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sion of the liquid solder and make it flow over and through the joint. Properly fluxed solder will actually flow against gravity to penetrate a small crevice by capillary attraction.

"Keep in mind that making a solder connection is not just a matter of sticking two pieces of metal together with a kind of conducting glue. There is actually a complex chemical action taking place. After the melted flux has cleaned off the corrosion on the metal surfaces, the solder wets and penetrates these clean areas and actually dissolves very thin layers of the juxtaposed metals so that they form an alloy with the solder. They thus unite with each other as an alloy that is partially solder and partially the joined metals. Ideally, this alloyed layer is only 0.004 in. (0.1 mm) thick. Any solder added after this alloy has formed is both superfluous and wasteful.

"Now, let's get back to what's wrong with carrying the molten solder to the joint on the tip of the iron. The rosin core of the solder is very volatile. You can see it evaporating into blue smoke when you touch a hot iron to a piece of solder. When this happens, the flux has dissipated itself on the tip long before you reach the joint, so you have solder with no flux. The solder may surround the oxidized surfaces of the wires, but it cannot wet and penetrate them by itself. The result is a mechanically poor, high-resistance joint."

"OK, I'll follow the Golden Rule no matter what soldering instrument I use," Barney promised. "Manufacturers of electronic equipment must certainly go by the book. Considering how many of their solder joints we look at, it's amazing how few poor connections we find."

Commercial Techniques. "True. They've found that following sound soldering principles pays off. Of course, their mass-soldering methods are much different from those we use, especially with pc boards. We've talked about dip-soldering and wave-soldering before; but recently I read in Western Electric's *The Engineer* about some new and very intriguing methods of mass-soldering.

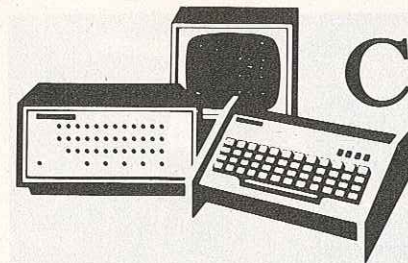
"One of these is solder fusing with forced convection liquid heating. One problem associated with pc boards is solder slivers. They result from the undercutting of electrode-deposited solder used as an etch resist during copper removal. Unless removed, they can short circuit pad layers in multilayer circuits. The slivers can be eliminated by raising the board temperature to about 410°F (210°C) and holding it there for about 30

seconds. One way to do this is with radiant heat, but heating a multicircuit board uniformly without exposing heat-sensitive components to excessive heat is difficult. Heat shields can be used, but they are expensive. Forced convection heating with hot air is also used, but it requires longer exposure to heat and may also require baffles to protect low-mass areas from excessive temperatures. Immersing the board in a heated fluid, such as glycerol, avoids most problems encountered with the other two methods and provides excellent temperature control, but glycerol requires very careful handling.

"A new method, called condensation soldering, is now being used not only to eliminate solder slivers but also to perform 'reflow soldering.' In this procedure, rosin-coated solder preforms shaped like little doughnuts are placed over the tops of pins to be soldered to the plated-through holes in the pc board. When the temperature is raised sufficiently, the solder melts and flows along the pin through the plated hole and forms a solder fillet. If the temperature can be precisely controlled, the distance the solder travels along the pin can be easily adjusted—a factor to be considered when the protruding end of the pin will be connected in an automated Wire-Wrapping process. For a good connection of this type, which is common in telephone work, there must be no solder under the wrapped wire—which rules out wave or dip soldering.

"Condensation soldering is accomplished very easily. In simple terms, a tall, open-topped vessel contains a liquid, say fluorinated polyoxypropylene, which is brought to its boiling point of 436°F (224°C) with immersion heaters. When a relatively cool object such as a pc board with solder preforms is placed in the saturated vapor, which rises to the top, the vapor condenses uniformly on the object, releasing the latent heat of vaporization. A very high heat transfer rate is associated with this phase change, so the heating process is quite rapid. In fact, 20,000 solder connections have been made simultaneously in 60 seconds with this contamination-free process."

"Wow," Barney said. "All I needed was a little help unsoldering that transistor, and I got an introduction to a new type of soldering iron, a refresher course in good soldering techniques, a lecture on the functions of solder flux and the real nature of a solder joint, and finally a description of some methods of mass soldering. That will do me for today." ◇



Computer Bits

By Leslie Solomon

SOME NEW HARDWARE AND SOFTWARE

THE MARKETPLACE is so loaded with enticing material (hardware and software) for the computer hobbyist—with more being introduced all the time—it's getting so he hardly knows where to start. The "well-known" hobby computer manufacturers are doing their best to introduce new products on a regular basis; and many new firms are starting to spring up. Once the hobbyist gets things under way, however, there is enough equipment available for him to build up a really powerful personal computing system.

