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the CP/M* and S-100 user's journal

MICROSYSTEMSTM

JAN/FEB 1981

VOL. 2/NO.1

DOUBLE DENSITY DISK CONTROLLERS

See Pages 20 - 23

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and more

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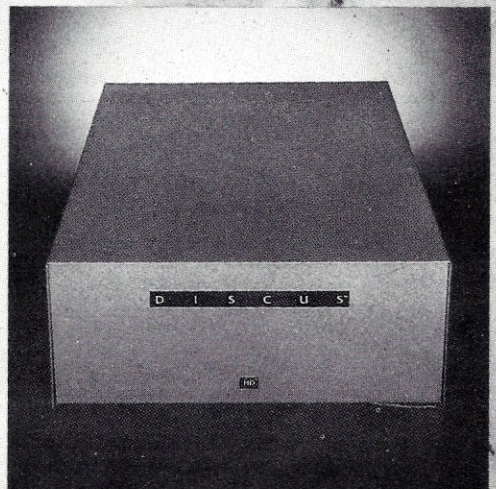
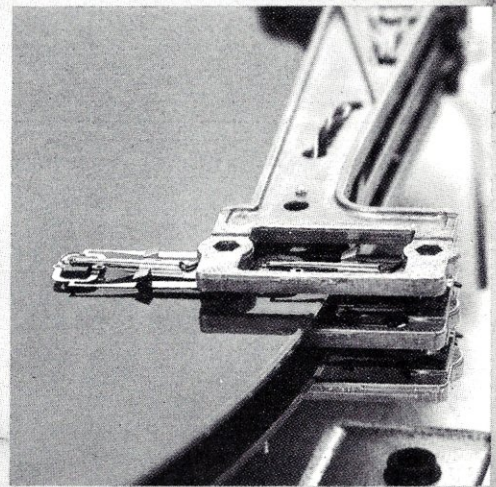
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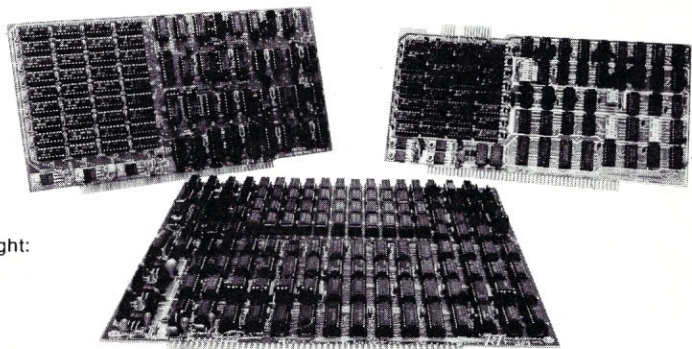
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MICROSYSTEMS

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Volume 2 Number 1

January/February 1981

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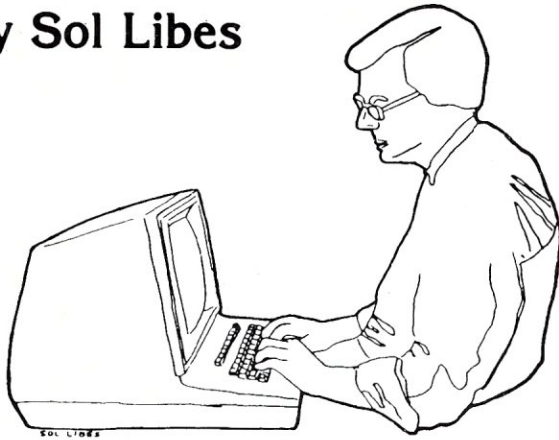
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by Sol Libes



EDITOR'S PAGE

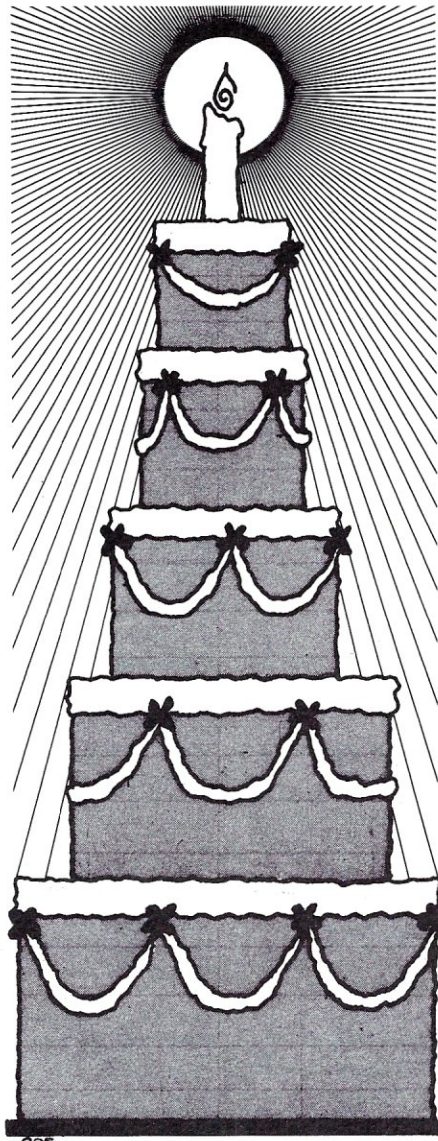
Happy Birthday *MICROSYSTEMS*!

With this issue *MICROSYSTEMS* has completed one full year of operation and starts its second year. Many subscribers wrote to me expressing doubts that I could make it beyond the first or second issue. I hope that by now they are convinced that *MICROSYSTEMS* is here to stay.

I am very pleased with the way *MICROSYSTEMS* is turning out and extremely pleased with the response from our readers. I have gotten an awful lot of compliments and pats on the back. I have gotten a few suggestions on how to improve the publication, with very few negative criticisms. I therefore plan to continue in the direction I have been going.

To judge by our circulation the magazine is a real success. By the end of the first year we had a circulation approaching 8,000. We have approximately 4,500 paid subscribers with the remaining distribution through computer stores and direct sales.

We are making a few changes in the magazine. This is reflected in a subtle alteration in the name of the magazine. The magazine was always titled *MICROSYSTEMS*. I had placed the 'S-100' in the upper left corner to indicate the area of emphasis of the publication. However, our trademarked name was *MICROSYSTEMS*. It has become apparent that the primary interest of our readers is



software, primarily CP/M software, and that their secondary interest is hardware, S-100 hardware. The magazine content has reflected these interests with the content divided about 80% software and 20% hardware. Therefore we have changed our magazine masthead to read: *MICROSYSTEMS*, The CP/M & S-100 Users Journal.

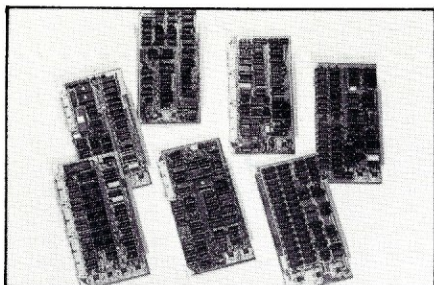
Further, we recognize that the S-100 bus, although presently the optimum hardware bus for the more powerful microcomputer systems, will at some point in time give way to a new hardware bus that will better meet future needs. Therefore, we will continue to emphasize S-100 (or better yet, IEEE-696) but as new hardware systems for sophisticated users become available we will provide coverage of them, too.

We would appreciate your help in making *MICROSYSTEMS* grow. You can do this by mentioning to potential advertisers that they should run ads in *MICROSYSTEMS*. You can mention to computer store dealers that they should carry *MICROSYSTEMS* on their racks. You can mention to your friends that they should subscribe to *MICROSYSTEMS*. But most of all, you can help by providing me with feedback and articles so that I can tailor the magazine to meet your needs.

The staff of *MICROSYSTEMS* wishes you a happy and healthy New Year.

At Intersystems, "dump" is an instruction. Not a way of life.

(Or, when you're ready for IEEE S-100, will your computer be ready for you?)



While everyone's been busy trying to convince you that large buses housed in strong metal boxes will guarantee versatility and ward off obsolescence, we've been busy with something better. Solving the *real* problem with the first line of computer products *built from the ground up to conform to the new IEEE S-100 Bus Standard*. Offering you extra versatility in 8-bit applications today. And a full 16 bits tomorrow.

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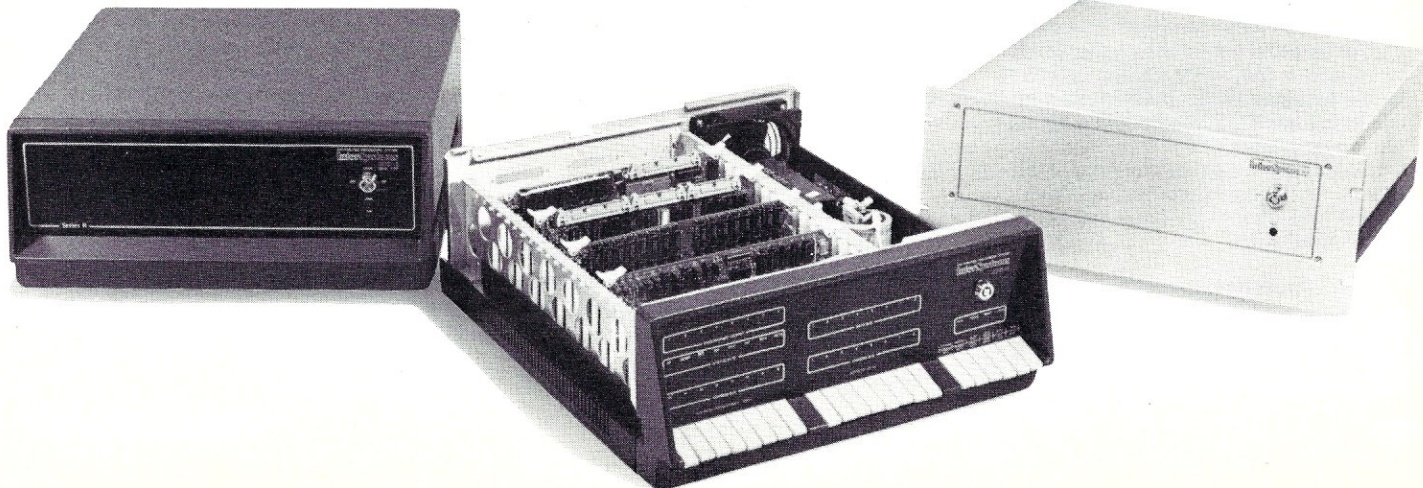
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Whatever your needs, why dump your money into obsolete products labelled "IEEE timing compatible" or other words people use to make up for a lack of product. See the future now, at your Intersystems dealer or call/write for our new catalog. We'll tell you all about Series II and the new IEEE S-100 Bus we helped pioneer. Because it doesn't make sense to buy yesterday's products when tomorrow's are already here.

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LETTERS

TO THE EDITOR

Dear Editor:

MICROSYSTEMS has lived up to your promises and my expectations. Congratulations, that's rare in the "Power Systems" microsmogs we seem to be engulfed in these days.

Reference your reply to Holger Petersen's letter (Vol 1/4, p. 8). "Text should be entered using either 'Wordstar' or 'Electric Pencil,' illustrates a problem many of us are having out here. There is apparently no way of receiving text on disk and working with the ASCII files without bloating the income of the specific word processor's manufacturer or his franchisees. As it is now, files of one are unusable on any other. It is a "pain in the BIAS" to have to support every word processor that comes down the pike. I notice that Micro-Pro/Wordstar had to back down from their "use only us" high horse recently with their unsaleable version 2.0. I emphatically support protection of actual programs from piracy, but object most strongly to the attempt to effectively include the customer's work in the "protected" area by making it unusable with any other WP program—as though all articles typed on Remington typewriters had to be read back through a Remington, or only Kodak film would work in Kodak cameras—remember when? This becomes piracy of the writer's property rights by the programmer, an insidious and deliberate form of the protection racket. We need standardization of the writer created ASCII files within word processors, and/or a usable sub-program within each WP program that will translate its unique jargon to a standardized form, and which can then translate it into its own jargon for editing or printing.

Having worked with Wordstar, Magic Wand, Spellbinder, and Electric Pencil, I am still looking for two items that none of the above do yet.

1). A wordprocessor that will create a genuine book type index, preferably with full multilevel indents, operating from non-printing characters embedded in the text either during writing or after editing.

2). A wordprocessor that will take "foreign" WP files and utilize the same. I suspect I'll have to take up smoking shredded floppies before I see either, but if any progress is being made along these lines, I'd like to hear about it.

James B. Johnstone
Los Altos, CA

Dear Editor:

In the July/August issue there are two articles of interest which should be tied together. In the Editor's Page you infer the IEEE-100 bus standard has been issued. When was it issued? In the ongoing series of "S-100 Boards & Manufacturers" it would be helpful to state if the manufacturers' boards meet the new IEEE S-100 bus standard. If a board does not meet the standard then its limitations could be listed or a statement that it does not work.

Larry Elliot
Mammoth Lakes, CA

The IEEE S-100 standard, regrettably, still has not been formally adopted. With luck the vote will be taken by the time this appears in print.

It would indeed be helpful to be able to indicate which boards actually do meet the standard. Some manufacturers claim IEEE compatibility when in fact they are not 100% compatible. It is intended that the degree of compatibility will be indicated in the hardware product reviews published in MICROSYSTEMS.

Editor

Dear Editor:

I am preparing a handbook for assembly language programmers, consisting primarily of quick reference charts and tables, and universal programming tricks. I would appreciate suggestions as to material that assembly programmers would find useful.

Robert Rose
Falls Church, VA

Dear Editor:

A tip for your CP/M users column:

Those users of ED may experience difficulties with lower case, over which the manual is not all that clear; the clue to the full use of all ED's find, substitute and juxtaposition commands is to use lower case commands to operate with lower case. That is—I, N, F, S, J operate only on upper case codes and i, n, f, s, j operate on both upper and lower case codes. The credit for this must go to Digital Research, who provided this in response to my plea for lower case operation in ED.

With regard to CPUs operating on the S-100 Bus:

A year ago I received data on the 2650 Slavemaster Multiprocessor manufactured by Victoria Digital, 401 Dundee St, Victoria, TX 77901, Tel (512) 575-3836. The 2650 was originally considered by Dr. Kildall for CP/M since he had written PLUS for Signetics. My 2650 will eventually use an 8080 CP/M system as a filing cabinet.
Mike Baker
Garstang, England

Dear Editor:

The description of the CP/M File Control Block in Part II of Chris Terry's series agrees with Digital Research's documentation, but CP/M is smarter than they claim! The ET byte, which is the first byte of the FCB, is not always zero. Zero denotes the currently logged-in drive (the default drive). However values 1 through 4 correspond to drives A through D.

The CCP uses this convention in building the FCB from the command line parameters and the CP/M file operations obey this convention. For example:

A PROG B:FLC
will build an FCB with a 2 in the ET byte. If program PROG.COM acts on this FCB it should not zero the ET byte or it will attempt to work with the default drive, A, instead of the specified drive, B.
Dick Greenlaw
Gahanna, Ohio

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Is There an Alternative to CP/M — Try it — You'll Like it say the developers.
 — Westport, CT

InfoSoft Systems, Inc., the developers of I/OS 2, think they have an answer to the complaints about CP/M (the trademarked product of Digital Research). InfoSoft's head of development revealed many of the advanced features that I/OS allows while still supporting all previous CP/M programs. He discussed what the development group learned from their previous development of Cromemco's CDOS, with over 15,000 installations. I/OS 2 is geared, he stated, toward the turnkey system and the developer, yet presents a friendly face to the user. Such features as turnkey startup, local batches, no system on the 'A' disk, and terminal controls are integrated into the design.

