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PORT TO PORTAL -- Editorial

The first thing I **must** do is to apologize to you for the tardiness of this issue! Here I told you I was back on the old publishing track in the last issue, and now I'm off it again! The only excuse I can give you is that my dear old Diablo 630 daisy-wheel bit the dust about a week after I put that last issue in the mail. Now the 630 is an "industrial-strength" printer--this is only the **second** time I've taken the thing into the shop in the ten years I've had it--but even industrial-grade equipment can act up. And such happened to mine.

Indeed, as I write this (in mid-February), it's still there! And I must express profoundest thanks to Hank Lotz for printing camera-ready copy for this issue. Without his timely assistance, you certainly wouldn't have had the issue this speedily!

I have a few other things to discuss, as well. First off, I still have four copies of WordStar 4.0 in stock. Indeed, I was able to do more with the package than I reported in the last issue's Software List. Besides a patch to bring up the keypad and function keys, I've added labelling of the latter on the terminal's 25th line. Further, to help you remember the key assignments, I'm including one of my keyboard overlays (K0-19) in the package. You may use this to label the keys with the definitions provided by my patch or one of your own. I'll also be discussing how I developed the patch I supply in a two-part article later in the year.

And speaking of software, my acquisitions are looking much better. For example, you'll find the first of a bunch of packages for CP/M just released by Generic Computer Products of Marquette, MI. (Thanks are due David Powers of GCPI for this.) Over the next several issues, I'll be listing others that Dave has furnished to me. However, Dave Powers wrote software for both HDOS and CP/M that he has lost copies of. Some of this was released to me by Studio Computers of Birmingham, MI, and is listed on issue #9's insert. Other programs have completely disappeared. You could help other "staunch" '8/89 users and me out if you would look through your software collection for other titles by Dave. Most of these were sold under the "Generic Software" or "GCPI" labels. Send me a list of what you have and I'll pick out those I don't already have for future general distribution.

Third, I was hoping to include a subject index for the last two years in this issue. Regrettably, there simply hasn't been enough time to complete it. I expect to have it for you later in the year. One thing, though, has helped index preparation. While preparing the index in the insert for issue #16, I **thought** I had encountered a bug in the indexing software I was using. With the files I've already produced for the coming index, I've discovered that the index formatting program requires **lots** of memory. It was hanging two years ago because I didn't have enough TPA! Knowing that will greatly simplify the task. And I owe the find to the installation of WordStar 4.0 on my index preparation disk.

Finally, you'll find one additional item of interest at the end of the Software List. I've procured an Iowa State sales tax collection permit. This will help me **reduce** costs for a number of my **Staunch**-related expenses. And fortunately, sales tax isn't applicable to the newsletter itself, **only** to software and accessories (such as back issues). So if you live in Iowa and order anything **other** than the **current** year's newsletter issues, you'll have to include 4% tax.

Kirk L. Thompson

THE EIGHT-BIT R/W -- Letters

H-8 Speedup [From Pat Swayne, ZUG Software Engineer, Benton Harbor, MI 49023-0217] "Concerning the letter from Bernard L. Waltuck in the July-August issue of **Staunch** (just happened to come across it while cleaning up my desk): I did a speed up mod for the H-8 with the Z80 board way back in the March 1983 issue of **REMark....**"

Commentary on the Last Issue. [From Tim Zmudzinski, South Bend, IN] "Just a few thoughts on recent issues of **Staunch**. I welcome the hardware fix-it series. I say this because I've just spent a few weeks off and on trying to revive one of my '89's. The article on the power supply was great.

"I had an '89-A that wouldn't reset. One beep on power up and no prompt. I found a bad choke on the CPU board and wound up replacing a few chips in the power-up and reset circuit. This, of course after much trial and error. So much of the work involved in keeping these machines running is spent in learning. That is the fun I suppose. For this reason I welcome any information on hardware operation or maintenance.

"Peter Shkabara wonders where to direct his future attentions. Let me first thank him for his past articles on CP/M. This guy's a wealth of information and we're all the wiser for it. But I'd hate to see too much space being spent on DOS. I agree that many have moved over to other machines, and some kind of 'transition' articles will be of value. I recently got into Macintosh. But I wouldn't look to **Staunch** for help in that area. There are plenty of other sources for that. Henry's **H-SCOOP** is one that comes to mind. Personally, I find myself looking for basic information on how these '89's of

[Continued on p. 3]

SOFTWARE LISTING

On-Disk General Software Catalog

A catalog of **Staunch** software is available. Initially prepared by Ralph Money, the disk files include listings for both HDOS and CP/M. If you wish to combine the catalog with other offering(s) on the same disk, the files will be "squeezed" to conserve disk space and an unsqueezer provided to recover them. This catalog now **requires** two (2) disks in standard hard-sector, one (1) disk in any other format. See the "Placing an Order" section, below, for supported formats.

Source Code in this Issue

If this issue includes any source code, be it BASIC, Pascal, C, assembler, or whatever, you may obtain it **at no charge!** Merely send a **formatted** disk with a **postage-prepaid** mailer and I'll transfer it for you. Please clearly indicate the format you are supplying. See below for supported formats.

FOR CP/M ONLY

These next three packages have just been released by Generic Computer Products, Inc.
(My thanks to David Powers of GCPI)

STOCK-MASTER

A Stock Market Investment Aid
By GCPI (P.O. Box 790, Marquette, MI 49855)

STOCK-MASTER is a stock market investment aid which is especially useful for the management of stocks and mutual funds. This package is for the casual investor who does not have the time to become familiar with all aspects of the stock market, but who needs effective buy and sell advice. **STOCK-MASTER** takes a conservative approach to stock investments, with an emphasis on obtaining consistent returns.

This software is completely menu-driven for ease of operation. Multiple stock funds can be tracked on a single disk. Indeed, any number of stocks or mutual funds can be handled by the program. **STOCK-MASTER** does not limit the size of transaction data files. This limit is determined by your disk drive storage capacity. With **STOCK-MASTER**, the user may check the status of any active stock fund, add a buy/sell transaction to any stock fund, or obtain a listing of the transaction log for any fund. Transaction log listings may be directed to the user's console, a line printer, or to a disk file.

STOCK-MASTER can be used on a periodic basis to obtain timely buy/sell instructions. The program provides recommendations as to how many shares to buy or sell, but you make the final decision. The software is easy to use, yet an effective investment tool for stocks and mutual funds.

STOCK-MASTER requires the following: any CP/M-80 ver. 2 computer system, 48K RAM, and a line printer device for listing output. If you are also running MS-DOS (including Z-DOS and PC-DOS), a compatible product is still available from GCPI for \$50.

The disk files supplied with the product include documentation, BASIC source code for the Heath and Epson QX versions, plus executable .COM programs for H/Z, Kaypro, Epson QX, Televideo, and ASCII terminals. This package requires 244K of disk storage.

FOOTBALL: A Fast-Action Game of Skill
By Thomas Llanos

FOOTBALL is a video game that can be played by one or two players, and challenges your skill against a computer-controlled defense. This fast-action game allows you to run, pass, or punt the ball and even try for a field goal! An entertaining halftime show is presented as you plan your second half strategy. With nine skill levels, **FOOTBALL** provides the novice and the experienced player with hours of challenging enjoyment.

