.0.

Richard, by the way, remains the only remaining original author of HDOS 3.0. (Bill Parrott is no longer available.) We should all be grateful for his continuing support of an operating system which after all has a very limited user base and as such has to be more a labor of love than an enterprise for profit.

Richard added quite a few features to SYSCMD and PIP, some of mine and some new ones of his. With these changes HDOS 3.0 is much easier to use. For a new user the addition of documentation, which when printed measures about 3/4 inch thick, is most welcome.

A new feature of his system is MegaPIP. Actually MP.ABS is a support program which is a new front end to PIP.ABS and gives a user a powerful multi-capability file manager. (This is one of the things I missed most when I switched from Super Sysmod.) MP uses PIP and the H-19 terminal to do everything from COPYING to VIEWING to DELETING to ... a file in a quite friendly screen-oriented menu driven environment. While at this time its only documentation is within the program itself (in my haste to try it out and only giving the screen a cursory reading I

managed to erase a few files by accident), it is really quite easy to use. I highly recommend it.

SYSCMD and PIP are now rather dependent on the H-19's features and capabilities which is different than from the original versions which were terminal independent. He does support the ULTRA ROM (developed in part by Bill Parrott) which I have found is both a virtue and a vice for those of us who use Lee Hart's SUPERSET/FONT/CLOCK mods. It seems that both SYSCMD and MP see it as an ULTRA ROM and then make some assumptions about the code which Lee did not put into his ROM. This sometimes results in a rather messy screen. When I pointed this out to Richard, he did work out a patch for MP.ABS and I have a patch for SYSCMD which eliminates this problem. I feel though that as long as an H-19 terminal is now almost required for the new version, why can't the 25th line be used more freely? After all, even the stock H-19 had the ability to transmit the 25th line so its former contents could be saved and redisplayed. I have used this feature many times myself.

A really nice addition is an expanded task function. Richard tells me that most of these were written in part by Bill Parrott, a real HDOS wizard. The core of the TASK facility is TMG.TAS a task manager. This program when STARTed becomes co-resident with the operating system and controls other tasks allowing them to be activated, deactivated, and otherwise manipulated by the user. The new tasks include:

ECHO echoes all screen activity to the printer. (Actually it does this too well for me since it also echoes ESCAPE codes which gives my printer fits. I had the source so this was easily fixed.)

KEYS dynamically defines and redefines the special function keys on the 25th line. (Apparently this is why he avoids using the 25th line as a status display.) The special function keys can be enabled and disabled at any time and can add function keys to any HDOS 3.0 program.

SCALL keeps track of HDOS 3.0 SCALLs on the printer. It is a super tool for those just learning HDOS and is rather interesting for anyone who wants to watch HDOS working. It's hard to believe the amount of information it gives you.

CRASH will crash your system when the BREAK key is touched. Not really useful but isn't it neat!

CHAN prints a 25th line display of all I/O channel activity.

BATCH works with JTRA.ABS (a job translator) to allow the implementation of many **very** complex and powerful BATCH jobs from general purpose job library files.

TDU is a **very** powerful terminal debugging utility which allows a user to examine and alter the current state of the CPU. This is rather similar to DDT in CP/M.

SYSMON monitors the system stack for overflows and fatal system error conditions (S.FASER calls). This can be of use to programmers. I used it to

document a bug in SYSCMD which showed its face when a CTRL-C was touched during a PATH search.

Part of the greatly expanded documentation is concerned with writing tasks for use under TMG.TAS. This is very useful to anyone who would like to be a power user. Interestingly, since HDOS30.SYS has not been changed, all TASKs should work under the old version. Richard wrote some one-time base page initialization code into his SYSCMD, which writes zero bytes in unused OAAh. Some tasks use these previously unused locations for flags. The documentation obviously was a real labor of love and not only gives each SYSCMD command and PIP switch descriptions but also gives similar commands and examples of their use. It is a real work of art.

An interesting, and on my early perusal, really powerful program in the package is RESOURCE.ABS. It is a tool to make a new (re) source for any absolute binary program. According to Richard it can be used to produce perfect source code to any .ABS program for all intents and purposes. I plan to explore its use in great detail as time permits.

I originally planned to use this installment to explore some of the advanced features of HDOS 3.0 but with the new release and all its features I couldn't resist this digression. I hope you have found it interesting and informative. (Anyway my hard disk crash trashed my prospective installment.) I hope to receive the source code to this new version shortly and fully expect to be able to work in concert with the few remaining HDOS 3.0 programmers to keep HDOS and especially version 3.0 alive and well and constantly improving. I hope that through the efforts of those like Kirk and **Staunch** it will continue to enjoy a group of active and loyal adherents. In the next installment I hope to catch up with my time schedule.