This month, let's take a look at some of the more recently introduced items that are available.

Printers. This seems to be an area of great interest to most hobbyists, as reasonably priced hard-copy devices are scarce. The Digital Group (Box 6528, Denver, CO 80206; Tel: 303-861-1686) has a kit for \$495 for an interface card and a printer that produces 120 characters per second, 96 characters per line, 12 characters per inch horizontally by 6 lines per inch. This printer can make up to four copies simultaneously. The character set and pitch are variable under software control and allow for double-width characters, different-width characters in the same line, etc. The printer uses a 5x7 matrix and the ribbon has built-in re-inkers for an expected life of 10-million characters. The paper is standard 8½" roll, fanfold, or cut page, and the system interfaces via an 8-bit parallel port.

Video Displays. If you have an Altair-bus system, take a look at the VB1 Video Board from Cybercom (Solid State Music, 2102A Walsh Ave., Santa Clara, CA 95050; Tel: 408-246-2707). This \$189.95 kit (\$269.95 assembled/ tested) video board features cursor, video reverse and graphics under software control, a selection of either 32 or 64 characters per line, 16 lines, upper and lower case with Greek alphabet and

interchangeable fonts, matrix graphics, and parallel and composite video outputs. It can be addressed as 1k memory block.

Interactive Systems (Box 335, Jamison, PA 18929) is offering a pair of display units. The CDU-3216 (kit \$155, assembled \$189) is a 32-character-per-line, 16-line device with a 2-page capability; and the CDU-6416 (kit \$195, assembled \$220) is a 64-character-per-line, 16-line device with a 1-page capability. Both units have full cursor control and are contained on a single 9½" x 9¼" pc board and require a single +5-volt supply. Input data is 7-bit parallel and will load at an 80k-bit rate. The carriage return-line feed control characters are decoded and there are six spare codes that can be user defined.

From up Canada way, Matrox Electronic Systems (Box 56, Ahuntsic Stn., Montreal, Canada H3L 3N5; Tel: 514-481-6838) is now making available its MTX-1632SL (\$225), a RAM-like video display device that produces 32 characters per line on a 16-line format, and "looks" like a conventional 512x8-bit RAM. The 128-character set features a 7x9 matrix with upper and lower case. Since each character on screen corresponds to a memory location, the full power of the computer is available for data display manipulation. The device requires no external refresh and has a 550-nanosecond access time, TTL compatibility, character blinking, and uses a single +5-volt supply. A unique feature of this video system is that it accepts external H and V sync that allows the display to be locked to any external sync source for video titling, and other uses. The system output is conventional video.

Mass Storage. Micro Designs Inc. (1175 Colusa Ave., Berkeley, CA 94707; Tel: 415-526-7794) has introduced a pair of new digital cassette mass storage systems with up to 1-megabyte(!) memory. Each of these systems features complete file management soft-

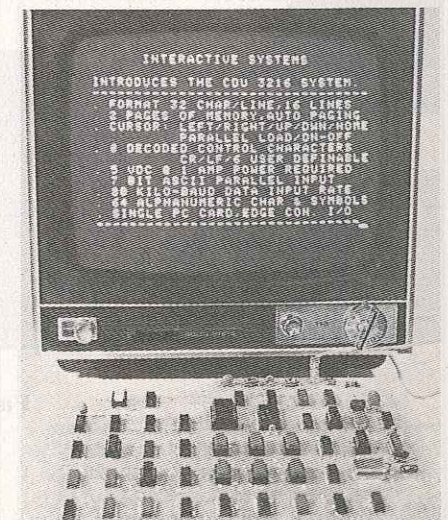
ware that allows the user to manipulate both symbolic and binary files with high-level commands. The Model 100 (\$550) uses a single cassette drive and stores ½-megabyte of data. The disc-like format allows access to any 128-byte record, the data transfer rate is 1000 bytes per second, and the tape can be searched at rates faster than 120"/second. The Model 200 (\$825), featuring dual transports, puts one-megabyte on line.

Both units come assembled and ready for installation in an Altair bus. To bring up the operating system, the user loads a cassette, and transfers control to a ROM on the interface board. All further operations are automatic. Status lights keep tabs on relevant tape conditions, and hardware error detection is provided as well.