FOOTBALL requires: 48K CP/M-80 and the H/Z-19/89 terminal. If you are also running MS-DOS (including Z-DOS and PC-DOS) and want color and sound, a comparable product is still available from GCPI for \$25. This package includes the game program, documentation, and BASIC source code. It requires 88K of disk storage.

TPRINT/TCOUNT

By U-WARE

TPRINT is a flexible text file printing program which allows selected portions of your file to be listed. It is command-line driven and provides you with on-line help so that the utility can be used without reference to the manual. **TPRINT** also provides for multiple copies and single-sheet feeding.

TCOUNT is a text file summary statistics program providing you with character, word, line, and page counts. You have control over what characters are considered to be word delimiters. This utility is a necessity for authors and other people that need to know how many characters or words are in a document.

TPRINT and **TCOUNT** will work on any CP/M-80 V2.2 or higher system with 32K of RAM. **TPRINT** will work with any printer. These utilities will process a text file of any size. They will not generally work with special word processing formats. However, most word processors provide an option to generate ASCII text output which can then be processed. This package requires only 40K of disk storage.

FOR HDOS ONLY

Tweedy Systems Public Domain Files
(Provided by Dan Jerome)

This collection is an **extremely** large set of .ABS and BASIC programs, text files, assembler source and .ACM's, utilities, device drivers, games, and picture files that you can dump to your screen or printer. A detailed description isn't possible here, but these are highlights:

GENDW

A program to convert .ABS to DW (Define Word) files before transfer to BBS's or other computers; recover .DW files with ASM.ABS.

- PLANTS** A B.H. BASIC program for selection and care of house plants, by Haywood Nichols.
- Tiny Pascal** The original version for HDOS as distributed by Jim Teixeira of The SoftShop; the package in the last issue is a considerably enhanced version of this one, though you may find this one useful for compiling older Tiny Pascal program source; included is a "Towers of Hanoi" game.
- Games :** SWARMS, Backgammon, Life, ATOM20/40, several versions of Oregon Trail, Pinball, Star Wars, Starship, a simple DND, and many more, all requiring B.H. or MBASIC!
- SAVEFILE** Program to recover files embedded with a bad sector; only for hard-sector; in .DW format.
- BADSECT** Program to mark bad sectors out of a disk's free sector chain; only for hard-sector; in .DW format.
- DISKUSE** Program to list files, sector allocations, free-chain, and bad sectors; only for hard-sector; in .DW format.
- VERIFY** Disk structure report program more sophisticated than DISKUSE; for either hard- or soft-sector; a run using the /ALL switch can generate an **extremely** voluminous report (up to 115 pages on a well-filled, DD/DS/48-tpi soft-sector disk); in .DW format.
- SATL** A BASIC program to help you aim your satellite disk.
- BASIC Programs :** A large set of financial, trig., algebraic, statistical, and utility programs from Poole and Borchers's two-volume **Some Common BASIC Programs**.
- Pictures** Frosty the Snowman, Horse, JFK, Santa Claus, Snoopy, others.

This description is only a sampling! This package includes 220 files and requires 3750 sectors of disk storage! If you can only handle standard hard-sector, I will "preprocess" even disks you send me (to reduce the size of DIRECT.SYS) to stuff more files on the ten disks required. Even if you have the benefit of 96-tpi DS soft-, this package will require two full disks!

SOFTWARE UPDATE

WordStar 4.0

(Originally announced in issue #26/27)

Besides the function key and keypad patches announced for this package in the last issue, I also managed to add display of the function key definitions on the terminal's 25th line. So you may install my patches or do your own. As well, I'm including one of my keyboard overlays (KO-19) so you can label the keys as you wish. I'll be running a two-part article later in the year on **how** I designed and installed my patches. Further, I **still** have four (4) copies of this package at the originally-announced price of \$60, shipping included; check the last issue for a fuller description.

Placing an Order

With the exception of **WordStar 4.0**, 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) or double-sided (DS/SD), 48-tpi hard-sector and single- or double-sided, 48- or 96-tpi soft-sector for both HDOS and CP/M. **Staunch** only supports 96-tpi soft-sector if you supply a **formatted** disk; if this is a problem for you, please let me know (I'll flex a bit). If you do **not** have an H/Z system available, **Staunch** also supports **many** CP/M-80 formats, but (**only**) in 48-tpi (40-track), such as Osborne, Kaypro, and Televideo, as well as PC-XT. If you don't see what you need described here, let me know what your requirements are, giving alternatives if possible. Please **clearly** indicate the format you are supplying or require. If you desire DS hard- or any soft-sector format, I will pack multiple items onto one disk. I will **not** subdivide a disk. Send mailorders to:

Kirk L. Thompson / **The Staunch 8/89'er** / P.O. Box 548 / West Branch, IA 52358

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THE EIGHT-BIT R/W (Continued from p. 1)

ours do what they do. And I'm more interested in keeping them working than learning about a new operating system; at least as far as **Staunch** is concerned. Granted, mine is probably a minority view. I have yet to find the need for a DOS computer. The only reason I was drawn to the Mac was because it looked like FUN. And that's the reason I got interested in computers in the first place.

"I'd also like to add my name to those wanting to see a portable '89. Software compatibility with my '89 and future memory expansion would be things I would like to see. And certainly an 80 x 25 display. "I came across a catalog from GLOBAL Computer Supply. They are advertising hard-sector disks, (3-M/Verbatim). I haven't followed up on this, but am merely passing on what I have read. Their phone numbers are 1-800-845-6225 for orders and 1-800-227-1246 for customer service."

[From Dan Shrager, Dowagiac, MI] "The H-89 p/s article [in the last issue] looks good. I'm having trouble after about 2 hrs of operation. Will try it as soon as possible."

[From Julian S.H. Loui, Framingham, MA] "I like your publication very much. I think it would be a great idea for someone to market a laptop H-89 if the price is reasonable; I myself may want to buy one."

HMODEM Bug. [From Nelson Howard III, East Derry, NH] "I did manage to get a hold of Harold Maney, author of HMODEM II, and discovered that there is a problem in the Z-Modem transfer [protocol] on version 2.1.07 (the one you have and I had too). He

has sent me an update, but I haven't had time to check it out yet. Also, he would be happy to send you Source Code (he made the offer to me, but I don't have the technical skills or time to really do anything constructive with it, so I asked if the offer could extend to **Staunch** and its readers, and his answer was yes). I hope to be able to get the update off to you with some comments before mid-January, along with [a] software order.

"Must say that issue 26/27 was grand, and I sure hope you keep getting all those good articles from Pete Shakabara, Lee Hart, Dan Jerome, and, of course, Hank Lotz." [Thanks for the bug report, Nelson. I've written to Harold Maney expressing my interest in the source for HMODEM II. When it arrives, I'll include it with the original package (introduced in #18, p. 2) and/or the update from you and announce its availability. -Ed.]

