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JANUARY 1981/95¢

Build a Car Battery Trickle Charger
Developing a Computerized Phone Dialer
How to "Type" Morse-Code Signals

PE Tests 8 Audio Power Amplifiers

CARL WARREN EXAMINES:
Heath's H-89 "All-In-One" Computer

COMPUTER BITS

By Carl Warren

Backup May Be On Your Mind

AS A result of the growing number of Winchester disks being used for prime storage in microcomputer based systems, a need for backup has arisen. Numerous manufacturers are touting so-called streaming methods that employ magnetic tape. This backup philosophy, unfortunately, offers more disparities than it does possibilities. Among these are included:

• Inability of the streamer to accept data faster than 30 ips (30K bytes/s). This is primarily for 1/4-in. 3M cartridge drives. Drives that employ 1/2-in. reel-to-reel tape are able to handle fast data rates, but you pay the price.

• Although the 3M data cartridge works well in start-stop operations, it appears to be almost a detriment for streaming operations. The reason for this is that in a streaming environment, even at 30 ips, the tape is traveling at an unusually high rate for its design. As a consequence, the tape can lose its tension, causing a fluttering against the head; this produces both soft and hard errors.

There is an alternative to streaming tape drives, though, and it is available now. It is the Corvus Mirror®. The Mirror permits up to 100M bytes of removable back-up storage by using a Panasonic NV 8208 video cassette recorder and a Corvus controller. The Mirror is designed to back up the Corvus 10M byte Winchester drive and interface to a host of computer systems, including Apple, TRS-80, S-100, LSI-11 and Heath H89.

Essentially, 532 byte blocks of data are sent to the video recorder and, in the process, are transformed into video signal format as shown in the accompanying photo.
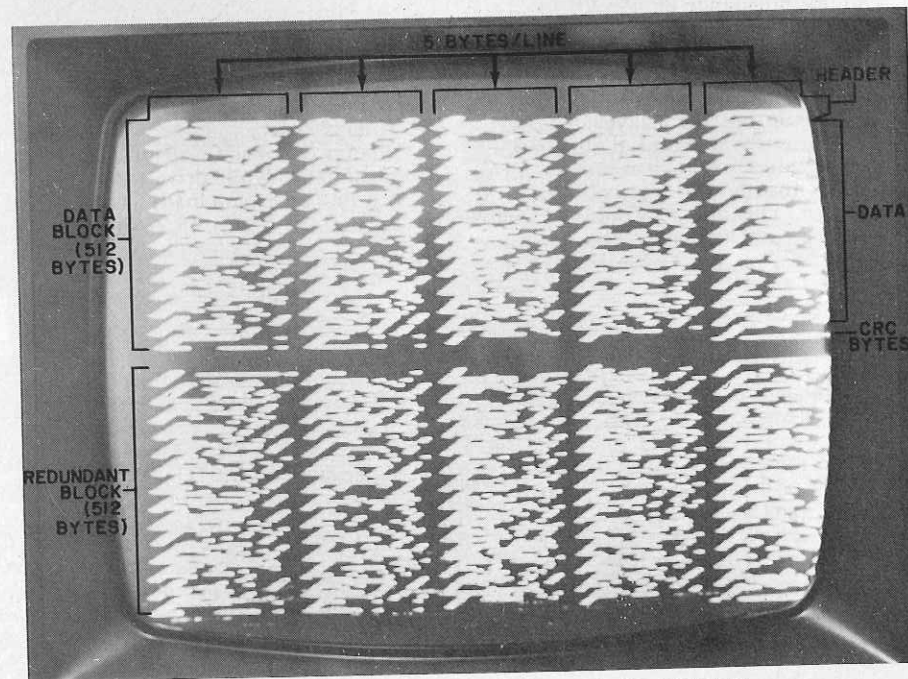
The advantage of the Mirror over other methods of backup, including floppies, is that individual blocks of data can be searched for on the tape, with specific portions either updated or written out to the disk. The only advantage streamers have over this device is speed. But speed is relative, and flexibility is at a minimum.