Taking concepts from Unix, I/OS 2 has full hard disk support, the ability to mix various sized disks; and a clean documentation format. For the developer, I/OS is the only system available with a full mix of devices and disks supported by the developer, and a question and answer system creation process. End user price is similar to CP/M, yet the dealer has a greater margin to work with, and far more support from the factory.

The spokesman refused to comment upon rumors that other, lesser developed programs were being released for the more sophisticated hacker.

• • •

Software Beasts released from the dungeons — Westport, CT

A spokesman for InfoSoft Systems today admitted that strange creatures were being released from their development dungeons below their software sales offices in beautiful downtown Westport. "These creatures are totally unrelated to our normal superb line of micro-processor software", stated the speaker.

Stressing that the beasts were not harmful, she admitted they did tend to bewitch hackers, forcing them to tinker till all hours. Under intense cross-examination he disclosed that these creatures, while only half-formed, were very useful as assistants or homunculi for would-be software wizards. Before dissolving into a puff of green smoke, she (???) intimated that full details on capturing the creatures were available from the sales desk.

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Original Adventure is an undisputed classic. The treasures you seek are hidden in underground caverns. All you have to do is find them. It's easy...just overcome a giant clam, nasty little dwarves and other deathly perils. This game is bi-lingual so, to make it really a cinch, just type in "GO FRANCE" and the characters will speak and understand only French. (CS-9004) \$24.95.

The Basic Games Library features 190 top-notch simulations, battles and strategy games from the celebrated Basic Computer Games Book and its sequel, More Basic Computer Games. **Volume I** (CS-9001) and **Volume II** (CS-9006) include Super Star Trek, Slalom, and Checkers. Each disk is \$24.95. Both disks and the Basic Computer Games Book are available for only \$50.00 (CS-9000).

Volume III (CS-9005) and **Volume IV** (CS-9006) feature Yahtzee, Tennis, Wumpus and Grand Prix. The disks are \$24.95 each. Both disks and the More Basic Computer Games Book are \$50.00 (CS-9007). The entire four disk collection also includes both big games books, edited by David Ahl, and is \$95.00 (CS-9008). All are on 8" disks, require 48K and Microsoft Basic.

Your local computer store should carry Creative Computing Software. If your favorite retailer does not carry the software you need, have him call in your order to 800-631-8112. Or, you can order directly from Creative Computing. Write to Creative Computing Software, Dept. AHGG, P.O. Box 789-M, Morristown, NJ 07960. Include \$1.00 for postage and handling. For faster service, call in your bank order toll free to 800-631-8112.

sensational software

Dear Editor:

While investigating a disk of new utility software given to me by a friend, I came across an unusually useful program which I would like to share with your readers. This program enables the user of CP/M to recover from a variety of system halts and lockups without losing any prior program or data from RAM. This can really save the day when you have a fault or error after entering a lengthy program in Basic and are forced to press reset to regain operation. This could be the result of getting stuck in a WAIT command, or a printer not being ready during a LPRINT, etc. In general when this happens you must re-read the interpreter and start from scratch.

This program, which I will call GO.COM, consists of precisely zero steps. In other words, it is merely a file entry with a length of zero records. This may sound weird, but if you research the inner workings of CP/M you will understand. What happens when you execute any .COM file is that the file is read into memory starting at 100H, and then the CPU begins to execute at that same starting point, 100H. Thus if you have a .COM file of zero length, it reads nothing new into RAM, and begins to execute whatever was in RAM prior to the request.

It happens that doing this with the Microsoft interpreter causes you to be back under interpreter control, with the program and all variables still intact. The only proviso is that you have not read in any other .COM files or powered down in the interim. You can even intentionally leave Basic (using the "SYSTEM" command), and use all of the intrinsic CP/M commands, like DIR, ERA, TYPE and SAVE, without hampering your ability to return to the interpreter—program and all.

There are two ways that I know of to create such a file, one within the CP/M environment, and one in Basic. They are as follows:

```
CP/M version: SAVE 0 GO.COM
Microsoft Basic Version: OPEN "R",
1,"GO.COM"CLOSE
```

Immediately after either of these commands, you will see in the directory a file of zero length called GO.COM. To test it, run any .COM file, push reset or CTL-C during execution, and then simply type GO. If you were running Basic, you will see the OK prompt, and likewise with other programs you will be back executing the file without having to read it again from disk.

This is really not a program at all, but a novel way to fool the operating system into thinking there was one to read, and making it run again whatever happens to be in RAM starting at 100H.

Another use for this approach is to allow repeated execution of a program without having to re-read it each time from the disk. This could be a time saver when you don't have the source code of a program, and it does not have a built in repeat function, like some disk formatting programs I have seen.

Hope this is as helpful to other users as it continues to be for me.

Neil Rosenberg
Littleton, MA

MICROSYSTEMS

NEW! TPM* for TRS-80 Model II
NEW! System/6 Package
Computer Design Labs

Z80* Disk Software

We have acquired the rights to all TDL software (& hardware). TDL software has long had the reputation of being the best in the industry. Computer Design Labs will continue to maintain, evolve and add to this superior line of quality software.

— Carl Galletti and Roger Amidon, owners.

Software with Manual/Manual Alone

All of the software below is available on any of the following media for operation with a Z80 CPU using the CP/M* or similar type disk operating system (such as our own TPM*).

for TRS-80* CP/M (Model I or II)
 for 8" CP/M (soft sectored single density)
 for 5 1/4" CP/M (soft sectored single density)
 for 5 1/4" North Star CP/M (single density)
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BASIC I

A powerful and fast Z80 Basic interpreter with EDIT, RENUMBER, TRACE, PRINT USING, assembly language subroutine CALL, LOADGO for "chaining", COPY to move text, EXCHANGE, KILL, LINE INPUT, error intercept, sequential file handling in both ASCII and binary formats, and much, much more. It runs in a little over 12 K. An excellent choice for games since the precision was limited to 7 digits in order to make it one of the fastest around. \$49.95/\$15.

BASIC II

Basic I but with 12 digit precision to make its power available to the business world with only a slight sacrifice in speed. Still runs faster than most other Basics (even those with much less precision). \$99.95/\$15.

BUSINESS BASIC

The most powerful Basic for business applications. It adds to Basic II with random or sequential disk files in either fixed or variable record lengths, simultaneous access to multiple disk files, PRIVACY command to prohibit user access to source code, global editing, added math functions, and disk file maintenance capability without leaving Basic (list, rename, or delete). \$179.95/\$25.

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A character oriented text editor with 26 commands and "macro" capability for stringing multiple commands together. Included are a complete array of character move, add, delete, and display function. \$49.95/\$15.

ZTEL

Z80 Text Editing Language - Not just a text editor. Actually a language which allows you to edit text and also write, save, and recall programs which manipulate text. Commands include conditional branching, subroutine calls, iteration, block move, expression evaluation, and much more. Contains 36 value registers and 10 text registers. Be creative! Manipulate text with commands you write using Ztel. \$79.95/\$25.

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A Z80 Text Output Processor which will do text formatting for manuals, documents, and other word processing jobs. Works with any text editor. Does justification, page numbering and headings, spacing, centering, and much more! \$79.95/\$25.

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A macro assembler which will generate relocatable or absolute code for the 8080 or Z80 using standard Intel mnemonics plus TDL/Z80 extensions. Functions include 14 conditionals, 16 listing controls, 54 pseudops, 11 arithmetic/logical operations, local and global symbols, chaining files, linking capability with optional linker, and recursive/reiterative macros. This assembler is so powerful you'll think it is doing all the work for you. It actually makes assembly language programming much less of an effort and more creative. \$79.95/\$20.

MACRO II

Expands upon Macro I's linking capability (which is useful but somewhat limited) thereby being able to take full advantage of the optional Linker. Also a time and date function has been added and the listing capability improved. \$99.95/\$25.

LINKER

How many times have you written the same subroutine in each new program? Top notch professional programmers compile a library of these subroutines and use a Linker to tie them together at assembly time. Development time is thus drastically reduced and becomes comparable to writing in a high level language but with all the speed of assembly language. So, get the new CDL Linker and start writing programs in a fraction of the time it took before. Linker is compatible with Macro I & II as well as TDL/Xitan assemblers version 2.0 or later. \$79.95/\$20.

DEBUG I

Many programmers give up on writing in assembly language even though they know their programs would be faster and more powerful. To them assembly language seems difficult to understand and follow, as well as being a nightmare to debug. Well, not with proper tools like Debug I. With Debug I you can easily follow the flow of any Z80 or 8080 program. Trace the program one step at a time or 10 steps or whatever you like. At each step you will be able to see the instruction executed and what it did. If desired, modifications can then be made before continuing. It's all under your control. You can even skip displaying a subroutine call and up to seven breakpoints can be set during execution. Use of Debug I can pay for itself many times over by saving you valuable debugging time. \$79.95/\$20.

DEBUG II

This is an expanded debugger which has all of the features of Debug I plus many more. You can "trap" (i.e. trace a program until a set of register, flag, and/or memory conditions occur). Also, instructions may be entered and executed immediately. This makes it easy to learn new instructions by examining registers/memory before and after. And a RADIX function allows changing between ASCII, binary, decimal, hex, octal, signed decimal, or split octal. All these features and more add up to give you a very powerful development tool. Both Debug I and II must run on a Z80 but will debug both Z80 and 8080 code. \$99.95/\$20.

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Digital Research's operating system configured for many popular micro-computers and disk systems:

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Corvus Add 80.
Konan Phoenix Add 80.
ICOM 4511/Perfec D3000 Add 80.

Software consists of the operating system, text editor, assembler, debugger and other utilities for file management and system maintenance. Complete set of Digital Research's documentation and additional implementation notes included. Systems marked * and ** include firmware on 2708 and 2716. Systems marked + include 5440 media charge. Systems marked **(H)** require the special **(H)** versions of software in this catalog. **(H)** includes hardware addition to allow our standard versions of software to run under it.

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- ① **DISTEL**—Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files, Intel or TDL/Xitan pseudo ops optional. Runs on 8080 **\$65/\$10**
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- ① **SMAL/80** Structured Macro Assembler
- ② **Language**—Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE-LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs. Not compatible with CP/M version 2 or greater. **\$75/\$15**

- ① **RAID**—8080/8085 debugging aid and general system utility program. Both a software emulator and real-time debug monitor. Features multiple breakpoints, symbolic input, symbolic display and altering of registers, built-in assembler & dis-assembler, tracing, single-stepping, memory protection, histograms, memory search, direct disk access. Requires 32K CP/M **\$250/\$25**

PHOENIX SOFTWARE ASSOCIATES

- ① **PASM***—Z80 macro assembler, Intel/TDL **(H)** mnemonics. Generates Intel hex format or relocatable code in either TDL Object Module format or PSA Relocatable Binary Module format. Supports text insertion, conditional branching within macros, recursive macros and parameter passing. **\$129/\$25**
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- ④ **BUG*** and **μBUG***—Z80 interactive machine **(H)** level debugging tools for program development. BUG has full mnemonic trace and interactive assembly (mnemonics compatible with PASM). Dynamic breakpoints and conditional traps while tracing (even through ROM). μBUG is a subset of BUG and is used in memory limited situations. **\$129/\$25**

DIGITAL RESEARCH

- ① **MP/M**—Installed for single density MDS-800. Multi-processing derivative of the CP/M operating system. Manual includes CP/M2 documentation **\$300/\$50**
- ② **MAC**—8080 Macro assembler. Full Intel macro definitions. Pseudo Ops include RPC, IRP, REPT, TITLE, PAGE, and MACLIB. Produces absolute hex output plus symbol table file for use by SID and ZSID (see below) **\$120/\$15**
- ③ **SID**—8080 Symbolic debugger. Full trace, pass count and breakpoint program testing. Has backtrace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values **\$105/\$15**
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- ③ **WHITESMITHS C COMPILER**—The ultimate in systems software tools. Produces faster code than a pseudo-code Pascal with more extensive facilities. Conforms to the full UNIX* Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M **\$630/\$30**

MICROSOFT

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- ⑭ **PASCAL/MT**—Subset of standard PASCAL. Generates ROMable 8080 machine code. Symbolic debugger included. Supports interrupt procedures. CP/M file I/O and assembly language interface. Real variables can be used. Software floating point, or AMD 9511 hardware floating point. Includes strings enumerations and record data types. Manual explains BASIC-PASCAL conversion. Requires 32K **\$250/\$30**
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Software with Manual or Alone

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GENERAL LEDGER II - Designed for CPAs. Stores complete 12 month detailed history of transactions. Generates financial statements, depreciation, loan amortizations, journals, trial balances, statements of changes in financial position, and compilation letters. Includes payroll system with automatic posting to general ledger. Prints payroll register, W2's and payroll checks. \$450/\$30

T/MAKER - Powerful new tool for preparing management reports with tabular data. Makes financial modeling projects easy. Do you want a weekly profitability report? Set up the table and compute. Just change the sales figures for next week and compute. You have a new report! T/MAKER includes a full screen editor for setting up tables which pages left, right, up and down. Compute includes standard arithmetic, percents, exponents, common transcendental functions, averages, maxima, minima, projections, etc. Requires 48K CP/M, CBASIC-2, CRT terminal with addressable cursor positioning. \$275/\$25

ESQ-1 - Professional time and billing for the legal profession. Designed for use by the first-time computer user. Records billable and non-billable time. Complete system includes transaction entry, posting, billing, reports, and client analysis. Records cash receipts, escrow receipts, and escrow transfers. Requires 48K CP/M system, 480K of disk storage space, cursor addressable CRT, and CBASIC-2. \$1495/\$50

Complete demonstration system for ESQ-1. \$75/\$50

BSTAM - Utility to link one computer to another also equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansion to send *.COM, etc. 9600 baud with wire. 300 baud with phone connection. Both ends need one. Standard and versions can talk to one another. This software requires a knowledge of assembler language for installation. \$150/\$10

BSTMS - Intelligent terminal program for CP/M systems. Permits communication between micros and mainframes. Sends character data files to remote computers under complete control. System can record character data sent from remote computer systems and data banks. Includes programs to EXPAND and COMPRESS binary files for transmission. This software requires a knowledge of assembler language for installation. \$200/\$25

WHATSI?? - Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC-2. \$175/\$25

SELECTOR III-C2 - Data Base Processor to create and maintain multi-key data bases. Prints formatted and reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source. \$295/\$20

GLECTOR - General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types insure proper double entry book-keeping. Generates balance sheets, P&L statements and journal. Two year record allowed for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2. CBASIC-2 and 56K system. \$350/\$25

MAGSAM III - Sophisticated keyed access file support system. Supports random, sequential, and generic retrieval by key. Also, multiple secondary keys. Dynamic allocation and extension of files with automatic free space reclamation. Interactive tutorial included to get the user started. Complete with documentation and quick reference card. Specify CBASIC or Microsoft BASIC version. Requires 48K system. \$145/\$25

MAGSAM IV - High speed machine code version of MAGSAM III for CBASIC only. Distributed as pre-loaded modules and Microsoft relocatable object modules. \$295/\$25

DMA - Configurable Business System is a comprehensive set of programs for defining custom data files and application systems without using a programming language such as BASIC, FORTRAN, etc. Documentation for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval with transaction processing. Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list systems included. No support required. \$395/\$40