Moving from MSDOS to CP/M. [From Tom Stenzel, Detroit, MI] "Thanks for doing such a good job in the face of seeming abandonment of the H-89. I note that in your last **Staunch** that there was some discussion of articles concerning moving from CP/M to MS-DOS machines. Some of us are going the other way—I'm ready to sell my Z-181, as the only thing it does that my H-89 doesn't is run BANNERMANIA.

"Anyone using VDE and wanting to contact Eric Meyer should know his address as of 4/90 is (was):

Eric Meyer / 401 12th Ave SE #139 / Norman, OK 73071

and not what's in the 266.UPD file. Anyone who must move on to MS-DOS should get the PC version of VDE. It works the same and is enhanced considerably.

"One of the things we readers need to do is send in address changes of shareware authors that request registration + fee." [Thanks for the address update, Tom. And you readers continue to be the best source of information I have! -Ed.]

Drive Conversion. [From Ben M. Fujita, La Puente, CA] "I pretty much read the '89'er from the first to the last page and enjoy not only the technical articles but also the human interest (your vocational changes) side of the publication.

"I know that the 8-bit machines are out (mainly because others can be manufactured for the same price) but still use several in my semi-business. Perfectly usable for word processors and spreadsheets and in small business.

"For your information, I have reconverted all my drives from 80 to 40 track, using 360K, now out-of-favor drives which I pick up for less than \$10.00 each, used. I install two half-height drives in place of the old full-height drive. I found that on some machines the radiation to the disk area is just too much and that I cannot get reliable operation no matter how much shielding and grounding I do. So I have thrown in the towel and converted.

"I have also abandoned HDOS, mainly because of better compilers under CP/M. However, I still keep an eye on HDOS ver. 3.0 and other developments.

"Please keep up your **Staunch** work. I know that getting articles is getting difficult and since I have been programming for about 15 years (word processors and spreadsheets), I may send you [an] article or two if time permits." [Thanks for your

remarks on 80-track drives, Ben. I haven't suffered that problem myself since my one and only such drive is in an external cabinet. As for articles, I'm **always** open to new submissions; you may have noticed that I haven't printed too many from that list of **REMark** articles I have permission to reprint. That's mainly because new stuff is **always** more interesting than old info. So by all means, send something! -Ed.]

Multitasking Series. [From David A. Shaw, 11059 Overrun Drive, Manassas, VA 22111] "I received and enjoyed **Staunch** #26/27 the other day. Call it big ego (my wife does), but I do enjoy seeing my name in print! To that end, I'm going to subscribe to one more year; check enclosed. I want to see the whole multitasking series in print.

"Note that I'm still willing to field any questions and/or comments that you might receive. Send 'em along, and I'll both answer the author directly and send a copy to you for inclusion in the newsletter as you deem it appropriate.

"Mr. Wing Hong Ho wrote me a few weeks ago to tell me that my old H-8 had arrived in Hong Kong. It was somewhat the worse for wear; I guess I didn't pack it as good as I had thought, and it suffered some physical shipping damage. But he was able to repair it using a vice and some epoxy (rough stuff for electronic equipment!) and has since been able to get the old war horse working. I don't know what they are actually doing with it now. Perhaps if you correspond with him he might be prevailed upon to send a brief report.

"With the exception of the H-8, I still have all that Heath equipment that I advertised for sale in **Staunch** last winter [#20/21, p. 22]. This includes the three double-sided 40-track (200 Kbyte) disk drives in the H-17 enclosure and the H-19 terminal. I also still have the Diablo 630 printer. If no one wants them, I'm going to try to find a school that can get some use out of them. The equipment isn't doing me any good, and I am willing to donate it to a good cause." [I'm glad you enjoyed seeing your name in print, Dave. **REMark**'s loss is **Staunch**'s gain! And thanks for repeating the offer to "consult" about multitasking questions. As for your Diablo 630 printer, readers should know that I've already put my name in for it as a "back-up" to the one that's still in the shop! -Ed.]

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Troubleshooting the '89, Pt. 2

The H-89 Keyboard Module

By Dan Jerome, with Kirk L. Thompson

INTRODUCTION. This article is applicable to the keyboard module for the H-19, H-88, H-89, H-89A, Z-89, or Z-90. The same keyboard with minor variations is used for each of these models. For example, the keys on the H-88 are a tad heavier to press. Physically they all look the same. The keyboard is the computer module which generates data input which the computer processes.

Many H-89 users have shared with me that they think the keyboard is an excellent one. It has a nice "feel" to it as your fingers tap the keys. If you are a touch typist, you can certainly agree with that statement. If you are not a touch typist still

you probably have noticed that the keyboard has a "pleasant" feel.

With this article, we are going to examine it at close range, and we hope that the new knowledge will be a big help to you.

Physical Description. The H-89 keyboard has 84 keys that are clustered in four functional groups, as follows:

(A) The Standard Key Set - The standard key set of 47 keys display the 26 characters of the English language alphabet, numbers, and symbols. To produce lower-case alphabet or number keys, shifting is not required. However upper-case letters and symbols require shifting. To do a shift, first press one of the two SHIFT keys and then type the desired key.

(B) Numbers from 1 through 0

(C) Letters from A through Z

(D) Standard H-89 "Zingbat" symbols: ("Z" for Zenith) - Exclamation point (!), at-sign @, pound sign (#), dollar sign (\$), percent sign (%), caret (^), ampersand (&), asterisk (*), open parens ((), close parens ()), underscore (_), and dash (-), plus (+) and equals (=), tilde (~) and back apostrophe (`), square brackets ([]), vertical split line (|) and back-slash, caps lock, colon and semicolon, quotation mark and forward apostrophe, curly braces, less than (<) and comma, greater than (>) and period, question mark, and finally forward slash.

NOTE: The combination of SHIFT-RESET is only available using the RIGHT SHIFT key. If you attempt to use the left SHIFT key in combination with the RESET key, nothing will happen.

CAUTION: Using SHIFT-RESET may result in data loss if one is not careful! Be sure to save any file you are working on first before issuing this key combination.

(E) There are ten programmable function keys: f1 through f5, ERASE, BLUE, RED, WHITE, and BREAK. Though the last is not usually listed as programmable, it **does** send a unique code (ASCII 00hex, otherwise known as NULL, NOP, or ^@) to the CPU board. You can see this at the CP/M prompt when you press the key.

(F) There are sixteen keys that do not normally display on the screen, but nevertheless are important to computer functioning. This set includes:

OFF-LINE, ERASE, RESET, BREAK, ESC, BACKSPACE, TAB, LINE-FEED, DELETE, CTRL, CAPS LOCK, RETURN, SCROLL, LEFT SHIFT, RIGHT SHIFT, and REPEAT.

(G) Finally, the keypad has twelve keys. These keys include the following:

IC (Insert Character) and NUMERAL 7, UP-ARROW and NUMERAL 8, DC (Delete Character) and NUMERAL 9, LEFT-ARROW and NUMERAL 4, HOME and NUMERAL 5, RIGHT-ARROW and NUMERAL SIX, IL (Insert Line) and NUMERAL 1, DOWN-ARROW and NUMERAL 2, DL (Delete

Line) and NUMERAL 3, NUMERAL ZERO, KEYPAD DOT, and ENTER.