The Mirror is currently priced at $790. This is the controller only and doesn't include the video recorder, which the company will sell to you but recommends that you buy elsewhere. A Corvus spokesman pointed out that the Panasonic unit is back-ordered, and lead times aren't being given. Therefore, you might latch on to a less expensive device and forego the remote control operation. Manual operation takes only ten minutes of your time, at the longest, but can save you around $1000.

Get Your System Ready. Those of you that have a Radio Shack TRS-80 will want to get your system ready to run nonmodified CP/M. This is important if you want to follow along with the various topics I'll be discussing in the next few months.

To update your system, you'll want

Corvus Mirror and VHS tape system provide tape backup for 8-in. drives.

Digital data, transformed by the Corvus controller, looks like video data with specific attributes. (Copyright 1980, Corvus Systems)

Mapper I from Omikron. This $199 piece of magic plugs into the TRS-80 MPU socket, and the processor is plugged into the mapper board. The board reorganizes TRS-80 memory to zero base, thus permitting the use of normal CP/M. Working in concert with Mapper I is Mapper II. This $109 interface, including cable, permits the installation of 8-in. floppies.

Using these together you can switch between TRSDOS or CP/M and build up some reasonably large data bases for yourself.

Short Software Reviews. I mentioned a few months back that Microsoft's Consumer Products Div. was offering a number of unique packages for the TRS-80. For game lovers, there is Adventure ($29.95). I can't say much about it, but my friend Ed Teja, who is a game nut, says this is a good one and makes for an enjoyable evening.

Typing Tutor ($14.95) is an excellent tutorial program; it should be since it was written by Al Baker. You can learn to type from this, if you don't know how, or upgrade your skills.

Level III Basic ($49.95) for the TRS-80. This software really represents unqualified slickness. Level III is designed for TRS-80's without disks, but gives you the same features adapted to tape.

The Editor/Assembler ($29.95) is another nice piece of work, and also resides on tape. It's a good solid tool with few bells and whistles, but includes everything you need for most small-system designs.

Some Hints. In the December issue, I started telling you about the conversion of BASIC. I offered a challenge, more or less, for you to come up with possible methods to convert a simple program. Well, if you're working on it but not sure what to do, here are some hints:

- Use the IF... THEN... ELSE... statements to test data.
- String operators MID$, LEFT$, and RIGHT$ are used to take words apart and put them back together again.
- Remember that two files exist: the source file (code to be converted) and the target file (converted code).

For all practical purposes, this is all you really need to know for developing the translation construction. I'd also suggest that you draw a flow-chart that shows where you want to get to.

Build a System. A few months ago, I suggested the possibility of assembling a single board computer (SBC). One such possibility, among others, is the Motorola 6809D4.

The D4 unit incorporates the MC-6809 microprocessor, a very powerful

monitor called D4BUG, and flexibility in adding memory both RAM and ROM. The system can be expanded with ease, using the optional card cage and accessories like memory boards and I/O boards.

Because the system is built around a 6809, it is easy to program and it offers more power than you will find in similar systems that use co-processors to achieve 16-bit power in an 8-bit world.

A reasonable system can be built for well under $1000, and systems languages, editor/assembler, BASIC and others are available from Motorola. Furthermore, a very tiny BASIC language, called VTL-09, which is designed after the 6800 implementation created by Frank McCoy and Gary Shannon for the Computer Store in 1977, is available. Instructions on using the language may be found in *The MC 6809 Cookbook*, published by Tab Books.

You might want VTL-09 since it is a fairly powerful BASIC-like language and is ROMable. For those of you who take advantage of the code, it's free, it can't be sold, and programs written for it must be given away. VTL-09 is not a commercial venture. The use of the code for the cookbook and free distribution of it for the 6809 were made possible by Dick Heiser of the Computer Store, Santa Monica, California. ◇

MORE INFORMATION

For additional information about products and services mentioned here, contact the companies directly.