MICROPRO

SUPER-SORT I - Sort, merge, extract utility as absolute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating & fixed point, exponential, field justified, etc. Even variable number of fields per record! \$225/\$25
SUPER-SORT II - Above available as absolute program only. \$175/\$25
SUPER-SORT III - As II without SELECT/EXCLUDE. \$125/\$25

DATASAR - Professional forms control entry and display system for key-to-disk data capture. Menu driven with built-in learning aids. Input field verification by length, mask, attribute (i.e. upper case, lower case, numeric, auto-dup, etc.). Built-in arithmetic capabilities using keyed data, constant and derived values. Visual feedback for ease of forms design. Files compatible with CP/M-MP/M supported languages. Requires 32K CP/M and CRT with addressable cursor. \$350/\$35

WORD-STAR - Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, Read/Write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning. \$445/\$40

WORD-STAR-MERGE - As above with option for production mailing of personal and documents with mail lists from DATASAR or WORD. \$575/\$40

WORD-MASTER Text Editor - In one mode has superset of CP/M's ED commands including global searching and replacing, forwards and backwards in file in video mode, provides full screen editor for users with serial addressable-cursor terminal. \$145/\$25

MAGIC WAND - Word processing system with simple, easy to use full screen text editor and powerful print processor. Editor has all standard editing functions including text insert and delete, global search and replace, block move and library files for boiler plate text. Print processor formatting commands include automatic margins, pagination, headings & footings, centered and justified text. Also prints with true proportional spacing, merges with data files for automatic form letters, and performs run-time conditional testing for varied output. Requires 32K CP/M and CRT terminal with addressable cursor. \$395/\$40

TEXTWRITER III - Text formatter to justify and paginate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertions. Ideal for contracts, manuals, etc. Now compatible with Electric Pencil and Word-Star prepared files. \$125/\$20

DATEBOOK - Program to manage time just like an office appointment book but using the speed and memory of a computer. Keeps track of three appointment schedules (three dental chairs, three attorneys, etc.) at once. Appointments consist of name, reason for the appointment, the date and time, and the length of the appointment. System can be quickly customized for the individual user. Many helpful features for making, changing, finding, and reporting appointments. Requires 48K CP/M and 180K bytes diskette storage. Requires 80 x 24 cursor addressable terminal. Specify 8080 CP/M, Z80 CP/M or Cromemco CDS. \$295/\$25

PEACHTREE SOFTWARE

General accounting software for small businesses. Each product can be used alone or with automatic posting to the General Ledger. Supplied in source for Microsoft BASIC 4.51
GENERAL LEDGER \$530/\$40
ACCOUNTS PAYABLE \$530/\$40
ACCOUNTS RECEIVABLE \$530/\$40
PAYROLL \$530/\$40
INVENTORY \$660/\$40

Other application products supplied in source for Microsoft BASIC 4.51
MAILING ADDRESS \$530/\$40
PROPERTY MANAGEMENT \$925/\$40

GRAHAM-DORIAN SOFTWARE SYSTEMS

Comprehensive accounting software written in CBASIC-2 and supplied in source code. Each software package can be used as a stand-alone system or integrated with the General Ledger for automatic posting to ledger accounts. Requires CBASIC-2.
GENERAL LEDGER \$805/\$40
ACCOUNTS PAYABLE \$805/\$40
ACCOUNTS RECEIVABLE \$805/\$40
INVENTORY SYSTEM \$555/\$40
JOB COSTING \$805/\$40
APARTMENT MANAGEMENT \$805/\$40
CASH REGISTER \$805/\$40

POSTMASTER - A comprehensive package for mail list maintenance that is completely menu driven. Features include keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Includes NAD file translator. Requires CBASIC-2. \$150/\$20

STRUCTURED SYSTEMS GROUP

Complete interactive accounting software for business. Each product can be used stand-alone or with automatic posting to the general ledger. Each product is thoroughly tested and very well documented.
GENERAL LEDGER \$820/\$40
ACCOUNTS RECEIVABLE \$820/\$40
ACCOUNTS PAYABLE \$820/\$40
PAYROLL \$820/\$40
INVENTORY CONTROL \$820/\$40

ANALYST - Customized data entry and reporting system. User specifies up to 75 data items per record. Interactive data entry, retrieval, and update facility makes information management easy. Sophisticated report generator provides customized reports using selected records with multiple level breakpoints for summarization. Requires a disk sort utility such as QSORT, SUPER-SORT or VSORT and CBASIC-2. \$250/\$15
LETTERIGHT - Program to create, edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Integrates with NAD for form letter mailings. \$200/\$25

NAD - Name and Address selection system. Interactive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. QSORT required if sorting is desired. \$100/\$20

QSORT - Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created. \$100/\$20

HEAD CLEANING DISKETTE - Cleans the drive Read/Write head in 30 seconds. Diskette absorbs loose oxide particles, fingerprints, and other foreign particles that might hinder the performance of the drive head. Lasts at least 3 months with daily use. Specify 5" or 8".
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LIFELINES NEWSLETTER FROM LIFEBOAT

LIFELINES is the first step in software support for the serious microcomputer user. Each issue reports new revisions together with information on the purpose for each such release, be it for correction of "bugs" or the addition of features and facilities.
Feature Articles! New Software! Product Comparisons! Info on CP/M Users Group!
SUBSCRIPTION INFORMATION:
\$18 for twelve issues: U.S., Canada, and Mexico.
\$40 for twelve issues: all other countries.
\$2.50 for each back issue: U.S., Canada, and Mexico.
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Ordering Information

MEDIA FORMAT ORDERING CODES. When ordering, please specify format code.

LIFEBOAT ASSOCIATES MEDIA FORMATS LIST. Diskette, cartridge disk and cartridge tape format codes to be specified when ordering software for listed computer or disk systems. All software products have specific requirements in terms of hardware or software support, such as MPU type, memory size, support operating system or language.

Table with columns: Computer system, Format Code, Computer system, Format Code, Computer system, Format Code. Lists various software products and their compatibility with different hardware configurations.

Prices reflect distribution on 8" single density diskettes. If a format is requested which requires additional diskettes, a surcharge of \$8. per additional diskette will be added.
Prices FO B. New York. Shipping, handling and C.O.D. charges extra.
Manual cost applicable against price of subsequent software purchase.
The sale of each proprietary software package contains a license for use on one system only.

DC 300 Data Cartridges Specify 450 XL or 300 certified. Pack of 5. \$100
FLIPPY DISK KIT - Template and instructions to modify single sided 5 1/4" diskettes for use of second side in single sided drives. \$12.50
FLOPPY SAVER - Protection for center holes for 5" and 8" floppy disks. Only 1 needed per diskette. Kit contains centering post, pressure tool and tough 7 mil mylar reinforcing rings for 25 diskettes.
5" Kit \$14.95
5" Rings only \$7.95
8" Kit \$16.95
8" Rings only \$8.95

THE CP/M HANDBOOK (with MP/M) by Rodney Zaks. \$13.95

PASCAL USER MANUAL AND REPORT - By Jensen and Wirth. The standard textbook on the language. Recommended for use by Pascal/Z, Pascal/M and Pascal/MT users. \$12

THE C PROGRAMMING LANGUAGE - By Kernighan and Ritchie. The standard textbook on the language. Recommended for use by BDS C, tiny C, and Whitesmarts C users. \$12

STRUCTURED MICROPROCESSOR PROGRAMMING - By the authors of SMAL/80. Covers structured programming, the 8080/8085 instruction set and the SMAL/80 language. \$20

ACCOUNTS PAYABLE & ACCOUNTS RECEIVABLE - BASIC book by Osborne/McGraw-Hill. \$20

GENERAL LEDGER - BASIC book by Osborne/McGraw-Hill. \$20
PAYROLL WITH COST ACCOUNTING - BASIC book by Osborne/McGraw-Hill. \$20

Program names trademarked

Recommended system configuration consists of 48K CP/M, 2 full size disk drives, 24 x 80 CRT and 132 column printer.

Modified version available for use with CP/M as implemented on Heath and TRS-80 Model I computers.

User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

This product includes/excludes the language manual recommended in Condiments.
Serial number of CP/M system must be supplied with orders.

Requires Z80 CPU.

NEWS & VIEWS

What Does "IEEE Compatible" Mean?

Mark Garetz, in a recent issue of *INFOWORLD* rendered the following comments about S-100 board manufacturers who use the term "IEEE compatible". He said:

"Since the IEEE published its S-100 specification, the phrase "IEEE compatible" has appeared all over advertising and sales literature. But what is "compatible?" Evidently, the word means different things to different people. I am wary of any product that has "IEEE compatible" on it. I would prefer manufacturers to use "meets all IEEE specifications." Furthermore, manufacturers should be prepared to back that statement up with figures, numbers and, if necessary, timing diagrams. I think customers deserve it. I'll give you an example. One S-100 CPU board manufacturer at the show (editor's comment: Mark here refers to the PC/80 show in Philadelphia) claimed in his literature to have "full S-100 compatibility according to IEEE standard." He also said his board "fully complies with the new IEEE S-100 standard, and runs in any environment on the S-100 bus." When I asked a principal of the company how close the board really came, he said, "Well, we haven't quite got around to measuring it yet, but we don't foresee any problems." The company's literature was nicely printed, though."

Also, Mark reported that "the military is using S-100 (excuse me, IEEE-696) systems for ground support systems in the MX missile project."

ADA Rush is On

At least 25 companies and universities are reportedly in the process of developing compilers for the ADA language. ADA is a new programming language created by the U.S. military which is intended to replace numerous other languages. ADA is a highly structured language intended for algorithmic real-time systems programming.

Intel claims that its 32-bit microprocessor, due for release shortly, uses ADA as its primary language. A few universities already have ADA compilers running. However, the first commercial release of an ADA compiler is not expected until late this year.

The ADA language has been finalized after the submission of 900 revision proposals. The most significant improvement made was the addition of tasking. The ADA reference manual may be obtained from DOD's DARPA office, 1400 Wilson Blvd, Arlington, VA 22209.

IBM & S-100?

The following is a quote, without comment, from *DATAMATION* magazine:

"Microcomputer product manufacturers are worrying among themselves about 'when' IBM will develop an S-100 bus capability. They seem sure the question is when, and not if. Latest speculation is that the giant will do it through a licensing agreement with a Japanese company."

UCSD Systems User Society Operating

The UCSD (Pascal) System User's Society appears to be off to a good healthy start. I recently received a copy of their 40 page newsletter. It contained much useful information for users of UCSD Pascal. The society has also released two volumes of software which is in the public domain. Membership in the society is \$20/year. For more information write to: UCSD System User's Society, Chip Chapin Secretary, c/o LMR, 4805 Mercury, Suite A, San Diego, CA 92111.

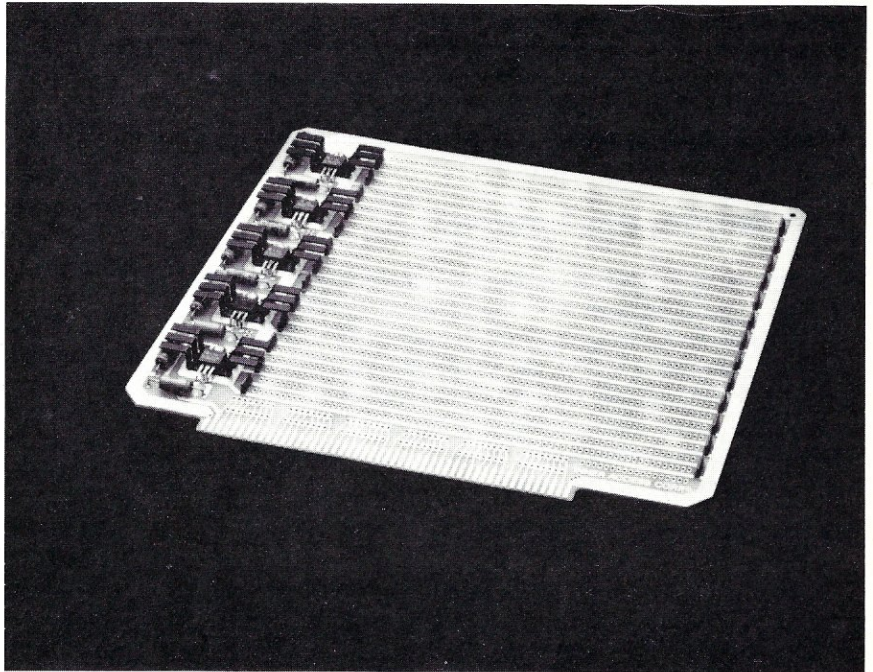
Expand Your 8-BIT Micro To 16-MBYTES

If you thought you needed a 16-bit micro to address up to 16-Mbytes, think again. You can do it easily using the new 74LS610 memory mapping chip. It takes the high order 4 address bits and converts it to 12 bits extending the address word to 24-bits. The result is 16-Mbytes divided into 4096-4K segments. An excellent article on using the 74LS610 was written by Carol Anne Ogdin and appeared in the Nov 5, 1980 issue of *EDN* magazine (pages 269-273). In fact micro buffs will find the issue of *EDN*, published by Cahners Publishing Co., 221 Columbus Ave., Boston MA 02116, packed with so much information on micro hardware and software that they will treasure it (cost \$7).



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New North Star User Group In Connecticut

This group meets monthly. For information contact Bert Pisak or Henry Pietras, c/o Technology Systems, 208 Greenwood Ave, Bethel, Connecticut 06810 (tel: 203-748-6856).

Micro Data Base Newsletter Published

Micro Data Base Systems Inc., Box 248, Lafayette, IN 47902 is publishing *Data Base Focus*, a newsletter for users of Data Base software packages. A sample copy is \$1.

First 68000 System Introduced

The first S-100 CPU card using the Motorola 68000 16-bit microprocessor has finally been introduced by Management Analysis & Control Inc., 3530 "C" Street N.E., Auburn WA 98002, tel: (206) 939-5676. Priced at \$2095, it includes 1K X 16 RAM and sockets for 2/4K X 16 ROM, serial and parallel I/O ports, 3 timers. A 2K Monitor ROM is included. An interface to a special 5 pin interface bus is also provided.

Build Your Own Z-80 CPU Card

Like to build a Z-80 CPU board that contains I/O, ROM, clock and interrupt controller from scratch for under \$200? Jim Gilbreath, 7266 Courtney Dr., San Diego CA 92111 (tel: 277-7863) is offering a 70-page construction manual for only \$10. Over 30 people have already built the board with no problems. The board is

wire-wrapped from precise instructions furnished in the manual. The following are a few of the boards features: 2,4 or 6 Mhz operation, IEEE S-100 compatible, wait-state for slow memory, up to 4K EPROM which may be phantom, 3 programmable serial I/O ports, 6 parallel I/O ports, real-time clock, interrupt controller. Construction time is approx. 10 hours.

Fastest Micro In The West

Intel has announced a 10Mhz version of their 8086 16-bit microprocessor. Called the 8086-1, it is claimed to be 15 to 20 percent faster than competing 16-bit micros in benchmark tests.

Rumors

NEC, Qume and Computer Tranceiver are expected to introduce low-cost daisy-wheel printers with OEM price tags of under \$800. It is further rumored that a California firm is developing a daisy for under \$300. Introduction is expected next year. In the meantime Pertec Computer has introduced a 17 cps daisy, made by Triumph-Adler in Germany and selling to OEMs for \$820 in 100 quantities. . . . ALTOS Computers is rumored to have switched from the Z8000 to the 8086 for its new 16-bit system. This decision was most probably due to introduction of CP/M-86 by Digital Research. . . . North Star Computers is rumored to be developing an 8088 based system using a single board. It will work with a hard disk and support CP/M. . . . Whitesmiths Ltd will soon introduce an 8088/8086 version of its C Compiler.