The above keys are programmed in their default (power-up) modes as described above by the computer design, but **application programs may override** them. Therefore, key assignments are not "cast in concrete." Keys that are most subject to change are the function keys (f1 through f5, ERASE, BLUE, RED, and WHITE) and most keypad keys. A good example of this is in EDIT19, where the function keys are user-programmed via the macro EDIT19.PRO [see *Staunch* #13 (p. 8) and #15 (p. 5)]. Here, the keypad key NUMERAL ZERO sends the cursor down 20 lines, and the DOT key sends the cursor up 20 lines, while the ERASE key toggles from the edit screen to the command screen. [An article describing how to program function and keypad keys for WordStar 4.0 will appear later in the year. -Ed.]

If you are a programmer for either CP/M or HDOS 2.0 or the advanced version, HDOS 3.02, you will need information as to what sort of signals each keyboard key ordinarily transmits. This information is to be found in the case of the H-89A, in the Operations Manual Pages 11-7 through 11-26. Each of the different versions of the H-89 include this data somewhere within their manuals. In case you do not have access to this data and require it, please do not hesitate to send a self-addressed long standard envelope to Kirk Thompson or myself and either of us will be happy to provide you with photocopies of the data you need.

Summary of Related Parts. Essentially the keyboard module consists of the keyboard assembly, the 34-pin flat cable that connects the keyboard to the Terminal Logic Board (hereinafter called TLB) and certain microcircuits that are mounted on the TLB. These chips are given in Table 1 [at the bottom of the following page].

The Terminal ROM, like all ROMs, is a special part and these days the best way to replace it is to cannibalize good parts from a second, spare H-89 or write to Kirk Thompson for help.

In the case of the Z80 this chip is rated according to the computer clock speed it can handle. Thus, Z80 is rated for 2MHz, Z80A is rated for 4MHz, etc. In the real world, often the parts can handle greater speeds than they are rated for.

The majority of these parts may be purchased from mail-order companies such as JDR Microdevices, Jameco, etc. ROMs are in a different category, since each part must be binary-coded according to a "secret" Heath pattern. Further, it is profitable to replace certain chips with CMOS chips, since these draw less current from the circuit and therefore cause your computer to have a longer serviceable lifetime. Replacement chips are very reasonably priced.

For details concerning replacement CMOS chips for the TLB, refer to *Staunch* issue #20/21, September/December 1990, page 6.

For details concerning the keyboard module schematic, refer to *Staunch* #22/23, January/April 1991, page 12.

Theory of Operation. As you learned above, the keyboard circuit consists of 84 keys. Each key is

essentially a single-pole, single-throw switch in a matrix-type circuit which is continuously scanned by U444 on the TLB, the Keyboard Encoder. This chip uses binary signal data to generate a unique binary code for each binary signal developed at each matrix intersection. The encoder sends a data strobe to U448. This signal is passed to U447 and then coupled with the microprocessor.

The keyboard interrupt routine reads the status of the Control Key, both Shift Keys, Repeat Key, Break Key, Off-Line Key, Caps Lock Key, Data Strobe, and Data Bit Latch in U448, section B.

The ROM program uses this information in conjunction with the Keyboard Encoder data to determine the routing of the data within the TLB. The binary data outputs of the Keyboard Encoder drive the address inputs of U445 (Z80) and the processor converts binary data to ASCII data.

When the computer is first turned on the ROM program must program U452 for baud rate and parity. The program then interprets the data and configures the ACE circuit accordingly. ("ACE" is defined as the Asynchronous Communication Element.) The TLB talks to the outside world through EIA and RS-232C compatible-line drivers and receivers. That is, the ACE, U452 converts parallel ASCII to serial data and the communication line through Line Driver U453. The ACE also converts serial data coming from the line receiver U454 into parallel ASCII data. The ACE puts this data on the BUS, when told to by the Z80.

Finally, the ASCII signal is sent through the Z80 processor, which analyzes it and determines how to process it according to the built-in ROM program. Signals flow through the Video Circuit Board, the Video Driver Board, and to the CRT (cathode ray tube), to be displayed.

COMMON KEYBOARD PROBLEMS AND HOW TO FIX THEM. This section lists common keyboard problems in order of those most likely to happen.

(1) **PROBLEM: KEYS STICK OR STUTTER** When you are typing there are times when one or more of your keys stutter - that is, repeats displaying the same letter on the screen when you don't want it to. This is a common problem and the cause can be one of two things, an off-center spring inside the key or corrosion rearing up its ugly head. The latter causes increased resistance between the "tines" of the contacts to the point where no electrical

contact is made.

SIMPLE FIX: CENTER THE SPRING First mark down on paper which key (or keys) are stuttering. Then you must partially disassemble the individual key(s). Carefully pry off the keycap using a tiny, flat screwdriver with a 1/8 or 1/4 inch tip. To accomplish this, slip the tip just under the keycap and gently pry it up until it comes loose. Then set the keycap aside. Try not to scratch it.

Referring to Figure 1 [on the facing page], what you will see under the keycap are the copper tines of the key contacts and the box-like retainer. The spring held in by the retainer will sometimes slip off-center. Carefully slip a long, thin (not round) toothpick into the slots to the left and right of the contact tines to re-center the coils of the spring. When done, reassemble the key.

THOROUGH FIX: DISASSEMBLE THE KEYS TO CLEAN AND LUBRICATE THEM First mark down on paper which key (or keys) are stuttering. Then you must disassemble the individual key(s). Carefully pry off the keycap using a tiny, flat screwdriver with a 1/8 or 1/4 inch tip. To accomplish this, slip the tip just under the keycap and gently pry it up until it comes loose. Then set the keycap aside. Try not to scratch it.

Refer to Figure 1, Keyboard and Exploded View of a Typical Key.

Note that the bottom side of the keycap is constructed with an extended, hollow, rectangular projection that dovetails inside the "honeycomb" structure below. The top of the circuit board is composed of many such "honeycombs." These are designed to facilitate vertical motion of the keys and to retain the integral parts.

If you look straight downward into the keywell, you will see a yellow or white, plastic, square piece. This is really a long, "keyed" rectangular "tine retainer". The tops of the two paired "tines" are separated by a small horizontal strip that is part of the tine retainer. The tine retainer is somewhat difficult to remove, because it is tightly-wedged into the socket which is part of the keyboard circuit board "honeycomb." On the top of the Keyboard Circuit Card, there is a nest of "honeycombs," one for each key. To remove the tine retainer use a tiny, long-nosed pliers about five inches long. (These are available at your local

Table 1: Associated TLB Parts

Type of Chip and Heath Reference	Commercial Replacement
(1) Keyboard Encoder - U444	S740
(2) Terminal ROM - U445	None
(3) Two each Schmitt Triggers, - U447, U448	74LS132
(4) Asynchronous Communications Element (ACE), U452	8250B
(5) EIA Line Driver, U453	75188 or 1488
(6) Line Receiver, U454	75189 or 1489
(7) the TLB Microprocessor - U430	Z80 or Z80A or Z80B, etc.