Corvus Systems, Inc.
2029 O'Toole Ave.
San Jose, CA 95131
408-946-7700

Microsoft, Consumer Products Div.
10800 NE 8th St., Suite 507
Bellevue, WA 98004
206-454-1315

Omikron
1127 Hearst St.
Berkely, CA 94702
415-845-8013

Motorola, Inc.
3501 Ed Bluestein Blvd.
Austin, TX 78721
512-928-6000

Tab Books
Blue Ridge Summit, PA 71214
717-794-2191

Popular Electronics Tests

Heathkit H89

Heathkit H89 Microcomputer

THE Heathkit H89 microcomputer is an all-in-one system that is compact, expandable, and flexible, with software backup. Furthermore, it's available in kit or assembled versions. The H89 (also known as Z89 in the Zenith version) offers a number of features that make it highly versatile. Among these are:

☐ Dual Z80 microprocessors, separate for CRT terminal control and main system processing.

☐ A fully interlaced 12-in. raster-scan monochrome CRT that permits an 80 × 24-line display for a total of 1920 characters. (A nonscrolling 25th line, under software control, can be used for special function displays such as identifying the upper row of user-defined keys.)

The 80-key, typewriter-format keyboard generates upper- and lower-

case letters on a 5 × 7 dot matrix. Lower-case letters having descenders use a 5 × 9 dot matrix, while up to 33 graphic elements can be created using an 8 × 10 dot matrix. A 12-key dual-purpose numeric cluster is also provided. In the normal mode, these produce the numerals 0 through 9. In their other mode, they provide useful secondary functions such as cursor up, down, left, right and home, carriage return, back space, line feed, tab (standard 8-column), etc. Editing functions include inserting and deleting characters or lines, while erase includes page erase.

☐ Most operating parameters (underline/block cursor, reverse video, graphics, baud rate, etc.) are preset via internal switches. By taking the system off line (one keystroke), the user can make temporary changes via

the keyboard. When the system is turned off and re-powered, all functions automatically return to the Preset switch selections.

☐ Package size is 13″ high, 17″ wide, and 20″ deep. The system operates from 120/240 volts ac, 50/100 Hz. The case is formed from structural foam plastic that combines lightness with strength. A fan provides a cooling air flow. A slide lock, one on each side, allows easy entry to the cabinet interior.

☐ A 5.25-in. single-density, hard-sector 40-track Seimens floppy-disk system is built-in with each diskette storing 100K bytes. A controller supports the two additional drives in the optional outboard H77 disk system.

☐ The H47 dual 8″ disk drive (kit is $2595, with $3500 for the wired

JANUARY 1981 **33**

version) features a pair of REMEX double-density, double-sided drives that support up to 1.2 megabytes/diskette.

□ Although it comes with 16K of RAM, the system has the ability to support up to 48K bytes of RAM simply by plugging the RAM chips into the sockets provided.(In conjunction with the 8-in. drive option, Heath will soon have a 16K-byte RAM add-on available to bring the system up to 64K, with a zero-base memory map.)

□ There is provision for serial op-

tion devices such as the Heath H14 line printer via an add-on RS-232C serial adaptor. (Use of this board also permits system-to-system communication using a modem.)

□ Software support is available from Heath and the Heath Users Group (HUG).

In addition, the H89 provides some functions that aren't readily evident. One of these allows it to be used as a terminal in a timesharing operation or as a front-end preprocessor. The basic system—with integral terminal, 16K

of RAM, H88-5 audio cassette interface, and a single 5¼" disk drive—costs $1,695 in kit form; assembled, with 48K of RAM and a serial I/O port (but less an audio cassette interface), it is $2,895. Options include a 16K RAM expansion kit (H88-2) for $95; an assembled two-port serial I/O interface card (H88-3) for $100; an assembled outboard floppy-disk drive (H77) for $595 and a dual floppy-disk drive (WH87) for $1,195; a modification kit (H88-6) for connecting the WH87 and other options to the H89 for $50; an HDOS plus extended Benton Harbor BASIC, which requires 16K (32K recommended), a two-pass absolute 8080 assembler, text editor, debugger, and several utility programs (H89-17) on disk for $150; and a Microsoft BASIC (H8-21) which requires 32K minimum RAM (48K recommended) for $150.