=====

Q minus A

Q -- With CP/M and a hard-sector controller you can have 3 drives max. Is there a software patch, or any kind of hack to allow 4 H-17 drives on one hard-sector card?

Q -- An answer to this one may give a clue as to how SUPERSET does its thing. Not having SUPERSET, I am curious what CP/M's CTRL-P would do to a daisy-wheel printer when displaying, say, Greek characters on the screen?

=====

VENDOR UPDATE

Derby Utilities Update. [From William S. Derby]
"The Enhanced Derby CP/M Utility Programs will soon be available. A fast and flexible SCAN program has been added to display any part of any file in hex or bcd mode with simple single-keystroke commands. Searching for hex or bcd patterns or symbols in absolute or case sensitive modes is allowed for a single file or across all files. The program decides the appropriate mode of display for each file unless it is told otherwise. It also properly displays files with any combination of carriage control characters, and long lines are split at 80 columns. Printer and destroy facilities are provided, and any

function can be instantly interrupted.

"With no increase in the total disk space needed by the earlier programs, several features have been added. The SUB submit facility is unchanged except for the default prompt character. The SD and CMP programs have been merged into a single CSD program to preserve space with the added features. COPY is merged with PIP so both files need not be present.

"The directory listing features can now be requested for any subset of files for any or all user numbers on the disk. Any combination of row or column and of alphabetic, directory, or extension order is allowed. The default is alphabetic by column, but this can be configured in any form; also the file names can be listed left adjusted or conjoined. The compare facility now accepts an ambiguous file specification to compare several files, and a checksum capability has been added.

"The COPY program is merged into the unused space of PIP (with a simple installation program needed only once). The resulting program accepts either PIP or COPY command lines. Its key additional feature is the ability to copy files from any user number to any user number.

"The programs work on the H89 or any CP/M 2.2 system; all but SUB work on a CP/M 3 system (e.g. Commodore 128), and all work on the HUG CP/EM emulator. The complete package is available for \$25.00 (this includes postage/handling, and is only \$15 to update from the earlier package). Questions about the programs, and orders indicating disk format should be sent to the author W.S. Derby - PO Box 2041 - Livermore, CA 94550. He can also be reached at (415) 443-1741 after 6:00 PM/Pacific Time."

Lindley and NEW Printer Drivers/Utilities? I was very pleasantly surprised by a phone call early in February from William Lindley (Lindley Systems, 4257 Berwick Place, Woodbridge, VA 22192, 703-590-8890). You readers responded enough to the note about Lindley Systems included in issue #8 that he is interested in writing more software for CP/M and HDOS. He specifically asked what I thought readers might be interested in. Since I know he specializes in printer drivers and utilities, I suggested some for the newer 24-pin printers. We also talked about HDOS 3.0 and I sent him the seven-disk distribution set so he could look at the device driver source.

In his follow-up letter, he added that he is updating his "Ultimate" and "UPC" drivers for HDOS 3.0. And he also sent source and object code for a task to read the clock built into the SUPER-19 terminal ROM chips.

So if you're interested in the newer printers, write or call Bill. Let him know what models you're considering, operating systems you will be running them under, and what you would like to do with them. For Bill to proceed with development, he **requires** input from you! **Do it today!**

And need I add that he (or any other vendor) would not find the prospect of piracy encouraging?

Micronics. You'll find an ad from Micronics elsewhere in this issue, but Darrell Pelan added the following in his cover letter: "I thought I would pass on the solution to a nasty little bug that consumed the better part of a day to fix. My H-89

started to die at odd intervals and sometimes wouldn't boot at all, even though the terminal seemed fine (it displayed what was typed when off-line). I wiggled all the wires and it seemed that the serial cable connecting the CPU and the terminal was bad. A quick swap killed that theory. So I swapped CPU cards--same problem. Next step was to take all the goodies out of the 89. Out came the H-37, serial card, H-17 and WIN89 card. Same problem!

"The only thing left was the Terminal Logic board. Since the terminal portion seemed to work, I figured it might be the 8250 serial chip. A quick replacement showed that I had a worse spare--but when I bowed the pins on the original chip to re-install it, it must have fixed an intermittent contact problem between the chip and socket. Everything is back working fine.

"I've expanded the BBS with a second 30 meg hard disk. I have some new CP/M files on the system and am willing to start an HDOS section if there are some uploads and interest. [Check Darrell's ad for the phone number of the BBS. -Ed.]

"The price on the WIN89 is down to an all time low of \$419. I am now offering the faster ST-125 with the WIN89 for just \$479."