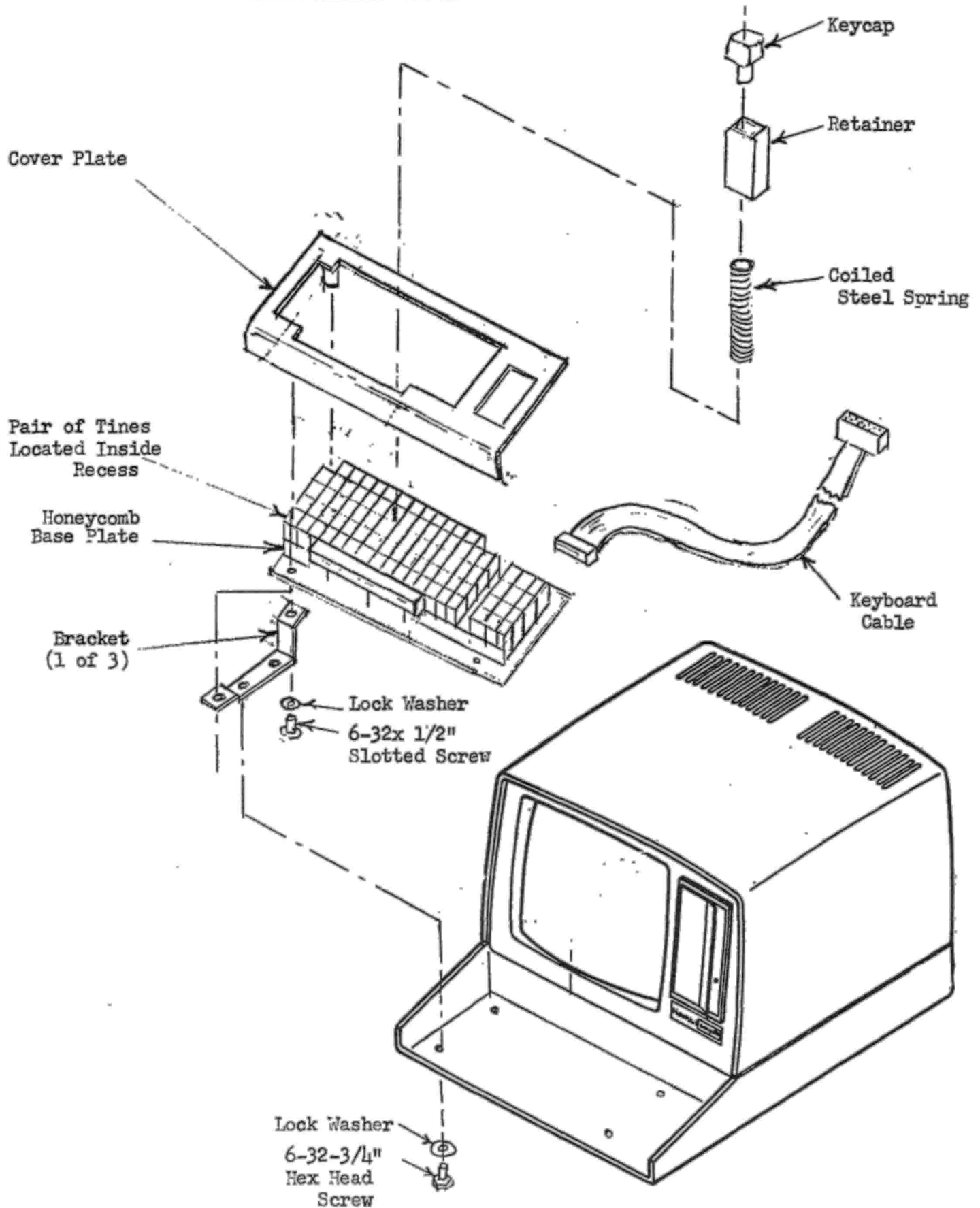


Figure 1. H89 Computer Keyboard Module

electronics parts dealer.) Make sure that the pliers only grasps the tine retainer and not the "honeycomb" below, exert steady but strong force, get a tight grip, and pull straight up.

The tine retainer has two purposes. The main purpose is the separate the two tines so that they normally remain in an "open" state. The secondary purpose is to hold the steel coiled spring which provides just the right pressure on the keycap.

Beneath the "tine retainer" there is a steel, coiled spring.

CAUTION

Be very careful to maintain positive control over the spring while you are removing it, since if it drops on the floor you will probably never find it! This kind of part is nearly impossible to purchase. After you have removed the spring, do not - REPEAT DO NOT - attempt to remove any other part!

The copper tines appear flat on top, but are really folded up and around on top in order to strengthen them.

Once the tines are exposed, the object of this project is to clean the corrosion from each paired unit, and then lubricate the inside surfaces of the tines. This task may be a little tedious, but it is absolutely essential for continued smooth operation of the keyboard. There are several methods that one could select to accomplish this task. These methods are explained in detail immediately below.

(a) The Most Efficient Way: Go to a Radio Shack store or the equivalent and purchase a small spray can of TV Tuner Cleaner/Lubricant with a spout so that you can direct the spray. Some technicians wrap the spout with an expendable cloth, allowing just a pinhead of open space at the business end so as to limit the area the spray can touch. Spread the tines apart with a tiny, flat blade screwdriver, and administer a tiny squirt of the liquid. Excess cleaner/lubricant is easily picked up by use of the cloth. Clean any remainder with a soft, high-grade paper towel, such as "Viva" or "Bounty." When done treating the keys, reassemble the component parts in reverse order of disassembly as described above.

(b) The Quick And Dirty Way: This technique works okay, but it is not recommended. The electric parts are very thin and this tends to make them even thinner. It is not a good idea to destroy too much of the silver or gold contacts. The only good quality this technique has to offer is SPEED.

The "quick and dirty" method is to take a small piece of FINE emory cloth which is available in most auto supply stores and in some hardware stores. This method is not recommended, but it does save time.

NOTE

I DID NOT call out the use of a FINE SANDPAPER, as the two abrasives are completely different! NEVER touch sandpaper to your trusty H-89, unless you are refinishing the cabinet!

Shape the emory cloth so that it is about 1/4-inch wide and slip it between the tines to carefully buff the corrosion and to restore the contacts. CAUTION: Just a couple of light strokes is sufficient.

WARNING

Too much buffing will cut away the plating which is definitely undesirable!

[Concluded in the next issue. -Ed.]

=====

VENDOR.UPDATE

W/PUG. If you're running WordStar on a PC, you should become familiar with this organization. It's the WordStar Users' Group; regrettably, it discontinued support for CP/M a couple years back. But it publishes a 24-page, bimonthly newsletter named **Scroll**. The issue its editor sent to me had articles mainly devoted to WS versions 5 and 6, but there was a nice historical survey about the beginnings of WS by Stan Veit. Annual subscription/-membership is \$20 domestic, \$25 Canada and Mexico, \$30 overseas. For further information, contact:

SCROLL NEWSLETTER / W/PUG / P.O. Box 16-1443 / Miami, FL 33116-1443 / 305-274-0099 / Fax 271-8904

Xerox's Paltry Service for Diablo 630. As I remarked in this issue's editorial, my Diablo daisywheel has been in for service. Unfortunately, Xerox (like Heath and the '89) has discontinued formal service on the printer. But my local authorized service shop did find out that some things could still be done through the factory in Texas. One of those was circuit board rebuilding. So I gave my shop the OK to send a bad board down.