Software. The HDOS is a very versatile library of utilities that looks like an excellent combination of a DEC operating system and CP/M. It requires 16K of RAM. Among the features are a 9-element debugger for machine-language programs, a text editor with a full range of commands, and an assembler for 8080 code that, when used with 16K of RAM, allows 350 user-defined symbols. HDOS (version 1.6) supports three disk drives.

Benton Harbor BASIC occupies about 13K of RAM and is full-featured. It includes 73 general-purpose commands and has 25 error messages. It will accommodate strings to 255 characters in length and accept variables consisting of a single letter or single letter with a digit (0-9). Both HDOS and BASIC must be on the same diskette to save a BASIC program. At least 16K of RAM is required for operation. This BASIC program will not accept a line having a syntax error.

Microsoft BASIC runs under HDOS and requires a minimum of 28K of RAM (32K is suggested). It features 116 statements, commands, and functions; has 23 general error messages and 16 error messages for disk operation. It also features 16 special-function characters. The BASIC contains provisions for single/double precision (16 digits), full editing, array erase, swap variables, trace/untrace, line width, a full complement of disk file operations, and all the capabilities associated with Microsoft BASIC. Other languages are available for the computer, including FORTRAN and COBOL.

Building the Kit. Construction of the H89 from a kit requires about 28 hours of assembly time. The process is straightforward and, as expected, provided no surprises. Before construction began, it was necessary to update the construction manual with some 15

pages of errata supplied by Heath to deal with typos and parts changes.

Assembly is greatly simplified since Heath supplies all logic assemblies completely wired and tested. This includes terminal-logic, main-CPU (with 16K bytes of RAM and system ROM), disk-controller, and cassette interface. Not only does this save assembly time, but it also relieves you of having to debug a system assembled from scratch. Assuming you wire the power supply, keyboard, and CRT circuit assemblies correctly and interconnect all cables properly, the preassembled logic boards should allow your H89 system to come up the first crack out of the barrel.

Most of the assembly you perform in putting together the H89 is mechanical mounting hardware, fastening and soldering connector pins to cable harnesses, and mounting and interconnecting subassemblies.

Even with extreme care taken during assembly, difficulties can arise, naturally. These can result from infant mortality of parts—only the preassembled boards (terminal controller, main processor board, and subcards like the disk controller) are already burnt-in. Specifically, I experienced a problem with insulating the video amplifiers on the heat sink. In this case, the mounting bolt of the IC caused a short to the heat sink, causing the circuit to blow. A call to Heath's service center produced a cure—new parts (free of charge), including insulating material for the mounting bolts.

CRT Electronics. The driving electronics for the CRT consist of the high-voltage section and fully interlaced vertical and horizontal circuits. The CRT is controlled by the terminal logic circuit board. This board provides seven functional blocks that include power supplies, keyboard encoder and configuration logic, terminal processor (Z80), master clock and system logic, communications, CRT and memory control, display memory, character generator, and video control logic.

The master clock, operating at a nominal 12.288 MHz, is crystal-controlled. In practice, the clock was found to operate at approximately 12.8 MHz with no adverse effect on the system.

The best resolution test for a CRT terminal is to first make sure that the brightness and focus are properly adjusted, then create a "test pattern" by filling the screen with *lower-case* "m"s. The bottom dots of the three small vertical lines that form the "m" create a light-dark-light pattern across each line on the crt. This is the maximum number of pixels developed by the circuit. To check resolution, note that each dot and "undot" are clear and distinct across the line from the top left corner of the display to the

lower right corner. Poor high-frequency response of the amplifier results in blurring images. By noting any size changes in the vertical and horizontal directions, the "m"pattern can also check vertical and horizontal linearity. Of course, there should be no dimensional changes over the screen. The CRT brightness control can be operated to check both screen brightness and dot "blooming" that tends to reduce resolution. The black-and-white Heath display passed these tests with flying colors.