Load **TRS-80** software on your S-100 **Z-80** or your money back!!!

Of the 500,000 home computers in this country more than 200,000 are **TRS-80**'s. Look through your magazines and you will see that there is more software available for the **TRS-80** than all other computers combined. Here is what we offer.

- 1) An assembled hardware interface and software drive which will enable you to load data from **TRS-80** cassette tapes into your S-100 memory.
- 2) Complete documentation telling you how to relocate the program at its correct address, find the entry point to the program, and link the program to your keyboard input and video output routines.
- 3) Includes examples of how we interfaced **TRS-80** Level II basic and **SARGON II** with our system.

NOTE: Knowledge of **Z-80** Machine Code is required

or **FREE** with purchase of Assembled and Tested Compurism or Super Compurism Unit.

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PLUS Expandoram (4MHz) MOD. KIT

PLUS 16 A-D 8 D-A

This S-100 board has 16 channels of analog to digital input and 8 channels of digital to analog output. Enough for most burglar alarm or home energy monitoring systems!! It uses *National Semiconductor's* ADC0816 sixteen channel analog to digital converter, which is available from DIGI KEY and other mail order houses for about thirty dollars. The total cost of construction including the board and parts should not exceed a hundred dollars. All inputs and outputs are 5 volts. Dual or split power supplies are not required. There is a on board kluge area for construction of custom circuits.

Board with documentation **ONLY \$45.00**

COMPURISM & SUPER COMPURISM COLOR GRAPHICS

Compurism is a color graphics interface for S-100 Systems, with 16K of on board dynamic memory. Refresh of the dynamic memory is accomplished on board compurism. (super compurism has 32K of on board dynamic memory) The resolution for compurism is 144 horizontal by 192 vertical pixels. (super compurism resolution is 288 horizontal by 192 vertical pixels). Each byte of memory controls only two pixels of the matrix. Four bits of memory are dedicated to the exclusive control of every single pixel. Therefore, every pixel may always be programmed in any one of sixteen colors or sixteen shades of grey, completely independent of all other pixels in the matrix. (Please compare this to any other color graphics interface in our price range.) From the upper left hand corner to the lower right hand corner of the matrix, the pixels are mapped to consecutive memory bytes. This greatly simplifies the programming of compurism.

COMPURISM SOFTWARE PACKAGE

Includes for both compurism and super compurism, alpha numerics, **TRS-80*** graphics simulation, and point plot and line draw.

The price of the software package is **ONLY \$20.00**

or **FREE** with the purchase of an assembled and tested compurism or super compurism unit.

The **TRS-80*** cassette interface described above is also **FREE** with the purchase of an assembled and tested compurism or super compurism unit. NOTE: Although we are happy to sell compurism as a bare board we strongly urge the novice or person who feels that they do not have a strong hardware background to purchase an assembled and tested unit.

Compurism Bare Board with documentation **ONLY \$45.00**

Kit - **\$240.00**, Assembled and Tested - **\$280.00**

Super Compurism Bare Board with Documentation **ONLY \$50.00**

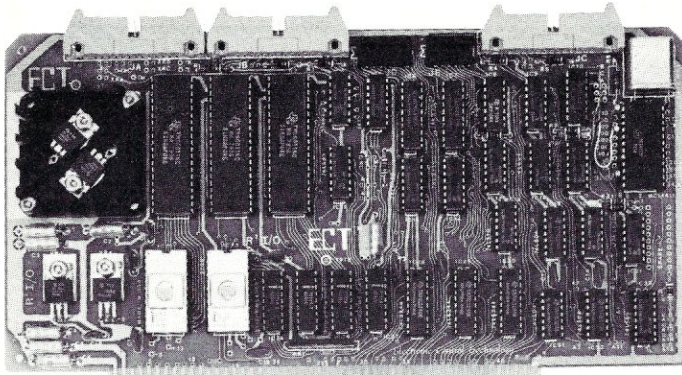
Kit - **\$350.00**, Assembled and Tested - **\$395.00**

Add \$3.00 to bare board price for hard to find I.C.'s / Add \$20.00 to assembled and tested price for memory management port. / Add \$20.00 to assembled and tested price for 16 level grey scale option.

J.E.S. GRAPHICS Box 2752 Tulsa, Ok. 74101 (918) 742-7104

*TRS-80 is a trademark of TANDY CORPORATION *SARGON II is a trademark of HAYDEN BOOK COMPANY (CHESS program written by DAN and KATHE SPACKLEN)

ECT R²I/O... The S-100 ROM, RAM & I/O Board



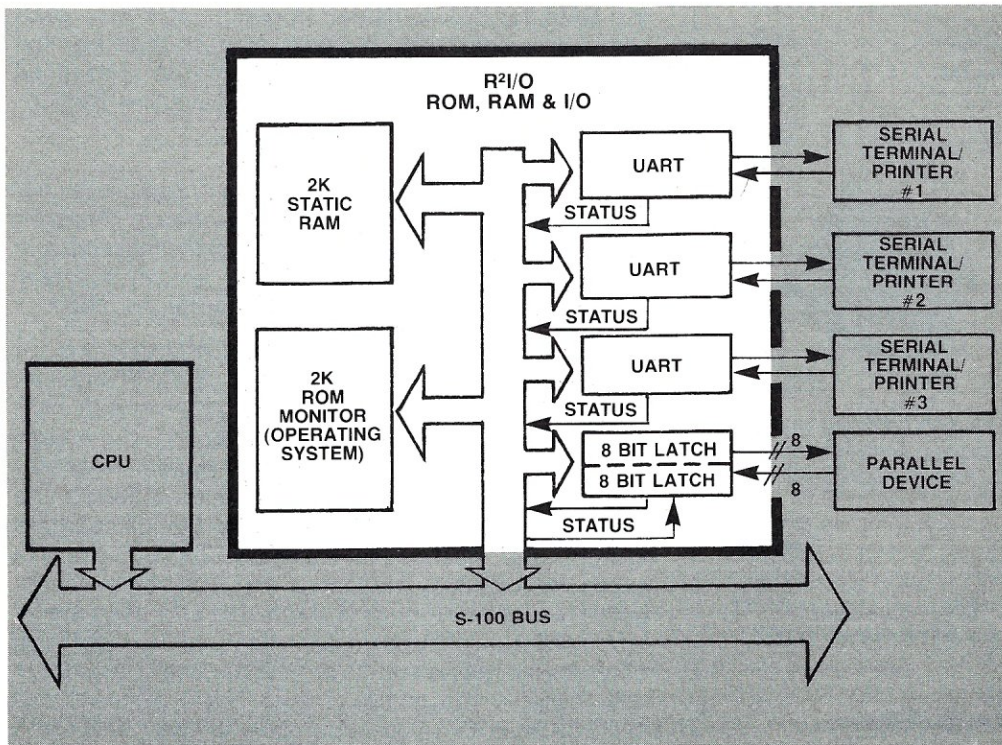
- S-100 BUS
- 2K ROM
- 2K RAM
- ROM Monitor (Operating System)
- 3 Serial I/O Ports
- 1 Parallel I/O Port
- 4 Status Ports

ELECTRONIC CONTROL TECHNOLOGY's R²I/O is an S-100 Bus I/O Board with 3 Serial I/O Ports (UART's), 1 Parallel I/O Port, 4 Status Ports, 2K of ROM with Monitor Program and 2K of Static RAM. The R²I/O provides a convenient means of interfacing several I/O devices, such as - CRT terminals, line printers, modems or other devices, to an S-100 Bus Microcomputer or dedicated controller. It also provides for convenient Microcomputer system control from a terminal keyboard with the 8080 Apple ROM monitor containing 26 Executive Commands and I/O routines. It can be used in dedicated control applications to produce a system with as few as two boards, since the R²I/O contains ROM, RAM and I/O.

The standard configuration has the Monitor ROM located at F000 Hex with the RAM at F800 Hex and the I/O occupies the first block of 8 ports. Jumper areas provide flexibility to change these locations, within reason, as well as allow the use of ROM's other than the 2708 (e.g. 2716 or similar 24 pin devices). Baud rates are individually selectable from 75 to 9600. Voltage levels of the Serial I/O Ports are RS-232.

8080 APPLE MONITOR COMMANDS

- A - Assign I/O
- B - Branch to user routine A-Z
- C - Undefined
- D - Display memory on console in Hex
- E - End of file tag for Hex dumps
- F - Fill memory with a constant
- G - GOTO an address with breakpoints
- H - Hex math sum & difference
- I - User defined
- J - Non-destructive memory test
- K - User defined
- L - Load a binary format file
- M - Move memory block to another address
- N - Nulls leader/trailer
- O - User defined
- P - Put ASCII into memory
- Q - Query I/O ports: QI (N)-read I/O; QO(N,V)-send I/O
- R - Read a Hex file with checksum
- S - Substitute/examine memory in Hex
- T - Types the contents of memory in ASCII equivalent
- U - Unload memory in Binary format
- V - Verify memory block against another memory block
- W - Write a checksummed Hex file
- X - Examine/modify CPU registers
- Y - 'Yes there' search for 'N' Bytes in memory
- Z - 'Z END' address of last R/W memory location



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- (SUPER ISOLATORS offer expended filtering and Spike/Surge Suppression capabilities)



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ISO-2

ISO-1A	-3 individually filtered sockets	\$ 56.95
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ISO-2	-2 filtered banks; 6 sockets	56.95
ISO-5	-3 filtered banks; 9 sockets	79.95



ISO-6



ISO-7

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- Spike/Surge Suppression - 2000 Amps, 8/20 usec

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ISO-7	-5 Super-filtered sockets	139.95

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The CP/M* Bus

by Bruce Ratoff

This new feature of **MICROSYSTEMS** will attempt to answer your questions regarding CP/M and related topics. Please mail all questions to:

The CP/M Bus
c/o Microsystems
Box 1192
Mountainside, NJ 07092

Q: CP/M manuals make frequent mention of the "DMA address" when talking about disk I/O. Does this mean my computer has to use Direct Memory Access to read and write the disk?

A: No. The term "DMA address" is a historical one, based on the fact that the first CP/M-based system did use DMA for disk transfers. In general, CP/M's "DMA address" is simply the memory address that the next disk sector will be read into or written from. To reduce the confusion, I prefer to interpret the initials DMA as meaning "Disk-Memory Address".

Q: I've written a checkbook-balancing program for our household account. The program is written in Microsoft Basic. I would like to be able to turn on the machine, put in the right disk, and immediately be into my program, without having to fool with CP/M. How can I do this?

A: There is a little-known feature in CP/M versions 1.4 and later that allows you to "build in" a command line. The Console Command Processor (CCP) normally calls the "read a line from the console" function to get each command, the same way that your programs normally would. However, when the system is cold-started, the CCP will first check its command buffer (the place where it stores the most recent command line) to see if a command is already present. If it is, it will be executed before any console input is taken, just as if you typed it in yourself. Note that a complete command line, consisting of a program name and its arguments, may be used. In your case, if the name of your Basic program was "CHECKBK.BAS", you could automatically execute it by building in the command "MBASIC CHECKBK".

To build a command into CP/M, you must do the following:

1. Count the number of characters in the command. Include the program name, its arguments and all intervening spaces. Do not include the ending carriage return or linefeed.
2. Using an ASCII table, determine the hex value of each character in the command.
3. Obtain a "sysgen image" of your CP/M system by executing either MOVCPM or SYSGEN and SAVEing

the result. This will enable you to read the system into DDT and make the necessary patches.

4. Execute DDT and read in the system image obtained in step 3. Dump memory from address 0980 hex onwards, until you find the Digital Research copyright. Now look backward to the nearest address ending in either 00 or 80. This will be the start of the CCP, and is usually either 0980 or 0A00.

5. Exactly 7 bytes in from the start of CCP, (0987, 0A07, etc.) change the existing zero byte to the number of characters in your command, as determined in step 1. Starting in the very next byte, replace the existing 20's (ASCII spaces) with the characters of your command, as determined in step 2. After the last character, insert a byte of 00.

6. Exit from DDT, SAVE the resulting memory image, and SYSGEN it onto a disk containing the program you wish to execute.

After performing the above steps, cold-boot your system with the disk you SYSGENed onto in step 6. Your built-in command should execute.

Q: Is there any way to re-execute a CP/M program without loading it?

A: There is a simple "cheat" that you can use to restart the last program executed. Normally, when you key in a program name, CP/M searches the disk for a .COM file of that name, reads it into the Transient Program Area (TPA) and jumps to the start of the TPA (0100 hex on most systems). The trick is to keep an empty file (one containing 0 records) of type .COM on your disks. When trying to load it, CP/M will immediately encounter an end-of-file and jump to the TPA, without wiping out the program that's already there. You may create an empty .COM file by typing:

SAVE 0 RERUN.COM

This trick has saved me more than once when I exited from Basic without saving the program I was working on. Watch out however, since some programs may be confused by data left over from their first run.

CP/M For 8086/8088 Systems Released

Digital Research has released CP/M-86. They started shipping copies the end of November. CP/M-86 is designed for 8086 and 8088 based systems and provides the same facilities and file format as CP/M, release 2. CP/M-86 can also function as a slave node in a CP/NET network. As with 8080 based versions of CP/M the logical and hardware dependent portions of CP/M-86 are modularized to facilitate custom modifications. DR also plans to release MP/M and PL/1 for 8086/8088 based systems in the near future.

Digital Research News

Digital Research will soon introduce a Record Keeping software package called BT-80. It is basically the kernel for a data base management system.

Digital Research has also released version 1.3 of the PL/I-80 language. It has several enhancements. It can

—CONTINUED ON NEXT PAGE—

Now
tiny C Soars!



...with tiny-c two — the compiler

Tiny-c two is ten times faster than tiny-c one, with many features, including long (32 bit) integers, lots of new operators, and redirectable and direct access input/output. Viable for professional work, either systems programming or business applications.

It comes with a UNIX™ style command interpreter called the "tiny-shell"™. Every compiled tiny-c program becomes a new shell command. Commands can have arguments, and dash (-) options, just as real UNIX shell commands do. The < and > input/output redirection operators are supported.

Fifty standard library functions, and readily extended. The input/output functions are UNIX styles, including fopen, fprintf, etc. Both ascii and raw (binary) input/output are supported.

Package is portable. Bringing it up on a new processor or new operating system should take just days. And as usual with tiny-c products, all the source code is included.

Tiny-c two is available now on standard 8" CP/M.

\$250.00 - Includes Owners Manual and Disk

Manual Only \$50.00

(20% Discount to tiny-c one owners)

The original tiny-c ONE is still available on a wide variety of cassettes and diskettes. This version is an interpreter, complete with a Program Preparation System. Disk or cassette versions \$100 (this price includes the Owners Manual, available separately at \$50). Disks: CP/M, Apple DOS 3.2, H8/89HOS, PDP-11, Flex 2.0, Northstar, CDOS. Cassettes: KIM, SYM, TRS-80, Tarbell, Cuts.

tiny C

Call or write tiny-c associates, P.O. Box 269, Holmdel, N.J. 07733 (201) 671-2296. You'll discover tiny-c is flying higher and faster.

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UNIX is a trademark of Bell Laboratories, Inc.
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CP/M Bus cont'd...

compile several external procedures in a single compilation. PICTURE specifications are included for use as format items for editing number data on output, in a PUT EDIT command. And, library facilities to add conversion from float binary to fixed decimal arithmetic are included.