Z-80 Stuff. Technical Design Labs, Inc. (Research Park, Bldg H, 1101 State Rd., Princeton, NJ 08540; Tel: 609-921-0321) announces a Z-80 CPU card (\$269) that is compatible with the Altair bus, and is designed to replace the current 8080 or 8080A CPU's. There are two on-board clocks—one crystal controlled and the other variable from dc to well beyond the limits of the Z-80. The use of the Z-80 dynamic refresh capability is made by bringing this signal out to the bus, making possible simple and inexpensive dynamic memory designs.

The pc boards are made from FR4 epoxy, with full solder mask and silk screen, all IC's are socketed, and each package contains full documentation including the Zilog Z80 manual, as well as the 1k Monitor and source code.

Also available from this same firm is their line of ZAPPLE software for the

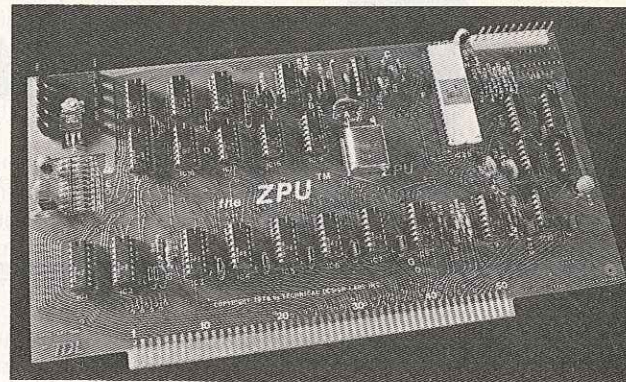


Interactive Systems' CDU-3216 is one of two new display units.

Z-80. Five software packages are currently available at \$150 each, with complete user's manuals. Monitor documentation includes the source code so that the hardware independence feature of Zapple software may be fully realized.

The Zapple Monitor occupies 2K of RAM and offers 27 instructions which includes full program debug capability, I/O handling, and modular organization to allow expansion with user-provided routines. The Zapple Text Editor occupies 3k of RAM and is both line and character oriented, which allows maximum user freedom in text manipulation as well as speed improvement over similar 8080 editors. The Zapple Re-locating Macro Assembler occupies 8k of RAM and features the ability to generate fully relocatable object code, allows infinite nesting of Macros, and many other features. A linking loader extension will soon be available. Zapple Basic occupies 8k of RAM and features all "normal" commands, including complete text editing facility, a List Variables statement that allows internal variables to be observed and/or modified during execution, a trace command that displays line numbers while they are being executed, and a renumber command to

This ZPU card from Technical Design Labs, Inc., is compatible with the Altair bus.



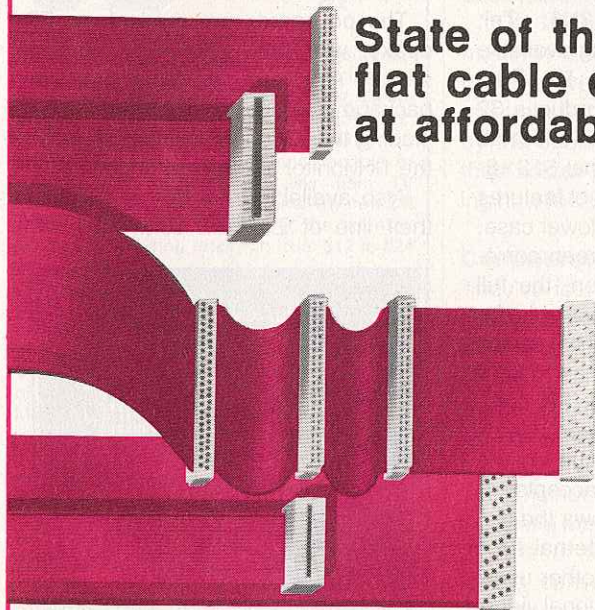
allow line number change according to any starting and interval parameters. Zapple Script is a word processor that occupies 3k of RAM or ROM and allows complete word processing capability including automatic paging, justification, concatenation, spacing, tiling, and substituting, and other formatting functions.

Some New Software. Binary Systems Inc. (634 S. Central Expressway, Richardson, TX 75080; Tel: 214-231-1096) has introduced a new interpreter program for 8080 machines. Called BASIC ETC., the new interpreter was co-developed by John Arnold and Dick Whipple, authors of Tiny BASIC.

BASIC ETC. uses the lower 8K of memory plus at least 1K of RAM for scratchpad. Because this new language was designed for games and business applications, the less frequently used scientific functions of Dartmouth BASIC are not available. It does have full string capability (up to 255 characters per string), N-dimensional arrays, variable precision arithmetic, handles assembly language routines, direct memory and I/O addressing, 27 error codes, character and line erasure editing, permits subroutine nesting, 31 commands and statements, 8 functions plus user defined functions, null control from 0 to 25 seconds, and formatted outputs.