One minor problem we noted is that the screen surface of the CRT is sufficiently reflective to make glare from room lights annoying. This can be easily avoided by using an anti-glare filter, such as Heath's new Pannelgraphix HCA-3 for $8.95.

Z80 Keeps Terminal On Track. The Z80 processor in the terminal logic examines data and decides what to do with it. This CPU operates at 2 MHz and keeps track of terminal I/O, terminal personality (the H89 can be configured to emulate a DEC VT 52 terminal), and the location of the cursor. Operations of the terminal logic CPU are guided by an onboard ROM. This firmware program provides the ability to tell the terminal how to act under certain conditions, plus supporting the Z80 in performing general "housekeeping."

The terminal ROM, flexible as it is, does appear to have a bug in the transmit page function. Although the function appears to exist, adequate documentation doesn't. But according to a Heath system engineer, the problem is being solved in new updates of the ROM and by making the ROM software available in listed form.

Main CPU is a Z80. The terminal portion of the H89 communicates with the computer section via serial ports at selected (switches or software) rates up to 9600 baud. The main CPU logic board incorporates another Z80 microprocessor, system software ROMs for controlling the computer, system RAM (up to 48K bytes), and the system backplane that uses Molex pin connectors to allow
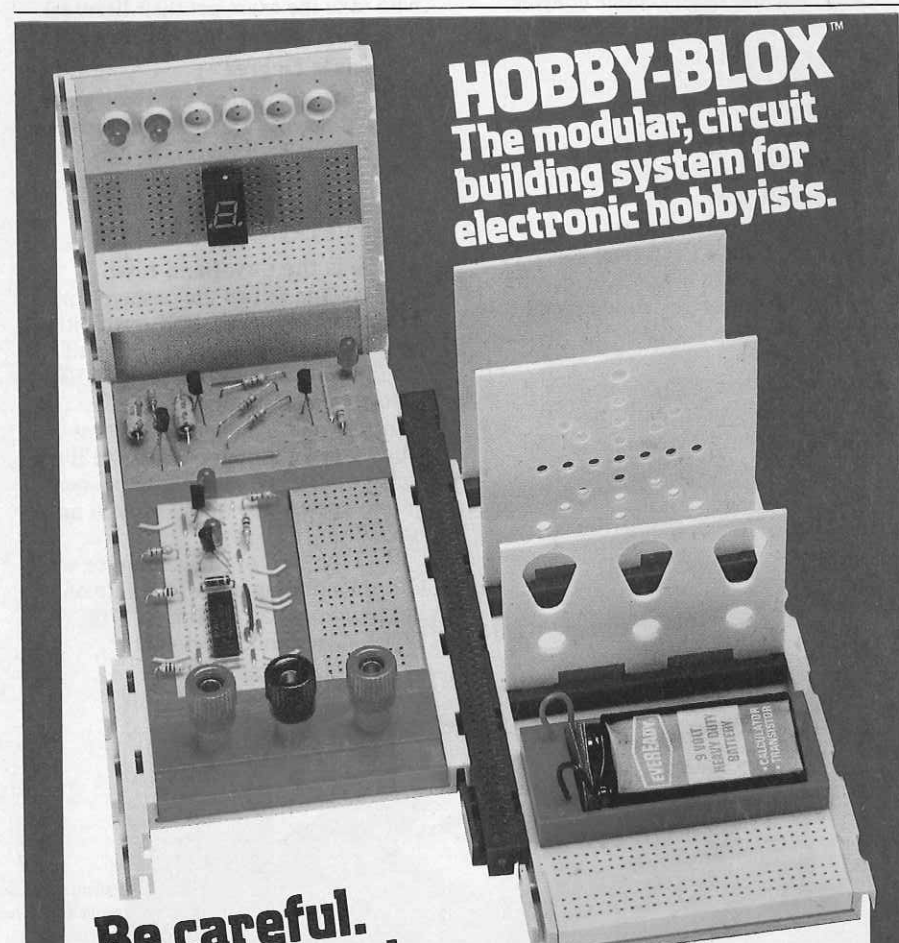
use of additional boards such as serial interface, disk controller, and cassette.