In follow-up letters, Darrell added: "I started a regular conference [in C01] on CompuServe for 8 bit users, with Joe Katz's prompting. It starts at 7:30 PM EST every Sunday and runs as long as people join in to chat. Pass the word. CompuServe is willing to increase support in terms of library space if the number of uploads and downloads increases."

And "Micronics Technology will begin selling a new modem program for both HDOS and CP/M that supports XMODEM file transfers, text capture, and a split screen for conferencing. The split screen allows you to type your message without interruption from incoming traffic. The price is a low \$14.95 and ... will be available by mid March."

Turbo Pascal. Borland International's Pascal for CP/M apparently hasn't died, as I thought it had! As I was assembling this issue, I received a package from reader Ben Violette. He bought Turbo ver. 3.0 from **Alpha Systems Corp.** (711 Chatsworth Place, San Jose, CA 95128, 408-297-5594) and it came on soft-sector disk. I was happy to perform a media conversion to hard-sector for him. Ben also mentioned that the documentation is now supplied for a 5-1/2 x 8-1/2 binder, but no binder is included. I also gather from the label on the distribution disk that Alpha has assumed support for the package.

Software Toolworks. Regrettably, the news from here is not good! Reader Richard Goode called them in mid-January and was told that PIE 1.5 editor, TEXT 4.0 formatter, and the REACH modem program are no longer available. Fortunately, there are a number of editors, formatters, and modem programs for both HDOS and CP/M in the public domain which can fill this gap. I'm working on the problem and hope to have alternate public domain software for both HDOS and CP/M available through **Staunch** shortly. So keep your eye on these pages!

Soft-Sector Disks. Dan Jerome sent me a note recommending **MEI MicroCenter** (11 Steelwood Road,

Columbus, OH 43212-3972, 1-800-634-3478) as a source for generic soft-sector floppies. Pricing is around 25 cents each for "premiums" with a 100-quantity minimum order and 49 cents each for "hi-densities", 50 minimum order. He has also found that "QUILL" brand disks (from various commercial sources) are unreliable on 96 tpi drives, but OK at 48 tpi.

Drive Source. And James Schmidt sent a brochure from **jb Technologies** (21011 Itasca St., #F, Chatsworth, CA 91311, 818-709-6400) giving prices for new, unused, and refurbished floppy disk drives. Prices are indeed exceptional and the Siemens FDD 100-5's he ordered for \$29 apiece (!) checked out fine. But he added that jb charges \$10 for shipping and a 2.5% charge-card fee.

Disk Controller Close-Out! (From Henry Fale, Quikdata, Inc., P.O. Box 1242, Sheboygan, WI 53082-1242, 414-452-4172 [MC and VISA accepted]) "Please be informed that Quikdata, Inc., the sole remaining source of a complete line of products for the Heath/Zenith 8-bit machines, and the oldest independent H/Z vendor in the business, has lowered the price on the double density controller boards for the H/Z89/90 and H8 computers. The H89 H37 double density disk controller board has been reduced to \$175 without ROMs and power supply upgrade (not needed except in early systems). The H8 WH8-37 board (which is both an H37 double density controller and a hard disk host adapter card) has been reduced to \$275. Both are completely assembled and tested and include board, HDOS diagnostics software and manuals. We also have some bare boards available.

"If you have ever been thinking of adding a soft sector controller board to your 8-bit machine, now is the time to act! We at Quikdata have decided that when our current very limited quantity of these stock boards are sold out, they will be gone for good. Because of the slow down in sales ... we do not plan to make another production run. There is still plenty of life in these systems, and if you have been considering upgrading to a soft sector controller board, now is the time, while there are still some left." [Strongly recommended! -Ed.]

THE STAUNCH 8/89'er, created by Hank Lotz, is a bimonthly newsletter on 8-bit H/Z computers. The editor is Kirk L. Thompson; #6 West Branch Mob Hom Vil; Route 1; West Branch, IA 52358; home: 319-643-7136. Subscriptions always start and end with the calendar year. Rate: \$12.00/year (overseas, add \$4). Single copies: \$2. Make checks payable to "Kirk L. Thompson". **Staunch** pays authors for their articles; write for an author's guide. It also accepts commercial ads for a modest fee; contact the editor. Neither this newsletter nor its editor is responsible for damages or losses resulting from use of any information presented herein. Info from **THE STAUNCH 8/89'er** may be reprinted only if this publication's name and address is included. Credit should also be given to authors and other sources of said material, if known. This publication is archived by the University of Iowa Libraries. CP/M is a registered trademark of Digital Research, Inc. REMark is a registered trademark of Heath/Zenith Users' Group. EOF