Digital Research has also leaked some of their future plans. They have indicated that they "are taking a long, hard look" at possibly implementing CP/M, MP/M and PL/1 on 68000 and Z8000 systems. Further, DR has purchased a DEC VAX machine. Although intended primarily for keeping track of their internal operation, it will be using the UNIX operating system—and there is a strong likelihood that DR will start taking a close look at UNIX. Several DR staffers have strong UNIX background.

Lastly, DR has disclosed that they are considering the possibility of developing a software interface between CP/NET and the EtherNet systems.

DR Hot Line

Did you know that Digital Research maintains a technical hot line that is in operation from 9AM to 5PM West Coast time? The number is (408)375-6262.

Access CP/M Library Via Phone

There is a CP/M dial-up system that will provide you with any program from the CP/M Users Group Library. The number is (414) 241-5406; it is in operation from 2PM to 2AM CST. Do FIND B:MASTER.CAT FN.FT to find the program you want, ask the SYSOP to make it available on a certain day, and you will find it available when you dial back. Other CP/M dialups in operation are:

NJ
(201)283-2724
Bruce Ratoff *

NJ
(201) 227-5361
Ray Glueck
conversion/distribution on
Micropolis format.

NJ
(609) 461-4351
Kevin O'Connell

MI
(313) 588-7054
Keith Peterson

CA
(805) 527-9321
Kelley Smith
MP/M Net

MI
(313) 846-6127
Dave Hardy

MA
(617) 388-5125
Howard Mounton
Password: 1183SM930*A207
Up 7-11PM weekdays and 24 hrs
weekends

*Ring once then dial back within 40 seconds.

New SIG/M Disks Released

The SIG/M groups for the Amateur Computer Group of New Jersey and New York Amateur Computer Society have released four more CP/M disks, increasing the

library to seven disks. All of the software is in the public domain and may be copied. The disks are the following:

SIG/M001 Standard ADVENTURE object code.
SIG/M002 Standard ADVENTURE source code.
SIG/M003 Super ADVENTURE object code.
SIG/M004 Assembler-language utilities.
SIG/M005 8080/8085 diagnostics package.
SIG/M006 6502 monitor and simulator.
SIG/M007 modem and BBS utilities.

These diskettes are available for copying at the CP/M User Group meetings of both clubs. A donation of \$1/disk should be made to support club activities. The disks are available via mail to other clubs for copying at \$6/disk (\$4 for disk and \$2 for shipping) in U.S. Outside U.S. add another \$1/disk. The catalog listings of each volume are on all participating BBS's, or may be obtained by sending a self-addressed stamped envelope to: SIG/M, Box 97, Iselin, NJ 08830.

New CP/M User Group Disks Released

CACHE (Chicago Area Computer Hobbyist Exchange) has finished putting together Volume 46. It includes the following:

CPM-FDOS.ASM CPM to ICOM FDOS II transfer
CPMLABEL.BAS Make CPMUG disk labels
CPMLABEL.COM MBASIC compile of above
CPMLABEL.DOC DOC of above
CRCK3.ASM Full 16 bit CRC a file
CRCK3.COM COM of above
DU-8/12.ASM Disk dump/patch, supports many controllers
DU-V61.ASM Later version of CPMUG40.20, single density
FDOS-CPM.ASM ICOM FDOS II to CP/M xfer
MDIR8/17.ASM Fancy directory list program
MDIR8/17.COM CP/M 1.4 (or 2.X, all users)
MLIST3.ASM Type multiple files with lots of disk buffering
PLINK823.ASM Send/rcv to memory via modem
PMMIBYE5.ASM Remote console program,
PMMIBYE5.DOC Update of 40.34
PTSRCNVT.COM Convert Proc. Tech to CP/M ASM
PTSRCNVT.DOC DOC on above
RETDL.COM Disassembler to TDL mnemonics,
modif. of 42.18
SURVEY3.ASM Maps system memory/port usage as well as disks status
SURVEY3.COM COM of above
XD-7/4.ASM Fancy directory list program
XD-7/4.COM COM of above

CACHE held back releasing Volumes 43, 44 and 45 which contain the Osborne business package as they are still debugging this software. Volume 47 is also in the works, it will include a new version of Ward Christensen's MODEM program modified by Mark Zeiger, a PMMI dialing program which includes a library of numbers to dial, and more.

People who wish to donate software to the CP/M User Group should call or write to Jim Mills, 824 Jordan Pl, Rockford IL 61108, (815)398-0579.

The CP/M User Group disks are available from: CP/M User Group, 1651 Third Avenue, New York, NY 10028.

Xerox, Maytag, Shugart

UCSD Pascal*

The common bond among these "Household words" is the fact that they all represent concepts or products which are the state of the art in their respective domains. To achieve this kind of status means that a great many criteria have been satisfied, such as simplicity, dependability, performance, and reliability.

In the case of UCSD Pascal*, one need look no further than the list of system features to realize that this is a product of sincere thought aimed at answering many programming concerns - a truly dynamic, functional, practical, progressive, and reliable operating and program development facility. The structure, readability, transportability, screen and line editors, disk file interface, file management, ease of interface to assembly language and machine routines, all address the demands and needs of the progressive programmer.

But haven't we heard these claims from other developers of operating systems and languages? The real question is "what makes the UCSD P- system* stand apart"? The answer is simplicity. That is the benefit you receive whether programming, using system utility programs or any of the systems functions. Throughout the UCSD Pascal* system, simplicity is the byword. You may, perhaps for the first time, apply your creative talents to the task at hand - the creation of a bug-free, easy to use program, rather than expending half your energy on the demands of an obscure and poorly documented operating system.

All these facts are what qualify UCSD Pascal* as a household word. So it's not just a case of being able to perform a given function such as screen editing. It's the ability to do it easily, without a lot of mental gymnastics related to syntax or peculiarities. This simplicity is what makes UCSD Pascal* the state of the art in operating systems.

Our desire to distribute the UCSD Pascal* system arose from our own use of the system and language for in-house development of applications software. We have experienced a reduction of roughly 50% in program development and maintenance time since converting from one of the popular Basic systems. Unfortunately, the UCSD system has been available until now only in a form which was extremely demanding of proficiency in assembly language programming and which required a high degree of intimacy with the hardware requirements of a system. We have reduced this complexity to nothing more than plugging in a disk, and pressing the bootstrap button.

Northwest Communications is proud to offer the UCSD Pascal* system ready to run on North Star Horizon, Morrow Discus and M-26 hard disk systems. Currently, Ansi 77 Fortran is available to supplement your efforts in Pascal where it is more appropriate.

The UCSD Pascal* operating system and compiler, along with 8080 and Z80 assemblers, linker, screen editor, numerous utilities and complete documentation is available for \$350.00

The Ansi Fortran 77 compiler is \$225.00 (\$200.00 if ordered with a Pascal system)

A cross assemblers package is available for the 6502,6800,6809,9900, LSI-11 and PDP-11 for \$150.00

Documentation only (with full credit if you subsequently purchase a system) is \$45.00 for the Pascal system and an additional 20.00 for Fortran.

To order your Pascal or Fortran package, please use our toll-free order line 800-635-4706 (208-529-4388 within Idaho), or write enclosing check or money order to:

NORTHWEST COMMUNICATIONS INC. #2 Airport Plaza Box 2454-Idaho Falls, ID 83401

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Double Density Disk Controllers

by Bob Weidemann

*Thinking of getting a double-density disk controller card?
Then read this article on what you are getting into.
It also includes a comparison of five popular disk controller cards.*

Are you currently working with a single density floppy disk controller and thinking about upgrading? Or are you contemplating adding a disk system and wondering which controller to get? Or maybe you'd like to learn a little bit more about that double density board of yours? If so, this article can help you.

What Is Double Density?

You may have discovered that your old single density disk drive doesn't have to be changed when you go the double route. This means that you will be using the same old recording head with the same size gap that worked so well with single density; except that now it must work with twice as much data packed into the same disk space. Right? Wrong! The recording head still sees the same amount of information per inch in double density format, as it did in single. So, what is double density?

Double Talk And A Missing Bit!

If all this sounds like "double" talk (pardon the pun) then let me clarify the point. In single density every data bit that you contribute to the disk gets accompanied by a clock bit. This clock bit is used to help recover the data when you read your disk back. In double density, the clock bit is essentially omitted so that the user can have more disk room.

If you suspect that that missing clock bit is going to make it difficult to recover the data from a double density disk, you are absolutely right. Fortunately, after experimenting with all kinds of hardware schemes a few good ideas have surfaced, and some of them even work. At any rate, double density recording is little more than single density without the clock bit.

Why Bother With Double Density?

Obviously, the overriding advantage for the double density user is that twice as much "useable" data can be packed onto the same disk as would be needed in single density; and the big disadvantage is that data recovery is more difficult (and perhaps that means less system

reliability). Read on to find out what I've learned after playing with (and using) a number of different dd controller boards.

But first, there are a few other advantages and disadvantages worth mentioning. On the plus side, it is a pleasure to have 450-650k bytes available on one disk. A complete compiler system, like PL1 can be housed in one place, along with some very nice sized programs.

It is also nice to have over 12k worth of system space available on those first two CP/M reserved tracks. I finally have a BIOS area big enough to handle all those goodies that previously had to be "com" files. Now, I've got my Selectric driver, my realtime software, my monitor with search routine, my screen-to-printer dump routine, and numerous other programs all on the system tracks and all brought in everytime I boot up.

Faster Operation?

A double density system works slightly faster than a single density system. Intuitively, it would seem that since twice as much 'useable' information is passing under the head during each revolution of the disk, that actual data transfer should be twice as fast. That's true for one sector's worth of reads or writes.

But don't expect an assembly or compilation to take half the time it used to take. That's because disk controller boards do not read all the data on a track in one revolution. There is in fact, something called the skew factor, that arranges it so that you read only every sixth sector from a single density disk (where there are 26 sectors per track). Thus, you are doing disk reads or writes from the disk only during one sixth of a time frame. During the other five-sixths of that time frame you must let your CPU catch-up on some of its chores; like figuring out where to load the information coming in from the disk to your memory.

So, if you upgrade to double you will be able to read a sector twice as fast as before and you can reduce that one-sixth portion of the time frame in half; however, you still must let the CPU have its time and since that is the major portion, your overall time saving will be about eight percent.

No Compatibility Between Controllers!

To complicate matters, in double density the skew factor is not accepted as a "standard" as it was in single density. As a result, each manufacturer is "tuning" the skew factor to match the virtues of his hardware and to match what he expects your hardware to be able to handle. At any rate, some manufacturers have a skew factor of 12 or 14 in double density mode. Therefore, during one revolution, you still read the same with double as you did with single.

This leads to another disadvantage of dd controllers. If your skew factor is different from mine, we are incompatible; and this is only the tip of the incompatibility iceberg. Some manufacturers are putting fifty sectors on a track; others 51, or 52. Some are making sector size 128 bytes; others 256 bytes or even more. Some are replacing the clock bit with an encoding scheme called MFM; others are using other schemes. It all adds up to one important observation: I have yet to see two dd disks recorded on different manufacturers controller boards that are compatible. In addition, if you tune your own skew factor you won't even be compatible with the same manufacturer's board that others have.

Let me be quick to point out that this is not all that serious as long as you are aware of the limitations and you are careful to make all your "exchange" disks in single density.

*I have yet to see two
dd disks recorded on different
manufacturers' controller boards
that are compatible.*

Compatibility With Other Boards

There are, in general, three "interaction-problem-prone" boards in an S-100 computer. These would be:

1. The CPU board
2. The memory boards
3. The disk controller board

Ideally, getting these three kinds of boards from the same manufacturer will ensure the least problems for you.

But one of the reasons I have an S-100 bus is so that I don't have to buy from the same source all the time. I like the idea of many suppliers competing against one another. I like the idea of being able to pick what I feel is the best buy for my money.

Some of my findings regarding CPU boards are as follows:

The Imsai 8080 may very well be the standard for CPU boards. I have not come across any board that was incompatible with it, as long as that board was designed for 8080's and not Z80's. As for Z80 CPU's, I have not seen a single one which worked with all other boards. But two excellent ones are the Cromemco which is very expensive and the InterSystems (Ithaca Audio) which is quite reasonable.

Memory boards present another problem area.

Basically, you must decide if you want to use hotter, power robbing, more expensive, but highly compatible static memory; or cooler, power saving, cheaper dynamic memory. I choose dynamic, but recognize that someday I may have a compatibility problem that will be difficult to solve.

Disk controller boards are very particular about who they work with. Try to get a manufacturer to supply you with a list of compatible CPU and memory boards before you buy. Tarbell's manual contains a list of some boards that he tested his controller with. How about the rest of you manufacturers doing the same thing? I'm sick of hearing "If you would have bought our CPU and our memory it would work right." Nonsense, if you designed it right there would be no problems.

Shopping List Of Questions About Controllers

Some of the items I looked for on double density boards are:

1. Does it have on-board provision for power-on or reset boot-up? Most boards have this feature. I like the Tarbell best because it completely 'disappears' after boot-up, leaving you with a full 64k.

2. Does it require a PROM for disk activities? And does this PROM occupy part of the 64k memory space? CP/M 2.2 doesn't leave much room for a BIOS in single density versions; so some manufacturers put their disk primitives on a PROM. Others bring in extras BIOS memory from actual disk com files. I don't like this as much as making the first two tracks double density, so that bigger BIOS's can be brought in. This is mostly a problem for people who don't change their own BIOS.

3. Does it use DMA or programmed I/O for disk transfers? DMA generally requires static memory. It is not faster since actual read and write time is governed by the disk drive. It is more sophisticated.

4. Does it use LSI chips (like the Western Digital 1791) or not? All of the boards tested for this article use the 1791 family of chips except Micromation. The InterSystems' board (not tested) uses a NEC chip.

5. Does it take a computer scientist to "bring it up"? Everyone of these boards is hard to bring up, unless you have specific equipment that the seller has assigned to his software. Some of the boards have on board serial ports which can be connected to video terminals which can make it easier to bring up. Still, you will probably have to set jumpers on your drives and jumpers on the board to match many different parameters; and you will probably have to do some tailoring of the BIOS source file.

6. Is it compatible with my existing hardware?

7. How much does it cost? The prices listed in this article are typical magazine prices. This means they probably are discounted from some "list" price.

8. What is the reputation of the seller? All manufacturers listed in the chart appear to be very cooperative and understanding.

9. Does it have any special quirks that are good or bad?

10. How good is the documentation?

11. How good is the software supplied by the manufacturer?

12. Is the CP/M Version 2.0 deblocking feature implemented? I like this feature very much. It enables you to read and write in blocks larger than the standard 128

Double Density cont'd...

bytes. Since you have bigger sectors, you have less sectors per track and less wasted area between sectors. This enables you to pack more data on a track; up to 25% more. Disk transfers will also be faster. Any board listed below can have this feature added by the user; but Morrow supplies it, all worked out for you already.

13. Does the board work? And is it reliable? After hours (or days) of setup time for each board tested, every one of them worked well and reliably.

The following comments and suggestions are really only needed by those in severe distress.

First read the section on compatibility; because that's the reason most boards don't appear to work at first. Next, redo the BIOS conditional assembly portions. Some manufacturers give you so many options in the source for the BIOS that you inevitably wind up with a wrong selection. Then when you concatenate the BIOS Hex file to your CP/M system, make sure you use the right offset. One trick I use to ensure using the right offset is to zero out the first few bytes of the BIOS jump vector table before I bring in the new BIOS.hex; then after bringing it in, I check to make sure those zeros are replaced. By the way, you may have to hunt for the jump table since everybody's CP/M seems to require different locations.