The main CPU board has a built-in interrupt structure in various levels to accommodate peripherals and program requirements. Interestingly, the flexibility of the main board makes it possible to change system ROMs to emulate almost any system. American Micro Systems, Inc. (AMI) uses the H89 as a development system (called the Phoenix 1), for example, operating totally through software.

Testing the System. Determining power of the software and hardware can be a difficult task. I decided that, although timing tests that establish the running speed of various BASICs served a purpose at one time, how fast BASIC executes makes no difference in processing of data. Consequently, I chose a different form of system test involving the use of CP/M, CBASIC, and Micro-AP's Selector III. (Note that, "as is," the H89 will not run standard CP/M without circuit changes that will be covered in an upcoming review of the H89/Magnolia system. The changes are related to system firmware in the memory field, not operating speed.)

Selector III was chosen because it is a good data manager and would exercise the RAM, disks and system software. Furthermore, Selector allows the user to create a large data base, manipulate it, print hardcopy reports, sort it, and make selective retrievals. CP/M and CBASIC were necessary for operation of Selector and allowed me to see how well the system worked with non-Heath software. The CP/M from Lifeboat Associates, patched to allow for the 4200_{16} origin of memory, was used.

For the purposes of the test, a database of 200 records was created with each occupying 255 bytes. The test consisted of first asking Selector to find all records that had a particular code letter, then sort the list, print a selected list, print a label list, retrieve and update the first record, retrieve and update the last record, changing its code, then reselecting. During the course of operation, Selector does not re-order the entire list, but develops

The H89 computer with H77 dual-disk system and H14 line printer.

computers

an ordered index list for retrieval (the same for selecting by type). It then uses these index list pointers for printing reports, etc. Incidently, the time it took to develop the data base is meaningless since it was done at various times and actually depends on the ability of the operator. The times for the operations as we measured them were as follows:

Function	Time (Min.)
Select 197 records	4.3
Sort	2.0
Print selected list	10.0 only company name, city, phone, and record #
Print label list	11.3 (six fields printed)
Retrieve-update and refile record #1	1.0
Retrieve-update and rerecord #200	1.4 (select code was changed)
Reselect	4.3

An operation similar to this, using an S-100 bus machine and a hard-disk subsystem decreased the times by orders of magnitude and gave a semblance of instant operation. But the Heath system scores are still respectable and indicate that the H89 is more than viable for a small business operation. Significantly, the H89 microcomputer performed the functions with accuracy each and every time they were performed.

Aftermarket Software. There are other types of software that are equally as exciting as the Selector system, and if you desire, these can be used to develop benchmarks for their operation. Among these is PIE 1.5 (Software Toolworks), a full-screen editor that permits using the Heath keyboard function keys to perform specific editing functions. The PIE editor is priced at $29.95 and currently works with HDOS. However, it has been reported that as soon as Heath releases its new PROM, which permits the use of CP/M at a zero base address, the editor will be made available as a CP/M-oriented product.

Heath also offers editors, assemblers and other functional aids to support the system. Most importantly, the company has been instrumental in establishing the Heath Users Group (HUG). This organization operates as a separate entity from Heath and offers a large volume of software for the H89. One exciting package they have is the Modem control system (MCS), which has already been discussed in a past "Computer Bits" column. This system allows connecting the H89 into timesharing services such as

Compuserve's "Micronet."

Further increasing the utility of the H89, with a storage capacity in the range of 10M bytes, is Magnolia Micro system's interface that permits the H89 to operate the Corvus version of the IMI Winchester hard-disk system. The interface, card, drive with intelligent controller, and interconnecting cables are offered for $5350. To make it all work, though, Magnolia's version of CP/M2.2 is required, as is the zero base memory map PROM, for a total of $295 more.

Heath is just beginning to offer the complete CP/M system, including assemblers, editors, and CP/M compatible Microsoft products such as CO-BOL, Fortran, and BASIC. It is thus possible for users to run any CP/M-based software. Also, the new Zenith Electronic Typing disk—a word processing system that requires 48K of RAM, dual-drive floppy capability and a printer—is available for $395. (Discounts are offered if you are also buying a computer or printer from Heath.)