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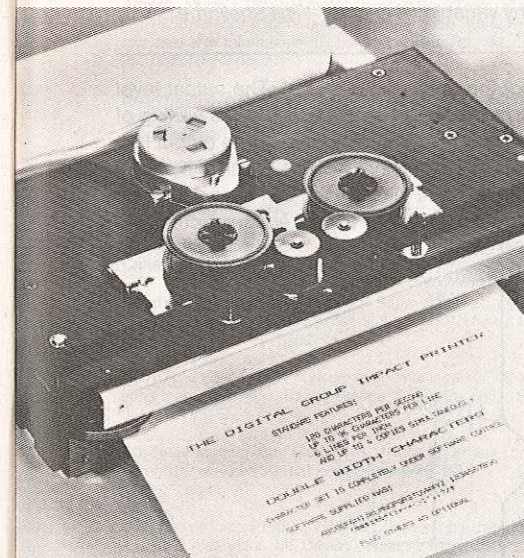
BASIC ETC is supplied on either KC audio tapes or paper tape for \$25, including a 32-page detailed users manual. The manual alone sells for \$6.

Tychon, Inc. (Box 242, Blacksburg, VA 24060; Tel: 703-951-9030) has developed some more interesting software for 8080-type machines. These include an Editor/Assembler tape (\$25, listing \$40), D-Bug tape (\$10, listing \$40), or a documentation package (\$5) which includes all the operating instructions for the editor, assembler, and D-Bug. These programs require 4k of RAM, and are available in 1702A or 2708 ROM. Each software package includes complete documentation on its use and information about changes for different I/O formats.

The Editor and Assembler are used to prepare programs from mnemonic and symbolic statements. The D-Bug package allows changes to be made in a program through a terminal or TTY. D-Bug also has single-step, breakpoint, paper tape read/punch routines, plus 13 useful subroutines.

If you do your own thing, Tychon also makes available its 8080 Octal Code Card (\$2.95) which is a slide-rule type of aid for programming and debugging 8080 software. It contains all the 8080 mnemonics and corresponding octal codes. All instructions are color-coded to indicate which flags are affected during execution. The card is 6.5 by 3 inches, and the rear side contains the ASCII code chart for all 128 characters, plus the 8080 status word and register pair codes.

Pro-Log Corp. (2411 Garden Rd, Monterey, CA 93940; Tel: 408-372-4593) is making available "The Design-



Digital Group's full-size impact matrix printer.

er's Guide to Programmed Logic—Featuring the 8080 Microprocessor" for \$7.50. This 148-page book covers the applications of programmed logic and features specific uses of 8080-type processors. It is profusely illustrated with drawings and tables, and contains numerous sample programs and experiments that demonstrate programming and program/hardware integration.

Intel Corp. (3065 Bowers Ave., Santa Clara, CA 95051) now has an expanded user's library named Insite™ (Intel Software Index and Technology Exchange). The library contains over 200 programs for 8080 and 8008 and over 100 programs for 4040 and 4004 systems. The new Program Library Manual contains all programs with listings up to three pages long. Programs longer than three pages are described in authors' abstracts. Update packages will be published every other month. Paper tapes containing source code for each program are available for a handling fee of \$15. As a bonus, new members receive five free source tapes of their own choice.

One-year membership is free to persons contributing acceptable programs, and the fee for others is \$100 annually. Members receive the program library manual and update packages during the term of their membership. Key among the new library programs are two BASIC compilers for the 8080A. One executes on a paper tape system, while the other requires a disc system. Both are available for a \$15 reproduction price.

If you are looking for a new source of computer hobbyist books, try the Computer Hobbyist Book Club (5405 B Southern Comfort Blvd., Tampa, FL 33614; Tel: 813-886-9890). They have a free flier upon request.

Micro-Navigation. A unique use for a microprocessor was brought to our attention recently. Developed by R.W. Burhans (161 Grosvenor St., Athens, OH 45701; Tel: 614-594-7184 or 614-593-8207) and called the Mini-L, the system was designed for experimental study of the Loran-C, 100-kHz navigation system. The circuit generates 10-microsecond interrupt requests that are locked to the extremely accurate Loran-C signals, making it easy for microprocessor users to devise their own time-measurement software. A 26-page experimenters' manual and two pc board (no components supplied) are included in the kit. A limited number of kits are available. Contact R.W. Burhans for further data. ◇

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