Micromation

One of the earliest double density boards to hit the market was Micromation's Doubler. It does not use LSI. I am not classifying this as a disadvantage, even though I feel LSI devices are easier to repair because sometimes an LSI chip can lock you into its peculiarities. The Micromation board contains an extra PROM that most other boards don't need. This PROM does the job that the LSI controller chip would do, using your CPU. The advantage here is that upgrades can be made to the board's operation via an inexpensive change in PROM. Micromation has in fact upgraded this PROM recently. The disadvantage is the loss of main memory space and increased chip count. The doubler uses programmed I/O for data transfer through memory-mapped ports rather than the normal 8080 I/O ports. I found it to be incompatible with my S&D dynamic memory, but it worked with all static memory boards and all other boards that I tried it with.

Micromation appears to be constantly upgrading their product line including the BIOS software for the doubler. I like a company that doesn't sit still.

A quirk that I found was that the speed of the doubler was slower than my single density controller board. Overall, the board works extremely reliably.

Tarbell

My first experience with floppy controllers was with the Tarbell single density board, some years back. It was and still is an excellent board at a fair price with many built in features; particularly for the experimenter, and it came with an abundance of excellent documentation.

Thus, with high hopes I eagerly awaited Don Tarbell's entry into the double area. Unfortunately, I was initially disappointed with that purchase.

This was Don's early board, labelled version "b". The good documentation I had expected was not there. Worse, many of my old single density disks could not be

read by the new controller. But this is the fault of the 1791 chip, which is used by most double density board manufacturers, not being as flexible in reading certain "formats" as the older 1771 LSI chip used in single density boards was.

However, the latest version of this board has been 'cleaned-up' and now works very well. This board appears to be one of the finest designed double density boards I've seen. It is one of the few that uses DMA (via Intel's 8257); or it can be used under programmed I/O. (My S&D memory worked when using programmed I/O, but not under DMA.) You can only operate in double density mode with DMA. Single density mode can use either method. It does not require any main memory space when used with supplied software and contains an onboard 32 byte bootstrap PROM. A list of compatible boards is supplied in the manual so that disappointments in that regard can be minimized.

S&D Versafloppy Two

This board turns out to be my favorite because it works (as you might expect) with S&D's memory board and it seems to work the fastest. By the way, I am very partial to the S&D memory because its price is fantastic and reliability excellent.

The Versafloppy is the simplest board I've seen. It uses the 1791 and will only work with a Z80 CPU (the 8080 instructions would occupy too long a time frame to allow data to be processed). It has some drawbacks. S&D would like to sell you their operating system; instead of CPM. But I had CPM already. Why should I spend \$150 buying another system? The answer was to write my own BIOS for the board to interface with my existing CPM system. Another problem, is that there is no on board provision for bootup. I had to burn my own 2708 or buy one from S&D to mount it on some other board, which has provision for power-on jump. I put my own prom on ;my Ithaca Audio Z80 CPU board. If any reader would like a single density disk containing my dual density BIOS; and a prom containing the required disk primitives, send me \$14 for the disk and \$18 for the prom and I'll send them to you.

Morrow's Disk Jockey 2B

I tested a late version of this board and as is typical of all the manufacturers, Morrow's board and software seem to have ongoing revisions that keep them right at the leading edge of the computer field. I was impressed by the latest software that makes using 512 byte sectors a snap. Also this is one of the few boards that work with an 8080 at two megahertz; as well as with Z80's; and four megahertz.

California Computer System's

This board came in late in the testing process and I have not fully evaluated it yet. It comes with a "free" CP/M 2.2, that makes it easier to bring up and appears to contain all the most wanted features; including bank select of the onboard disk primitive PROM.

Some Observations

An interesting fact regarding the Versafloppy is its quietness. Actually, I'm referring to noise from the disk drives. Some controller boards, like the Micromation use stepping speeds and head load times that make groaning

MANUFACT.	ON BOARD RESET	REQUIRE PROM	DMA	LSI	EASE OF BRING UP	COST KIT	ASSEM.
Micromation	yes	yes	no	no	3	n.a	400 c
Tarbell	yes	no	yes	yes	2	d	444
S&D	no	yes	no	yes	a	300	365
Morrow-D.J.	yes	yes	no	yes	3	n.a	429 c
Calif. C.S	yes	yes	no	yes	4	n.a	375 bc

a. S&D would probably come up quickly if you buy their CPU and their software; otherwise read article.

b. California Computer Systems supplies a CPM 2.2 with their system.

c. Includes on board serial I/O port.

d. Kits may or may not be available.

East of Bring-up. All require careful study. 1=hard . . . 5=easy.

sounds issue from the drives. Try speeding up the stepper motor rate to get a smoother, quieter sound.

Some controllers like the Tarbell require the stepper motor to be constantly engaged when the drive is selected, not just at the instant the head is loaded, as in most other boards. These motors heat up quite quickly and you cannot expect the long life that you would get from a controller that allows the stepper to be off most of the time. A stepper motor replacement from Shugart can cost you \$175. You can tell which type of operation your controller uses by checking the jumpers on your disk drive board. If you are using Shugart 800 or 801, there are two jumpers to pick from, called ds and hl. Usually, a jumper on ds means the stepper is on whenever the disk is selected. A jumper on hl indicates the stepper is on whenever the head is loaded. The type of software used determines which jumper must be on.

Summing It All Up

If you've been waiting until double density is perfected, the wait is over. All of the current batch of boards tested work reliably at both two megahertz and four megahertz clock speeds.

If you don't have a disk system now, and are going to buy one soon, don't bother with single density. Buy a double right off.

If you have a single density system now, you should calculate the savings involved in essentially cutting the price of disks in half.

But, even if you only use twenty disks a year and your net savings would only be about thirty dollars on the price of disks, consider whether or not your computer applications would be increased due to the greater disk capacity. If your decision is to buy now, check the features that you want from the list above and buy wisely.

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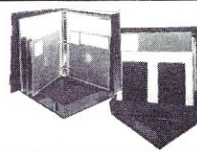
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5 1/4" applicator \$3.00
8" mylar hardholes (50) . \$8.00
5 1/4" mylar hardholes (50) \$6.00



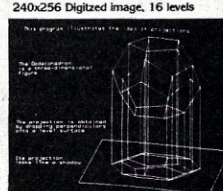
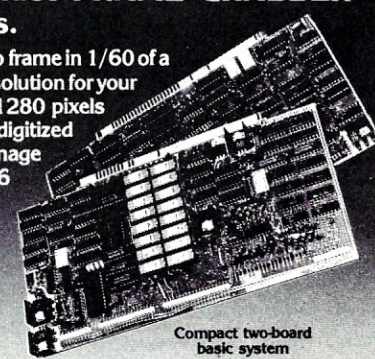
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The Casheab Music Synthesizer

by Jon Bondy

While at the West Coast Computer Faire, in March 1980, I discovered the Casheab music synthesizer for the first time. Previous to this, the best music synthesizing equipment one could purchase for use on the S-100 bus was the Solid State Music SB1 board, a board with distinct limitations (see below). Also, at that time, the only music synthesis boards for the Apple were made by ALF, and they only produced square waves. By comparison, the Casheab was extremely versatile and reasonable priced, so I purchased one of their first units, receiving it in June.

To give you an idea of how far things have come in about three years, the SSM SB1 costs about \$150 (kit) and will synthesize one voice with 32 8-bit samples per cycle of the waveform and 15 steps of amplitude control. The Casheab costs about \$1000, but provides 32 voices with sixteen waveforms each with 1024 12-bit samples per waveform and 255 levels of amplitude control. Although more expensive initially, the Casheab is far less expensive for someone who is serious about creating multi-voice music. In addition, the Casheab has FM capabilities, allowing it to do vibrato and more complex FM synthesis, as discussed below.

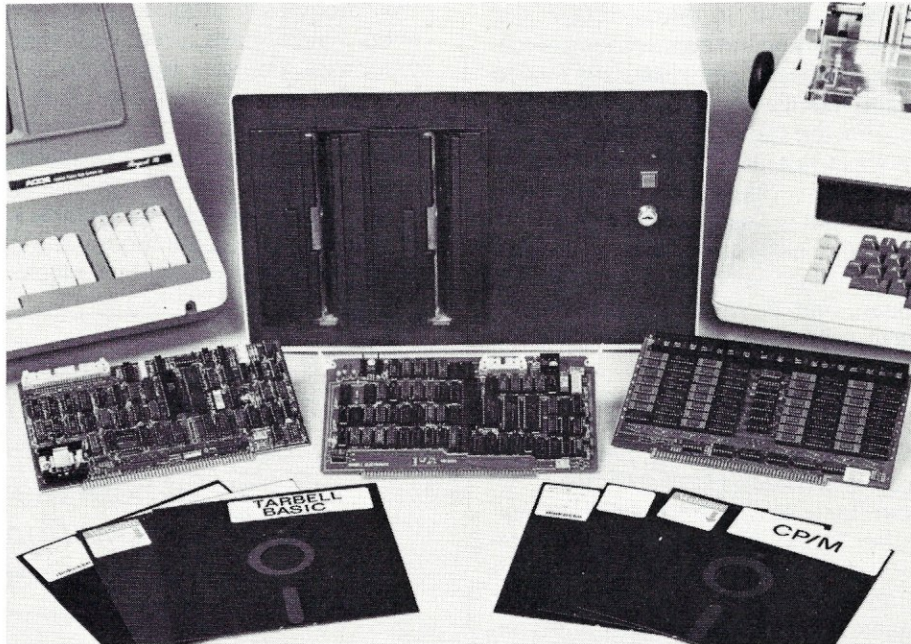
The standard Casheab synthesizer consists of two S-100 boards linked together by a ribbon cable: one a controller, the other one the synthesizer itself. The former contains the processor interface (S-100), timing generators, an accumulator, and the digital-to-analog section. The latter contains the frequency-generation hardware, waveform memories, and amplitude-control hardware. The synthesizer board contains a 16-MHz bit-serial signal processor which scans through the waveform memories at a rate determined by the frequency-generation hardware, to produce amplitude samples at a fixed rate through a time-multiplexing scheme. Because of the ribbon cable, the synthesizer cannot be debugged completely without having two extender boards; however you can debug each board individually for many problems by removing the jumper. Due to the high frequencies used, the boards are not available as kits, only as assembled and tested units.

The synthesizer has so many control parameters that it is memory-mapped in order to avoid tying up most of the I/O ports. It uses 256 bytes of memory for control, usually allocated at 0F800H, although I use 0FF00H. Because all of the memory locations used for synthesizer control are write-only, you can run this board at the same address as a working memory board and the two will not interfere with each other; when the synthesizer is not needed, that area will look like regular memory, and when the memory is not needed, the synthesizer will be available. The synthesizer does assert the wait lines to allow for internal synchronization, which could cause the regular memory to appear to be slower with the synthesizer in the computer. Inadvertently writing to the memory when the synthesizer is running will have some fairly discordant effects, however.

Each of the 32 channels has a two-byte Frequency Control Word (FCW) which controls the rate at which the waveform for the particular channel is scanned. Frequencies can be specified in multiples of approximately 0.3 Hertz from 0 Hertz to about 19 KHz, which provides reasonably precise control for musical purposes. Each channel also has what Casheab calls a 'weight', but which I call an Amplitude Control Word (ACW). These allow each channel to have amplitudes from zero (off) to 255. Each channel also has one byte for selecting which of the sixteen waveform tables it is to use, and a byte to indicate whether it is to FM-modulate the channel two above it or not. An FM channel, thus specified, uses its output to increase or decrease the rate at which the channel two above it is scanned, thus increasing or decreasing the pitch of that note. A channel which is used for FM is not heard at the synthesizer output; a non-FM channel is summed with all other non-FM channels and their sum is available at the sound output of the synthesizer for direct connection to a music amplifier. The synthesizer produces a single channel of audio output, combining all 32 channels into one signal.

The waveform tables are loaded by loading a special byte in the memory map with the number of the waveform table to be loaded, and then loading the table data sequentially into another special byte location in the map. One additional special memory location is used for

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One of the outstanding features of this new CPU board is memory-management hardware that allows dynamic mapping of logical to 1 Megabyte of physical memory in 4K blocks. Moreover, the CPU board is especially

designed to make it easier to implement multi-user operating systems, such as MP/M™ from Digital Research. It can run at 2 or 4Mhz, jumper selectable. It has two RS-232 Serial Ports (one for printer and one for CRT), with full handshaking capability.

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In addition to all the features of the new CPU card, the double density floppy interface has DMA which makes the multi-tasking operation quite efficient. Also, the 32K memory board is static, resulting in a reliable memory. The Tarbell System with all three cards can be expanded for more memory and thus provides the ultimate in flexibility.

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overall scaling of the synthesizer, since the output with all 32 channels in use is significantly greater than with only one channel.

The board is strewn with wire-wrappable jumpers, to allow the user to re-configure it for either 4 or 16 waveforms, either 1024 or 2048 samples per waveform, and either 10, 16, or 32 channels (yielding sampling rates of 50, 34, or 17 KHz (for frequency responses of 25, 17 or 8.5 KHz) respectively). Also, either normal or inverted phase one or phase two S-100 bus clocks can be used to trigger the board, allowing use with all 'standard' processor boards.

The first thing which impressed me about the synthesizer was the care which went into it, in terms of both the quality of the documentation and the boards themselves. The manual is over 70 pages long, and discusses how to install board jumpers to modify the options, how to use the synthesizer hardware, the software which is provided with the boards, theory of operation of the synthesizer (and some other theory too!), references, maintenance procedures, parts lists, and a listing of a sample test program. Schematics and parts layouts are supplied separately. The boards are somewhat densely populated, but the layout is clean, and there are no last minute changes to the PC layout strewn about, as is so common with initial production units.

The software is CP/M compatible and is mostly written in Microsoft Basic, consisting of three main parts: the waveform generator, the score generator, and the Play program. Source code is provided for all software.

The waveform generator uses a Fast Fourier Transform (FFT—see "Fast Fourier Transforms on Your Home Computer", W.D. Stanley and S.J. Peterson, *Byte*, December 1978) to transform user-specified harmonic intensities into a waveform suitable for loading into the synthesizer. Attack and decay envelopes can also be specified (64 values in the range 0-255 each for attack and decay), allowing a particular waveform to be customized into a complete timbre. During my preparation for this article, Casheab suggested that I try to generate waveforms by simply adding the weighted harmonic waveforms. Compiling turned out to take 7 seconds per harmonic (running under UCSD Pascal—more on that later), so that ten harmonics took about a minute, as opposed to about five minutes with the FFT. The FFT program running under interpreted Basic takes about 15 minutes to compute a waveform; under compiled Basic it takes about 5 minutes. Casheab may be supplying such a program with their synthesizer by the time this article is in print. Both harmonics and timbres may be saved on disk.

The score generator accepts score notation as character strings in Basic DATA statements, and produces a HEX file as output for the Play program. The notes are represented as SANXOTMS, where 'S' represents a possible slur; 'A' the amplitude of the note (0 off through 9); 'N' what note (A, B, C, D, E, F, G) is to be played; 'X' whether the note is sharp, flat, or natural; 'O' the octave number (0 through 6); 'T' the duration (time) of the note; and 'M' whether the note is dotted or not. Thus, a 'typical' note might be given as '3F#4Q-', meaning that with amplitude 3, play an F# in the fourth octave as a dotted quarter note with a post-slur. The number of voices to be scored is specified, as is which channel is to be used by each voice and which voices are FM modulators. The 'notes' for each voice are then listed sequentially, with an 'X' to

terminate each voice and an 'E' to terminate the piece. Some typographical errors are flagged by the program as errors.