The Bottom Line. The basic H89 is an excellent general-purpose computer. With the addition of an optional dual disk drive and the software now becoming available, the H89 is indeed a formidable small computer.

Exotic peripherals such as speech I/O, music, color graphics, remote control, etc., made for use with S-100 systems are not compatible but Heath engineers are currently evaluating the offering of such add-ons.

We have lived with the H89 for a while now and feel very comfortable with it. Even the disk system is quieter than most. The keyboard has a nice professional feel to it, with its IBM-style keys and slightly angled positioning. Furthermore, there's a "clicking sound" on-off switch should the user wish to be certain that keys indeed make contact when pressed. Good display contrast is in evidence with the P4-phosphor CRT. Do add an inexpensive anti-glare filter, though. Also, since the floppy drive motor is not "on" all the time, greater longevity than usual may be expected for this device.

In sum, the Heath H89 computer is certainly modestly priced in kit form for what it offers. Its all-in-one construction saves space and eliminates a rat's nest of interconnection cords compared to "separates." Furthermore, its professional-type features make it a pleasure to work with for long periods of time.

What Heath offers is indeed top-notch and should serve exceptionally well for any serious computerist who is not strongly motivated toward games and home-device controlling. Moreover, it is appropriate for very-small-business use where price is an object.—*Carl Warren.*

CIRCLE NO. 103 ON FREE INFORMATION CARD

COMPUTER SOURCES

By Leslie Solomon
Senior Technical Editor

Hardware

Apple Tablet. The VersaWriter is a high-resolution color-graphics addition for an Apple II or Apple II Plus. The device consists of an 8½" by 11" Mylar plotting board having a clear plastic overlay. Attached to this board is a jointed drawing arm at the end of which is a magnifying lens with a crosshair. To use, the item to be copied is placed in the baseplate and "traced" using the crosshairs. As it is traced, the drawing appears in the CRT screen. Immediate software commands include color choice, width of drawing line, fill figure with color, draw a straight line between two points, use a different scale, edit, erase, smoothing factor (rounds off rough edges), store picture on disk, and more. Any picture can be stored as a shape table that can be manipulated as usual. Other programs include Textwriter enabling upper/lower case symbols, area/distance calculations, and calibration. $252. Address: Peripherals Plus, 119 Maple Ave., Morristown NJ, 07960 (Tel: 201-538-3358).

TRS-80 Expansion. The Chatterbox peripheral for the TRS-80 features a COMM-80 Serial/Parallel Expansion Interface that includes an RS-232C interface, a parallel printer port, auxiliary expansion bus connector, power supply, and a modem. The device is completely hardware and software compatible with existing Radio Shack interfaces and application programs. It can also be used with the RS Expansion Interface to provide a serial port instead of adding the RS-232C board, or it can be used as a second port in systems already incorporating it. The serial/parallel port is address selectable and up to 16 COMM-80s can be attached to one TRS-80. The parallel port is 8 bits in and 8 bits out. COMM-80 (less modem) is $179.95, the Chatterbox (COMM-80 plus modem) is $259.95. Address: Hardside, 6 South St., Milford, NH 03055 (Tel: 603-673-5144).

Typewriter Interface. The Dynatyper is an electromechanical device that fits over the keyboard of almost any electric typewriter and is driven from an interface board. Other than mounting a pair of stick-on buttons,

there are no modifications made to the typewriter, and without the Dynatyper, machine can be used normally.Typing speed can reach the maximum at which the typewriter can operate. Each package contains an interface, power supply and software. The TRS-80, Apple, PET, Northstar, and Ohio Scientific versions are $499, the GPIB system is $489. Address: Rochester Data Inc., 3100 Monroe Ave., Rochester, NY 14618 (Tel: 716-385-4336).