As it turns out, the factory isn't the one doing the rebuilding. The task is farmed out. But that bothered me less than the length of time repair of the PC board has taken. The rebuilder and Xerox had the board for over a month!

So it looks like those of us who depend heavily on the 630 for printed output had better either obtain a back-up printer or a modern replacement. (Somehow this sounds vaguely familiar!) But I hope a word to you is more than sufficient.

=====

THE LINKAGE LOADER

(A column of reader-furnished routines)

Connecting BASIC's Dots. [Oren M. Wood, Norfolk, VA, sent the following listing as hardcopy; I've edited it for column width. -Ed.]

1 REM Written by Oren M. Wood to modify Paul Flexman's Connecting the Dots.

2 REM

3 REM My printer needs to have the dots numbered from top to bottom so

4 REM I recalculated his wreath label program and entered them in DATA

5 REM statements and wrote this Mbasic program to print them.

6 REM

10 LPRINT CHR\$(18): REM Puts printer in graphics and 7/72" line feed

20 FOR R=1 TO 8



To:

From:


```

30 READ N:IF N=999 THEN 80
40 IF N>=0 THEN LPRINT CHR$(128+N);:GOTO 30
50 READ M
55 REM CHR$(28) is a repeat so -4,127, in the data
   will repeat 127 4 times
60 LPRINT CHR$(28);CHR$(-N);CHR$(128+M);
70 GOTO 30
80 LPRINT:NEXT R
90 LPRINT CHR$(30): REM takes printer out of gra-
   phics
100 REM Have fun doing the rest of the labels.
110 DATA -61,1,32,16,8,8,8,112,112,8,8,8,16,32,0,0,
   0,96,96,999
120 DATA -7,0,64,-2,96,112,-3,120,-2,124,-5,126,-6,
   127,-6,126,-2,124,-2,120,-2,112,96,64,-24,0,66,
   61,61,66,0,60,66,66,60,0,0,24,24,999
130 DATA -2,0,64,112,120,126,-8,127,127,-2,63,-4,31,
   -6,15,-3,31,-2,63,-10,127,126,124,120,96,64,999
140 DATA 112,126,-7,127,31,7,3,1,-19,0,1,3,7,31,-10,
   127,126,112,999
150 DATA 127,-8,127,-28,0,11,127,999
160 DATA 3,31,-5,127,-3,31,56,32,-21,0,64,32,56,30,
   95,31,-7,127,63,7,999
170 DATA -3,0,3,7,31,63,0,-3,127,-2,126,-2,124,-2,
   120,112,0,-8,124,0,120,-3,124,-2,126,-4,127,0,
   -2,127,63,31,15,3,1,-15,0,8,112,112,-3,8,88,40,
   16,32,-14,0,-2,96,999
180 DATA -8,0,127,-2,63,-4,31,-2,15,-2,71,96,127,63,
   31,15,31,63,127,112,103,-2,71,-2,15,-2,31,-2,63,
   127,-22,0,66,61,66,2,2,0,124,2,2,4,0,60,66,66,
   60,0,124,2,124,2,124,0,0,24,24,999

```

=====

Multitasking for Real-Time Response...

Under HDOS?

Part 2 of 4

By David A. Shaw

TIMERS. It's frequently necessary to keep track of the passage of time in real-time systems. Sometimes, you need to know if another computer has responded to you within a certain amount of time. If not, you

need to send something, perhaps a poll, or maybe give up and hang up the phone. And timers are very handy for running a task periodically, like the status task described in the last issue. SWAP used in conjunction with a simple timer mechanism can easily provide both of these capabilities.

The H-8 and H-89 provide a hardware timer "tick" roughly 500 times per second. This timer is used by PAM-8 to update the H-8 front panel, and by HDOS to time disk head loading and motor turnoff. We can use it, too, to implement a small number of software timers.

Figure 3 [below] shows a clock interrupt service routine which provides, in this example, three different timers with 0.1 second accuracy. CLOCK decrements each of the timers in the list every 0.1 seconds until they reach zero. To find out when one second has gone by, set one of the clock bytes to 10 then wait until it reaches zero.

To use this clock routine, we first have to set up two fields:

```

VECTR.1 EQU 40037A   Address of interrupt vector 1
HOLD.1  DS  2        Original contents of vector

```

We will chain our interrupt processing routine ahead of the others using the clock vector. This code goes into your initialization routine.

```

LHLD VECTR.1+1 Load existing user's address
SHLD HOLD.1    ...and save it
LXI  H,CLOCK
SHLD VECTR.1+1 Then insert ours

```

From this point forward, we get hardware ticks first. Notice that the end of the clock interrupt routine loads HOLD.1 into the HL register pair then jumps there. This allows other routines, such as HDOS, to get clock ticks. Unlike other interrupt service routines, this one doesn't save or restore any registers. PAM-8 takes care of that for us.

CLOCK, as shown, "divides" the 500-per-second

Figure 3

* Clock Interrupt Service	JZ	NO.DEC	Yes - don't decrement
* We get here from PAM8, which has saved all the registers.	DCR	M	Else decrement
* This interrupt occurs approx. 500 times per second.	EQU	*	
* The first three lines "divide" this by 50, giving us a 10-cycle time source.	INX	H	Step to next clock
*	DCR	B	
*	JNZ	DECLoop	Loop through all timers
*	CLKXINT EQU	*	
*	LHLD	HOLD.1	Get HDOS vector address & pass this tick to HDOS
*	PCHL		
*	DIVIDE DB	50	Clock divisor
*	*		
*	List of timers...		
*	*		
* We get here 10 times per second.	TMRLIST EQU	*	
*	TMR.1 DS	1	
*	TMR.2 DS	1	
*	TMR.3 DS	1	
*	LISTLEN EQU	*-TMRLIST	Length of list
*	*		
*	HOLD.1 DS	2	Hold HDOS vector address
*			

```

*
* Clock Interrupt Service
*
* We get here from PAM8, which has saved all the
* registers.
*
* This interrupt occurs approx. 500 times per second.
* The first three lines "divide" this by 50, giving
* us a 10-cycle time source.
*
CLOCK EQU *
LXI H,DIVIDE
DCR M Decrement divisor
JNZ CLKXINT Not zero yet
*
* We get here 10 times per second.
*
MVI M,50 Reset divisor
LXI H, TMRLIST
MVI B, LISTLEN Get list parameters
DECLoop EQU * Loop to decrement timers
MOV A,M
ORA A Timer already zero?