The Play program is the only program written in 8080 assembly language, and it ties the timbres and the scores together. It allows a score to be read into memory and timbres associated with each channel. Channel assignments can be modified, as can FM modulation flags, and attack/decay envelopes can be scaled. The piece may be started and stopped, and when stopped, the amplitude of the piece and its tempo may be varied. This software works just fine for up to about 5 voices, but for more than that, it is recommended that a real-time clock be available to the Play program in order to produce timing which is truly even. I didn't have a real-time clock and didn't want to purchase one, so I rigged up a 555 timer chip as a variable-frequency square wave oscillator controlled by a potentiometer to provide synchronization to the software via an input port. Casheab supplies two versions of their software, one for use with systems with the 8253 real-time clock and one for systems without. Since source is supplied, you could modify the code for the 8253 to work with your own real-time clock.

The first thing which impressed me about the synthesizer was the care which went into it, in terms of both the quality of the documentation and the boards themselves.

The procedure for playing a piece is somewhat involved. You first create a series of Basic DATA statements, using a text editor, to represent the music you want to play. You then run the score program to create a score file. If you need new timbres for the piece, you run the waveform program to generate them. Finally you run the Play program to hear your music. If an error is made in the score, you must start again at the editor, then the score program, and then the Play program. Despite some inconveniences, however, the software which is delivered with the synthesizer is sufficient to allow one to encode and play any piece of up to 32 simultaneous voices.

Debugging musical pieces in this fashion is very interesting, since the scores are quite like programs, and you must listen to your 'program' to discover the mistakes which you have made. A quarter note which was written as a eighth note will result in one voice 'sliding' earlier by a eighth of a beat for the remainder of the song, usually causing some discord, and not revealing its exact location in obvious fashion.

The synthesizer comes complete with the above software and some musical pieces and timbres ready to play. A Bach Fugue and Prelude are included, as is "Pictures at an Exhibition" and the theme from Star Wars. Casheab also has coded a Bach Two-Part Invention, but it was not on my initial distribution disk. Timbres supplied included trumpet and clarinet, but it is relatively easy to construct new timbres from information in the literature (either *Computer Music Journal*, or text books on acoustics).

The synthesizer did not work at all when I first plugged it in, but a call to Casheab indicated that my processor (an Ithaca Audio Z-80 board) was one of those which required a modification to the clock phase and sense jumpers. After I removed the jumper from JP15 to JP17 and added a jumper from JP16 to JP17, it worked immediately and correctly. In fact, one surprising thing about this product is that it does what its documentation says it will; not much more, but certainly nothing less. I am used to a certain amount of 'puffing' in my sales brochures, but Casheab delivered exactly what they said, no excuses about "we're still working on it" or some such.

Use of the FM feature probably needs some explanation. Since an FM channel modifies the rate at which the channel 2 above it is scanned out, an FM channel running at low frequencies can be used to create vibrato in the modulated channel. If one places a sine waveform in channel 0 running at a low rate, say 1 Hz, then the sound coming out of channel 2 will warble slightly as its frequency changes. In order to facilitate this, I modified the syntax of the score program to allow frequencies in the range of 0.3 Hz to about 12 Hz to be specified directly instead of by using the score program note notation.

A more interesting use of the FM facility is to do 'real' FM music synthesis with it, as described in "The Synthesis of Complex Audio Spectra by Means of Frequency Modulation" by John M. Chowning (*Computer Music Journal*, Vol 1, No 2). This technique uses a frequency which is a fraction of the carrier frequency as a modulating signal; that is, if you want to hear a 1000—Hz tone, you concurrently modulate it with a 500— or 250—Hz tone. This has the effect of 'spreading' the spectrum of the carrier (1000—Hz) tone so that it has many rich harmonics, even if the two waveforms being considered are simply sine waves! This means that one makes decisions about the characteristics of one's FM timbres by modifying the ratios of the carrier frequency to the modulating frequency, not by changing the harmonic content of either. Additional ways to modify the FM timbres include use of non-sine waveforms for the carrier (but not for the modulator!) and modifying the degree of FM modulation throughout the duration of the note by modifying the attack/decay envelope of the modulating tone.

Other effects which can be obtained include echo and chorusing. Echo can be obtained simply by repeating the notes for a voice on a second channel at a lower amplitude and with a short delay (rest) inserted before the start of the second channel. This effect can be very pleasing with organ fugues, for instance.

Chorusing is an effect which makes you think that more than one instrument is playing a voice. One problem with a digital synthesizer is its precision: twenty identical voices played at once sounds just like one loud voice. In order for a chorusing effect to work, the voices must play at slightly different frequencies, and so I modified my score program to provide three equally tempered scales, each off from the next by about 2 Hz. This allows me to have up to three channels playing the same voice but with distinct frequencies. Adding a small amount of vibrato (FM) to each channel at a different vibrato frequency allows a reasonable chorusing effect to be obtained. Unfortunately, three FM'ed channels requires six channels for a single voice, making use of these effects somewhat complex and inefficient.

One final effect which I have not yet tried is to use a large number of channels, say eight, to control the harmonics of a single note individually. Using this technique, one can control the amplitudes of each harmonic of the note throughout the duration of the note, allowing very accurate synthesis of real musical instrument voices. Unfortunately, the Casheab could only support four voices which required control of eight harmonics each.

As stated above, I wrote the waveform program in UCSD Pascal, and in fact re-wrote the entire software system in UCSD Pascal, combining it into a single program in order to be able to customize it more easily; only portions of the Play program had to remain in assembly language. The Casheab software takes advantage of single-character keystrokes for command selection, just like UCSD Pascal, but it does not take advantage of the random addressing capability of most CRT systems. My new synthesizer software does, and maintains tables of information about the synthesizer and score on the screen at all times. The cumbersome Basic DATA statement formats and line numbers were replaced with free-formats and no line numbers. Also added was a screen-oriented note editor which allows one to halt the score in the middle of play and see the notes which were then being played displayed on the screen. Those notes and notes near to them in time can then be modified and the score re-played, short-circuiting the laborious edit cycle described above. A channel-inhibit feature was also added in order to facilitate debugging multi-voiced pieces. Casheab owners who are interested in running this software can contact me at the address given at the beginning of the article.

One thing which modifying the software showed me was that the Casheab software does not BEGIN to take advantage of the flexibility which the Casheab hardware could provide. As more people purchase Casheab systems, software should be developed to allow really innovative uses.

The synthesizer produces a single channel of audio output, combining all 32 channels into one signal.

One obvious augmentation of the current Casheab system would be to allow a keyboard to be played 'through' it to simulate a sophisticated organ, or better. Casheab is aware of this, and has a general-purpose slave processor card (also S-100), which could be used as a smart keyboard-scanning card, implemented in wire-wrap form at the moment. It contains a down-loadable Z-80 system and 16K bytes of RAM, with I/O ports and some breadboarding space for placement of multiplexers and cable connectors. Software to run the synthesizer from the keyboard is working at this time, but no product using either this hardware or software has been announced yet.

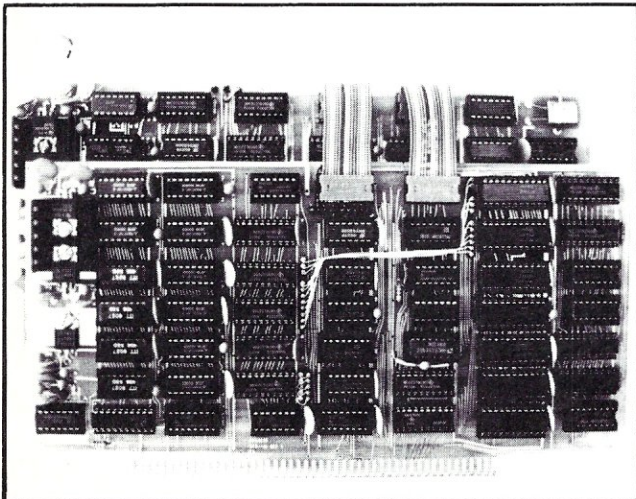
The current score syntax does not allow for modifications to the tempo of the piece while it is being played; nor does it allow for 'blue' notes, that is, notes which glide between normal equal tempered note frequencies. Also, the current implementation ties a hardware channel to a voice, a restriction which is really unnecessary. With the

current software, it is not possible for a note to decay at the same time that another note for the same voice is attacking; that would require one channel to be playing two notes at once. Software to provide dynamic channel allocation would allow this kind of attack/decay overlap.

In addition, the software is written to 'simulate' organ notes rather than percussive notes such as harpsichord or piano. With an organ, the note starts to attack when you hit the key, rises to a sustain level, and stays at the sustain level until the note is released, at which point it decays. With a piano note, the note attacks and then decays for the note duration, a completely different effect. Changes to the attack/decay software will be necessary fully to support percussive instruments.

There is no reason why the Casheab hardware cannot support any of these new concepts, or even more, but the software is not yet available to support them.

All in all, I would say that the Casheab is a high-quality piece of hardware, well thought out, well designed, and well implemented. The software is complete but somewhat Spartan, demonstrating the capabilities of the Casheab hardware, but really serving to provide a starting point from which serious computer musicians can depart. It is a



unique and reasonably priced S-100 bus board which all computer musicians with S-100 bus systems should investigate. For more information; contact: Casheab, 5737 Avenida Sanchez, San Diego, CA 92124, (714) 277-2547. □

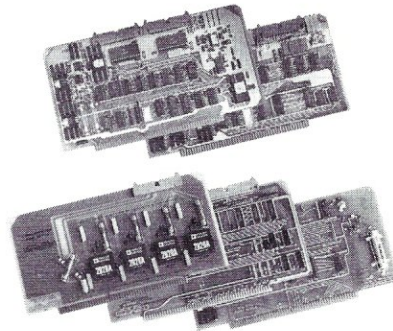
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Cold Boot Automatic Program Load And Execute

by Lorin S. Mohler

The following is a method for modifying your systems BIOS to allow assembly of a system for automatic program loading on a cold boot. Descriptions are preceded by an asterisk (*) and, of course, are not part of the BIOS modification.

The AUTO switch may be set true to produce the code needed for CCP to automatically execute a single command line directly after the initial system load. A suggested command to use is SUBMIT INIT, which requires that only SUBMIT.COM and a submit file INIT.SUB be present on the drive A. This way, by controlling what is in the submit file, multiple as well as single commands can be executed after system loading.

```
*assembly switch to enable or disable AUTO
*someplace above here TRUE and FALSE must be defined.
*I like
*FALSE EQU 0
*TRUE EQU NOT FALSE
AUTO SET TRUE           ; if auto start SUBMIT INIT
*CPMB is the first code location of the CCP portion of BDOS
*this remains as if for your BIOS and is given here to show that
*it precedes the AUTO code
CPMB EQU (MSIZE*1024)-xx ; system origin
```

```
*The following is the AUTO code that patches the CCP
IF AUTO           ; auto start-up feature
  ORG CPMB +      ; start patching CCP here
  DB ACLEN        ; message length calculated later
ACMSG: DB 'SUBMIT INIT' ; command line to be executed
ACLEN: EQU $-ACMSG ; message length calculation
ENDIF
```

```
*The BIOS is now ORGed
*This remains as is in your BIOS and is shown for reference
BIOS ORG CPMB + ... ; BIOS org for system generation
```

```
*The following code is added in the WARM BOOT code.
*Its function is to turn off the automatic program load
*operation so a warm boot ( C) will not initiate another AUTO
*Sequence. If you do not put this code in, you will not be able
*to get back to the promptA .
```

```
IF AUTO
XRA A
STA CPMB +      ; set command line empty
ENDIF
```

After the BIOS is edited and assembled the standard system generation procedure is used. Refer to your documentation. For most of us, it looks like:

```
DDT CPMxx.COM ; load DDT and CPM of the appropriate size
IBIOS.HEX
Rxxxx           ; refer to your documentation
                ; the patches now overlay the CCP

IBOOT.HEX
R900           ; load the booter
GO             ; exit DDT
SYSGEN
                ; write the system to diskette

etc. . .
```

When the diskette is cold booted (RESET) the normal sign-on message should appear, then the AUTO command line will be executed. This, for example, may take you directly into a word processor or MBasic or whatever is in the INIT.SUB file. Let me know how useful this is to you and what your application is.

The Integral Data System Model 440 Paper Tiger Printer

by Jon Bondy

When I first decided to write a course on Pascal, I realized that I HAD to stop procrastinating and buy a printer. My interest in graphics dictated that, if at all possible, my printer should be capable of 'dumping' graphic data to paper (see my article "Product Review: CGS-808 Intelligent Color Graphics Board" in MICROSYSTEMS, Vol. 1/ No. 2), so I invested in Integral Data System's Paper Tiger Printer (Model 440).

The IDS 440 is a dot matrix printer with the ability to print in four character widths (8.3, 10, 12, and 16.5 characters/inch), in double width and to control some of the printer parameters from the computer. This feature of computer commandable print characteristics allows one to mix print densities and even normal printing and graphics on the same line. The printer recognizes many form lengths (3, 3.5, 4, 5.5, 7, 8.5, 11 and 14 inches) and can print on forms up to 9.5 inches across, allowing use of tractor feed paper which tears down to 8.5 by 11 inches. It comes standard with parallel and serial interfaces, built in diagnostics, full upper/lower ASCII character set (no descenders), and a printing speed of about 92 characters/second (average at 16.5 characters/inch). Print rates at lower character densities are slower, since the printer prints each line in a fixed time, regardless of the print density.

Switch selectable characteristics include power source frequency (50/60 Hz), remote control select/deselect (by special characters), automatic line feed after carriage return (or not), automatic page skip with 1-inch margin at page boundaries, either 6 or 8 lines/inch (vertically), selection of horizontal print densities, selection of page lengths, selection of serial baud rates (110, 300, 600 and 1200), graphics mode enable/disable, and serial/parallel interface selection.

After hearing many good things about it, I purchased one late in 1979. Since the Paper Tiger had just been announced 6 months before, I had little to go on in the way of proven track record. Similarly, if you are thinking of buying of the new printers (like the 460), there is

little for you to go on except their record with their older printers.

The second thing I noticed was that the documentation was really very good. Unpacking (and packing) instructions, operation, normal maintenance procedures, trouble shooting, and even a PC board layout and schematic were included. Although the section on use of the graphics feature was not immediately clear, all of the information was there; I understood it after a few readings. A few examples of how to use some of the features might have been helpful, however.

*If you don't need high quality
graphic reproduction,
then perhaps the IDS printers
can be useful to you.*

The printer worked as advertized from the start, with more options than I knew what to do with. Some of the advertized features (such as the ability to do sub— and super—scripts) were not easy to figure out, but for the most part it worked easily and in an obvious way—no tricks. As I worked with the printer more and more, however, the way that some features were implemented began to annoy me. For instance, the printer was not designed so that a paper tray could be attached to it easily, making it difficult at times to stack listings without the paper jams; in fact, the most reliable way to stack listings is in front of the printer, but that makes it impossible to read the output as it is printed.