68xx Systems. A new catalog, covering almost every peripheral for 6800/6809 systems is available. Items discussed include motherboards, power supplies, RAM and ROM boards, video and high-resolution boards, disk controllers, and a broad variety of I/O boards all for the SS50 and SS50C bus. Address: Gimix Inc., 1337 West 37th Pl., Chicago, IL 60609 (Tel: 312-927-5510).

S-100 Printer Interface. The I/O Master features two serial and two parallel ports as well as an 8-level interrupt control and dual interval timer. It supports OEM versions of NEC, Diablo, and Qume, as well as Centronics/Data Products printers. It allows driving a daisy-wheel printer at the full rated 55 cps. An asynchronous and synchronous RS-232 interface, crystal-controlled baud rates to 38,400, and external baud rates to 56k are featured. Complete software support including WordStar word processing system and CP/M*2.0 is available. $400. Address: MicroPro International Corp., 1299 Fourth St., San Rafael, CA 94901 (Tel: 415-457-8990).

Software

Health and Education Programs. The Vista-Facts Series includes Growing Up, Talking about Sex, Drinking and Drugs, Birth Control, Your Blood Pressure, and Heart Attacks. They are available for Apple II, PET/CBM, and TRS-80 machines and are designed for use by families, schools, health education organizations, and the medical community. These programs have the approval of the Canadian College of Family Physicians. Each package comes with a 12- or 16-page manual containing illustrations and a glossary of medical terms. Each package is $19.95. Address: Personal Software Inc., 1330 Bordeaux Drive, Sunnyvale, CA 94086 (Tel: 408-745-7841).

Statistics Package. NWA STAT-PAK is a multi-function statistics library for use with systems having CP/M and MBASIC. The package contains file utilities and computational programs. The file utilities allow the user to create, edit, and merge data files and select and scale data within files. The computational section contains programs for probability

calculations, single variable statistics, regression analysis, continuous and discrete distribution functions, means testing, nonparametric analysis and survey data, and contingency tables. Address: J.L. Cawley, Northwest Analytical, Inc., Box 14430, Portland, OR 97214 (Tel: 503-238-9760).

Data Manager. Information Master is a sophisticated, easy-to-use data manager for the Apple computer. The user can define, enter, edit, sort, and retrieve data and print report formats. The program includes screen formatting; error trapping; and ability to perform calculations, totals, subtotals, addition, multiplication, division and exponentiation. Files may be transferred or copied from one diskette to another even with one drive. Address: Tinka Bolding, High Technology Inc., Box 14665, Oklahoma City, OK 73113 (Tel: 405-840-9900).

TRS-80 Self Taught BASIC. This self-teaching guide is for learning how to program a Level II TRS-80 with no previous computer experience. Each chapter presents a single topic on BASIC, the TRS-80, or a program that is being developed. $9.95 from all Radio Shack stores.

AIM-65 Graphics. The MTU K-1009-1C Text/Graphics Printout Program permits AIM-65 users to print text and high-resolution graphics with no modification to the computer or printer. Text print routine reproduces contents of the text buffer as 10 unbroken lines of up to 127 characters per line. Screen printout routine creates an exact image of a graphics display screen (in 8K memory) as a 300-wide by 200-high dot matrix. The Quick Print feature generates a 320 × 200 dot image on one paper strip. Quality Print generates the image as two 320 × 100 strips to be taped together. $25. Micro Technology Unlimited, David B. Cox, 2806 Hillsborough St., Box 12106, Raleigh, NC 27605 (Tel: 919-833-1458).

Color Accounting. Using color as its key, Color Graphic Accounting uses a combination of color and graphics in the interpretation and display of accounting records generated through standard accounting functions of general ledger, accounts receivable, accounts payable, payroll, sales analysis, and inventory control. Use with Intecolor CP/M models. Address: The Rainbow Tree Corp., 1 West Court Square, Suite 30, Decatur, GA 30030 (Tel: 404-377-9921).

PET Library. The Jacksonville Area PET Society has a number of programs for the PET computer. They cover games, finance, ham radio, astronomy, music, graphics, and utility programs. Send a SASE to PET Library, 401 Monument Rd. #123, Jacksonville, FL 32211, for a three-page list.   ◇