```

clock rate by 50, giving us ten ticks per second. You can use other divisors, and in fact can cascade divisors to derive a number of clock rates from this one routine. For example, you could divide the hardware clock by 5 resulting in a clock resolution of 100 ticks per second, or 0.01 seconds per tick. You can then use one of the clocks to further divide by 10, giving you a 0.1 tick resolution for more clocks. You can even stretch it out to get a one-second clock to time long events (over 4 minutes). If you do a lot of this, however, or use a lot of timers, you might want to use CLOCK to kick off a "timer task" to decrement your other timers. This will minimize the amount of time spent in interrupt service.

Let's say we want to update the display of some status variables on line 25 of the terminal, and we want to do so immediately after they change but no more often than every 1/2 second. We would code a status task that starts like this:

```
STATUS EQU *      Start of STATUS task
CALL SWAP         Swap now to save
*                complication
LDA STATDLY       Get delay clock
ORA A             If not zero...
JNZ STATUS        ...then SWAP check again.
*
LXI H,OLDSTAT     (Old and new status assumed
LDA NEWSTAT       to be one byte values)
CMP M             Has status changed?
JZ STATUS         No - SWAP and check again
*
* Update the display...
*
...
MVI A,5
STA STATDLY       Set delay to 0.5 seconds
JMP STATUS        ...and loop
```

Initially, the clock byte STATDLY would be zero. Any change in status will be immediately displayed. After the status change, however, we set STATDLY to five. STATDLY will be decremented every 0.1 seconds until it reaches zero. We won't recheck status until the timer expires. If status has changed, the display will be updated at that time.

In another example, let's say that we need to receive a character from an I/O port within 3 seconds or we must take some other action. The code might look like this:

```
GETCHAR EQU *      Get a byte; 3-sec deadline
MVI A,3*10
STA DEADLINE       Set a 3-sec deadline timer
GET.1 EQU *
CALL GETBYTE       Look for the character
RNC                'C' clear - (A) has char
CALL SWAP          Let another task run
LDA DEADLINE
ORA A              Has deadline expired?
JNZ GET.1          No - wait some more
STC                Else, flag error
RET                ...and return to caller
```

While we wait for the character to arrive, our other tasks keep running. If we get the character in time, the calling task gets the character and continues.

But if three seconds go by without the character arriving, we will return to the caller with the carry flag set so it can take some other action.

I've also used the H-8 front panel as an input device in real-time systems, using a clock to debounce the buttons. The task waits for a front-panel key value change, calling SWAP when there is none. When the task sees a change it waits 0.2 seconds then checks again to make sure that we aren't just seeing a transient value due to a key bounce. If the value is still different from before, then something has definitely changed. The "old" value is updated. If the key value is -1, the key has been released from the previous key stroke. Otherwise, we process the key. Remember that your program must restore the contents of VECTR.1 from HOLD.1 before it exits. HDOS does not do this, and if you leave the address of CLOCK in VECTR.1, your system will crash!

Clock accuracy is +/- the clock interval; in this case, 0.1 seconds. When storing a non-zero value into a clock byte, you can't tell whether the hardware timer just ticked, or if it is about to tick. You can't tell the value of DIVIDE. Therefore, your clock byte may be 0.1 seconds away from being decremented, or it may be half a microsecond away from being decremented.

What this means is if you set a clock byte to a value of 1, the actual amount of delay "d" will be $0 < d < 0.1$ seconds. If you routinely use a value of 1, timing will be very erratic.

Timers with a period of 0.1 seconds are good for timing of events ranging in duration of from 1/2 second or so to 25.5 seconds. If you need to time events that are shorter than 1/2 second, you should change the divisor to a smaller number and derive a faster, more accurate clock.

=====

CONTACTS

(A Wanted/For Sale/Swap Column)

Becky Cauthen (T & E Associates, P.O. Box 362, Millersville, MD 21108) "...I have some H-8 boards, drives and components. If you know of anyone that would be interested in any of this, let me know."

Harold D. Harfoot (Electronic Control Service, 4430 SW 34th Drive, Ft. Lauderdale, FL 33312-5514) "...I need a H-89 with a working hard drive and **controller board** for the two TMSI conversions (H-1000 8-16 bit) so I can run them on MSDOS. Still need info on Z-67 8" winchesters."

Mark Hunt (P.O. Box 280, Ray Brook, NY 12977, 518/523-1492) [Extracted from three recent letters. -Ed.] "I am looking for the following equipment/accessories/software for my Heath/Zenith H-89.

Z-89-11 In/Out Board, along with IBM Emulation Software

H-89-6 Backplane

[77319] Magnolia RF Modulator

Ham Radio Circuits & Software

H-1000 TMSI's replacement 8-bit/16-bit CPU Board

GP-29 Northwest Digital's replacement Graphics TLB Video Board for the Z-89-FA and Z-89A

H-67 Hard Drive, with cables, and HDOS software
Glare Filters
Amber CRT

To repeat - any software under HDOS for the H-67 - this might include diagnostics, archiving, parking, device drivers - whatever!"

"...Do you know of any [software] ...to unfragment a partition? (Or anything else?)..."

"...[I]f anyone has a problem with their H-67, or needs the HDOS 2.0 software for it, or the schematics, or whatever - feel free to send them my way. I've three complete sets of documentation for the beast, and a very nice disk full of software useful indeed.

"(Still looking for a nice PARK utility, and diagnostics for both the HD & the 8" FD.)"

Robert B. Frahm (30944 Mission Road, Bonsall, CA 92003) "I am ... interested in selling or trading an H-89 for an H-89A. I am also looking for graphics software for my H-89A."

Graham B. King (33328 NE Stossel Creek Road, Duvall, WA 98019, 788-9109 [home], 393-2876 [work]) "...I have for sale an extra copy of the Microsoft Macro-80 (M-80) Assembler which includes the LINK-80 linking loader, LIB-80 library manager, and CREF-80 cross-reference facility. This software has never been used and is still sealed in the original packaging. Requires a Z80-based CPU such as the H/Z-89/90 with a DSDO soft-sectored (H/Z-37) disk drive ...Only \$20 plus shipping!"

Bob Mason (PSC 43, Box 5657, APO AE 09466) "Anyone else out there have the Sigma-Soft & Systems IGC? I am running the IGC board w/ 256K RAM, and also the Sigma-Soft hard disk system w/ a 40 Meg hard drive. Would like info on any software available for the IGC besides the CAD89 program, which I already have. Also, is the IGC compatible with TMSI's SuperSet system of upgrades for the TLB? I would appreciate any words of wisdom, to help keep my 'dinosaur' alive and kicking!"

Elizabeth Y. Brown (1130 Pelican Rd., Pebble Beach, CA 93953) "I have a Zenith Z-80-80 computer and I believe a Z-37 extra cabinet drive which belonged to my late husband ...I am advised that although obsolete, this has collector's value and that you might be able to help me locate someone who might want it. I am willing to accept any offer plus shipping expenses."

Eugene G. Kiehl (2938 Bagley Drive, Kokomo, IN 46902, 317/455-0877) "I have a Z-89 (64K) with two outboard 94K disk drives. I have CP/M, HDOS and a great deal of other software including SUPERCALC, SUPERSORT, word processors, modem programs, recipe and checkbook programs, etc. I also have an external 300 baud modem.

"I also have several years of **Sextant** and **REMark** magazines along with several books on 'how to' whatever."

"I have seldom used this equipment over the past five years. One gets too used to 8 Meg memory and 100 Meg drives to go back to old programs, however delightful they might be.

"The point of all of this is, I would like to see someone who would enjoy using 'Conrad' (the computer) and the associated software. I would give the whole lot to someone who would pick it up or pay for boxing and shipping. I would demand visiting rights and an oath signed in blood that Conrad would not be dismantled for parts. I don't know how you feel about your first computer but I love Conrad and I would like to find him a good home."

H.T. Goranson (1976 Munden Point, Virginia Beach, VA 23457) "Three complete Trionyx H-8 systems [for sale]. Many extras. Please contact for list. Best offer."

F. Ronald Nelson (1448 Garland St., Green Bay, WI 54301-2328) "I'm late as usual, but would like to say that I do enjoy your newsletter. At the moment my '89 is dead and [I] haven't had the time to see what the problem is, so hopefully your troubleshooting articles will help. I have gotten a new DOS computer and I'm moving into a new computer room, so that project is slowing me down.

"I also ordered a Heath OctiPort while the price dropped and hope to interconnect my 2 PC computers with the '89. I have been checking some of the back newsletters for reviews on software that lets the '89 talk to the DOS machines, but [haven't] found anything. Maybe you could ask the newsletter readers how they have solved interconnects between '89s and PCs." [Ron, two possibilities are PC89LINK for file transfers (see issue #19, p. 11 for Dan Jerome's review) and REMOTE-CONSOLE -(described in the same issue on p. 8). Readers, would you have other suggestions? -Ed.]

The Staunch 8/89'er (P.O. Box 548, West Branch, IA 52358) You've probably already noticed (on p. 2 of this issue) the release by Generic Computer Products of some of its older CP/M software. I'll be listing more in the next issue. However, David Powers, GCPI's Director of Software, wrote quite a bit of material for both HDOS and CP/M. Some of this software was originally distributed through Studio Computers (Birmingham, MI) and was already announced in issue #9 (insert). But Dave has lost track of other really early stuff, particularly that for HDOS. I would be interested in acquiring software by Dave, under either the "GCPI" or his earlier "Generic Software" label (formerly of Troy, now of Marquette, MI), that I don't already have for purposes of general distribution. Hence, I would appreciate it if you could check out your library for Generic's software and let me know what you have.

=====

MISCELLANY

Attack of the Mutant Viruses! I observed in the last issue (p. 7) that PC viruses, those nasty little "bugs" you've heard so much about from other sources, won't run on the '89's Z80 CPU. (I probably need not mention that the same applies to the 8080 on an unaltered H-8.) But how, you're entitled to ask, do I know this?

Before I launch into that, I should probably define the term. A virus is a **very** small program

that "reproduces"! This "reproduction" is accomplished by the virus writing copies of itself to **preexisting** utilities, applications, system files, or even to the boot track of your disk(s). From these locations, a virus can destroy the boot sector or disk directory or even reformat a disk! A few (very few!) are innocuous; they merely announce their presence without doing significant damage except to your nerves.

Viruses are so small that they can hide rather effectively **inside** an existing program or in little-used sections of the boot track. Usually this means that an infected program might "grow" by 1K or less as listed in the disk directory, something you're not likely to notice in normal computer operation. And, of course, if the boot track is infected, you'll never see it.

Further, because a virus can piggy-back on another program, it can migrate from machine to machine without anyone the wiser. In a real-world example, some years back I heard of one getting into a software operation that prepared Macintosh disks for **commercial** distribution. It got there because someone in Chicago had downloaded a game from a BBS, run the game **once**, then sent **other** software to a friend at the software duplication company. Running that game infected the Chicago gamester's entire system and the software he passed along to his friend, doing the same thing to the commercial vendor's. As I suggested in the last issue, computer viruses can spread just as easily as the biological kind.

But returning to your question, how do I know a virus won't run on the Z80? Because I've deliberately tried running one! The "encounter" began last summer when I stumbled across an ad for a book on how to **write** viruses for the PC. I ordered it, read the thing, and discovered that there was a disk also offered that included both source (most of it 8086 assembler) and executable code. So I ordered the disk as well.

As I contemplated the "project" at hand, I set up an **isolated** disk just in case there was any consequent damage. I also decided to run the viruses under CP/M since MSDOS originated as a "clone" of CP/M ver. 1.4. (HDOS would be so incompatible with the environment a virus expects that I can virtually guarantee no damage even if a virus were fully functional!) However, the directory structure of "DOS" (as the PC cosmos calls it) has evolved since it branched off from its forebear. For one thing, that structure is much more complex than CP/M's since it has to accommodate calendar dating, time of creation, and sub-directories. Further, it doesn't occupy the same disk track as it does on our system. The DOS directory (FAT) is on track 0, whereas CP/M 2.2's (at least for our systems, whether hard- or soft-sector) is on track 3. So one of the first things I could expect was no damage to the CP/M directory even if one of the viruses attacked it.

Another thing I expected to see was no or minimal activity on the terminal. My perusal of the virus book showed that DOS BIOS calls are **completely** incompatible with CP/M's. So even if the virus were **supposed** to write to a PC terminal, CP/M **couldn't** recognize that as what the program wanted.

And third, as something of an assumption, I **presumed** that the binary opcodes for the 8080 and Z80 were a "subset" of those for the 8086. In other words, I figured that at least parts of a PC .COM program would make "sense" to the '89's Z80. But because of incompatibilities (in addressing, etc.) the virus would wander off into Never-Never-Land and the system hang up. Indeed, this hang was the worst I anticipated from the most damaging of the viruses on the disk.

So the virus disk arrived and I transferred the relevant files to my bootable, working disk with Anapro's CPC. And with considerable anticipation, I rebooted that disk in isolation from everything else and began running the virus programs. As it turned out, two things I anticipated were true: there was no damage to the disk directory (I was able to list it with the DIR command and TYPE some ASCII files on the terminal that I had also copied over) and those viruses that were supposed to print something on the terminal didn't. Further, there was no damage to the disk's boot track; I was able to reboot the disk without problems.

However, one thing surprised me. The system didn't hang as I expected! After the floppy drive accessed the program, there was a brief delay (presumably for execution), then the CP/M prompt returned! This confused me, to say the least. The only possible explanation was that my presumption about partial compatibility between the binary opcodes of the 8080/Z80 and the 8086 was erroneous. So I checked with one of the programmers at work and that is, indeed, the case. The two are **totally** incompatible.

Anyway, the experience verified what I suspected at the outset. A PC virus won't do any damage to our systems even if, by the remotest chance, one migrated over. Of course, the same would apply to Mac viruses since there is even less likelihood that the opcodes for Motorola's CPU chip are compatible with the Z80's than my erroneous suspicions about the 8086 and Z80. I think we can take some comfort in that.

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; P.O. Box 548; West Branch, IA 52358; home: 319/643-7136. Subscriptions always start and end with the calendar year. Rate: \$15.00/year. (Overseas, add \$4.) Single copies: \$2.50. 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 Zenith Users' Group. EOF