Most of the printer characteristic default values are switch settable via small DIP switches on the top of the printer, with override provided by special character sequences from the computer. In order to 'reset' the printer to the characteristics specified in the switches, one has to power the printer down and then up again. Unfortunately, the printer assumes that it is at top of form when it

powers up, so if you forget to keep it at top of form at all times, you can confuse it (and yourself) when attempting to reset it to the switch selected values. It would have been better if a push-button switch had been provided to reset the characteristics. Even worse, the on/off switch is on the back of the printer, making it difficult to locate and operate.

The format for initiating graphics printing is to send an ETX (control-C) to the printer. Thereafter, all characters except for ETX are interpreted as graphic data, where each of the low seven bits control whether a print hammer fires or not. The geometry of the printer is such that the lowest hammer on one line is at the same position as the highest hammer of the next, so only six unique hammer positions exist vertically, and in general one should not fire the seventh hammer in graphics mode. To terminate the graphics mode, you send an ETX character followed by an STX character to the printer. To print the hammer pattern which corresponds to the EXT character, you must send TWO ETX characters to the printer. This forced printing of the graphics pattern which corresponded to the ETX character to be a special case, making my graphics software somewhat more complex than I had thought it would have to be. It seemed to me that one could send a character with the seventh hammer bit set (since it overprints the first hammer anyway, and thus is not needed) as a signal to stop graphics mode, producing a protocol which was less complex than the IDS protocol.

The backspace character is ignored, making underlining a different operation with this printer than with simpler serial printing device. One has to print the first line without a line feed and then print the underline characters as a separate line. This turned out to be difficult for me using UCSD Pascal, since the operating system always appends a line feed to each carriage return. One way to fool the operating system is to send the character which is 128 greater than the carriage return character; the operating systems thinks that it is not a carriage return, but the printer accepts it as a carriage return (ignoring the most significant bit).

From time to time, one must remove the cover of the printer in order to perform minor maintenance. The cover is held in place by two thumbscrews in the front and two in the back. They come off easily, and the cover simply lifts up and off. When placing the cover back on, however, things are not quite as simple. First of all, one must hold the paper in place and thread it through the cover as the cover is lowered, not an easy job with only two hands. Also, with the cover off, the printed circuit board is exposed, and in fact part of the cover slides right by it on its way down. One must be careful that the cover does not damage the electronic components as it is replaced. At one point, my printer stopped working; I discovered that I had bent a wire slightly when replacing the cover, and had shorted the ONLINE/OFFLINE switch so that the printer always thought that it was OFFLINE.

Within a few months of getting the printer I had some complaints. First, the ribbon uses a re-inking scheme so that it can be used for a long time without replacement. This is fine, but when one starts using the printer each day, the ribbon contains dark spots corresponding to where the ribbon was in contact with the re-inker over-

night. After printing for a while, this becomes less objectionable, but one cannot print 'camera ready' copy without 'exercising' the printer somewhat. Initially, I thought that this was a defect in the printer, but IDS corrected me in this.

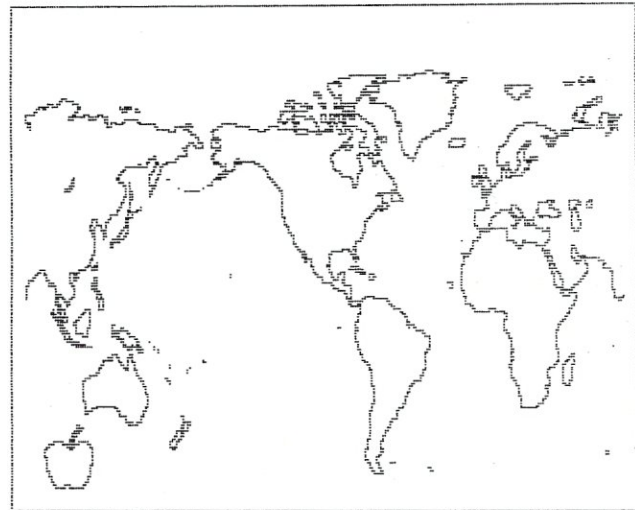
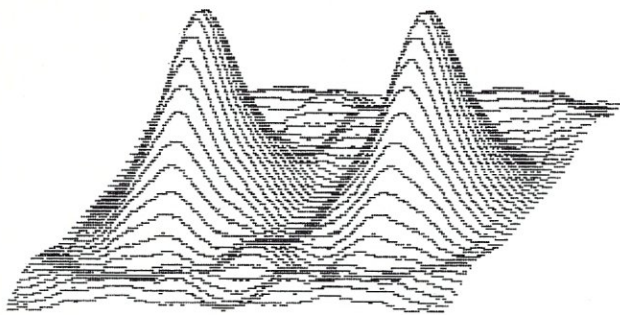
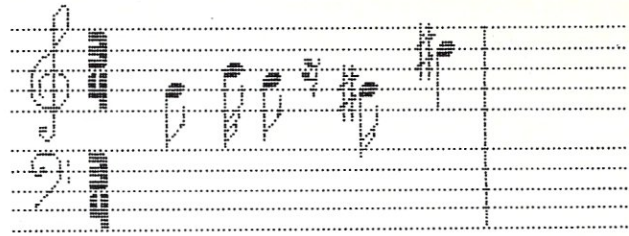
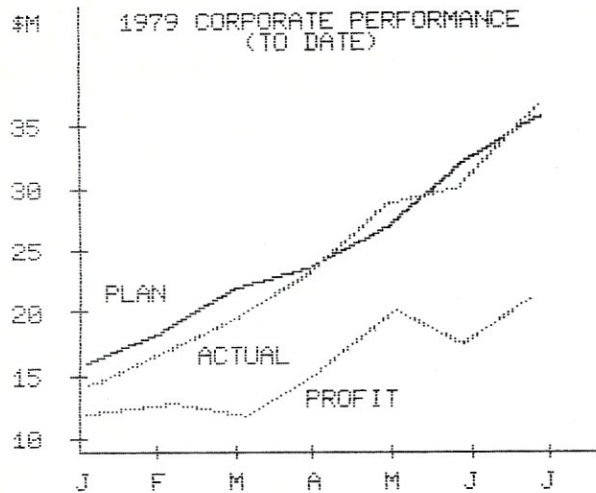
Also, one of the print hammers seemed to be printing lighter than the others. The manual states that one should "avoid selection of 16.5 when operating for long durations at 100 percent duty cycle (continuous characters)" because "this could cause excessive thermal load on the print head and result in print head failure". Since I had used that density for a while to print 132 column listings on my 8.5 inch paper, I sent a print sample in to IDS, asking them if they thought that I had a hammer problem. They agreed to look at the printer if I returned it for service, but it annoyed me that IDS would sell a product which provided the 16.5 character/inch capability, while at the same time indicating that use of that feature might damage the printer.

*If your graphics requirements
are reasonably stringent,
you probably should
look elsewhere for a
graphics output device.*

When I received the serviced printer, the hammer dragging problem seemed to be better, but from time to time the printer attempted to do a line feed and failed, causing lines to be overprinted and the top-of-form position to be lost. It seemed that some part of the paper advance system was slipping. After about 2 months of correspondence, IDS sent me some parts and I managed to get the line feeds to work correctly and reliably.

There still was one problem, however; a graphics printer, the IDS was not up to my expectations. I expected to be able to dump a graphics screen to the printer and find it accurately represented, good enough for publication in magazines such as this one. This meant that I had to be able to reproduce graphs of musical waveforms and the like accurately. I discovered that, despite the fact that the 440 uses tractor feed, it cannot position paper vertically better than plus or minus one hammer position. This means that a diagonal line drawn in graphics mode can have significant kinks in it due to variations in the vertical paper motion. In discovering this, I wrote a diagnostic program in Pascal to verify that there was a physical problem with the printer. The program appears at the end of this article.

The program employs a subroutine ('printchar') to send characters to the printer by calling some assembly language routines to do port I/O and the logical and function (see S-100 Microsystems, Vol. 1/No. 4, "A Monitor Program in Pascal" for more information on the routines). The first thing it does is to wait until the printer is ready (value of port 'pstat' anded with 'pmask' is equal to 'prdy'). It then places the character on the port with the MSB high, then with the MSB low, and finally with the MSB high again, to create a software 'strobe' of the 'data available' line at the printer. The tests proceed as follows; you can follow each test pattern in both the program listing



Integral Data Systems' Peter Eisenhauer, Vice President of Marketing and Sales, responds to this review of the Model 440 Paper Tiger Printer:

As regards the technical content of the article, most of the listed specifications are correct with the exception of the noted print speed. The correct maximum uni-directional speed is 198 c.p.s. at 16.5 characters/inch. The speed quoted was a nominal throughput speed. Another incorrect statement is the comment about paper jamming. An optional paper catch basket has been available for the Model 440 for more than a year and a half. This inexpensive (\$12.00 list) basket attaches readily onto the two thumb-knobs on the rear of the printer in about 10 seconds.

The balance of the article offers some very subjective comments about the control sequences used in implementing graphics and the "quality" of the graphics in some test patterns. If Mr. Bondy is hung up about the former, our Applications department recommends that he simply output graphics on needles 1-6 vice 0-5; in this implementation, an ETX code will never appear in a graphics string.

The graphics quality, however, is another issue. When the Paper Tiger 440 was introduced almost two years ago, it was the first ever full-function matrix print with raster graphics to sell for \$1,000. And during the interim period, it has proven to be the best. The tens of thousands of Paper Tigers in the field today bear witness to that fact. If Mr. Bondy concludes that the 440's graphics quality is not high in relationship to a \$10,000 plotter, I will give him the point. But for \$1,000, there is not a better plain paper printer with raster graphics on the market today, even though the 440 is no longer in production and has been replaced in the product line by our new Paper Tiger 445.

Above you will find a number of graphics print samples from a Paper Tiger 440. These graphics samples are from real life applications, not lab test patterns. I submit that the printouts speak for themselves. □

IDS 440 Printer cont'd...

and in the test printout.

Test 1 determines if the printing of solid black areas is even, to see if the ribbon is inked evenly and if the hammers are striking evenly. Horizontal streaking indicates that a hammer is bad, while large dark or light spots indicates a poor ribbon. The sample test run indicates that there is some streaking, indicating a hammer problem (or improper vertical paper motion which causes overprinting), but no inking problems.

Tests 2 and 3 print a series of horizontal lines, one for each hammer. If a hammer is failing, one of the columns of lines will be lighter or darker than the others, allowing the hammer which failed in Test 1 to be identified exactly. Test 3 prints many short bars, rather than few long ones, in order to reduce the possibility of mistaking ribbon inking variations for a hammer problem. Note in Test 3 that under the letters 'ng' in 'starting test three', the horizontally adjacent bars sometimes are not uniformly spaced in the vertical direction; in fact, some bars appear to be on the same line, while they should be above or below each other. The test does indicate, however, that all of my hammers are working properly.

Test 4 and 5 print diagonal lines in each direction. This allows one to determine by simple visual inspection if the vertical paper motion is uniform and if the hammer timing is even. Uneven timing or motion will be indicated by kinks in the lines, as is the case with the test printout.

Test 6 prints pairs of lines such that the first line fires six hammers and the second line fires first hammer 1 for a while, then hammer 2 for a while, etc, until hammer 6 is fired. The pattern should look like a solid black band for the first line, followed below by six horizontal lines starting just under the bar and proceeding to just above the next bar. If you look at the sample test output, you will see this pattern. Notice that the distances between the first line (bar) and the six lines should always be the same if

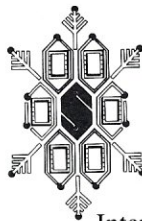
the vertical paper motion is constant (and correct). Notice also that in this test, the paper motion is not at all uniform, with variations on the order of one hammer distance. For example, under the characters 'six', there is a large distance between the 'bar' line and the next line in the first pair of lines, while there is almost no space at all between the 'bar' line and the second line in the second pair.

When I sent these test results to IDS initially, they did not understand what I was testing for; apparently my tests were more sophisticated than theirs. After three letters, they understood my observation, but then they said that the problem was that I was firing seven hammers in my test program. Observation of the program itself (which was enclosed with the letter I sent them) clearly shows that I was not in fact ever firing the seventh hammer. Finally, IDS wrote to me to say that their printer was not specified to print better than plus or minus one hammer position vertically. I could not find this 'specification' in their literature anywhere. Considering that they state that their printer is suitable for printing from "bar codes to photographic images" in graphics mode, I find this particular 'specification' to be absurd.

I have friends who claim that their IDS printers can produce good graphics copy; unfortunately, IDS will not fix my printer so that it will do so. This means that one cannot purchase an IDS printer with any certainty that it will provide good graphic copy; to get a good IDS graphics printer one must also be lucky. My feeling is that the IDS printer is a good printer, for the 'graphics' option's availability. I have been informed that their newer printers (the 460) have the same problems doing graphics as the 440, even though their character quality is better due to a more dense dot matrix. If you don't need high quality graphic reproduction, then perhaps the IDS printers can be useful to you. If, however, your graphics requirements are reasonably stringent, you probably should look elsewhere for a graphics output device. □

CP/M Systems Compatible 8080/Z80 Software

	STANDARD UTILITIES	\$	SOURCE/OBJECT
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D	Directory Files Entry/Space/Disk Status 4 Column Sort	40.00	20.00
DDB	Disk Directory Database of Your Programs, Update/Inquiry	60.00	25.00
DCOMP	Disk File Compare with Another Disk File	30.00	20.00
MCOMP	Memory Compare with Memory (EROM to RAM or EROM)	30.00	20.00
MTEST	Memory Test with Before/After Write Error Bits + PASS #	30.00	20.00
	ADVANCED UTILITIES		
CDIR	Comprehensive Directory/File Allocation Verification	30.00	20.00
COPSEQ	Define and Copy Disk File to CP/M File	30.00	20.00
DASM	8080 Object Dis-assembler with Symbol Table/XRef/Map	100.00	40.00
GEDIT	One Pass Gang Replacement Non-Destructive Editor	50.00	20.00
PREDIT	Program Version Number Maintenance at Pre-Edit Time	40.00	20.00
PROMER	Load/Display/Patch/Copy/Verify/Burn 1/2K+1K+2K+4K PROMS	60.00	30.00
RELOC	8080 Object Code Relocator (Known Data Areas Entered)	30.00	20.00
	SUPER SUBROUTINES		
DLOG	Data Buffer Logged Direct to End of Disk File Requested	40.00	
POLAR	Converts Origin/Angle/Radius to X/Y Coordinates Fast!	40.00	
RADIX	Alphanumeric Radix Bin Data Sort with No Data Movement	30.00	
SHELL	Shell Metzner Data Sort with Minimal Overhead/Movement	30.00	
	MEMORY MAPPED VIDEO		
CGEN	Video Character Generator/Editor for On Screen Updates	50.00	20.00
DXAM	Disk Examine in ASCII/Ebdc/Hex with Sector Update	40.00	20.00
VBASIC	9K Video/Disk Basic + Full Screen Basic Source Editor		100.00
VGAMES	For VBasic: Othello/Blackjack/Breakout/Star Trek/Football	50.00	
PMIS	Program Management Information System Written in VBASIC	200.00	
VIDEO	Flexible Multi-User/Window Super Video Driver	50.00	
VDRAW	Vector Line Draw and Plot Subroutine for Fast Graphics	30.00	
CHESS	Graphic Games for IMSAI VIO+VG Flashwriter2+SSM VB3	30.00	20.00
INVADERS	Zap!/Sound Effects/Joystick or Buttons or Console	50.00	20.00
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```

Program IDSCheck;

( test evenness of print density and graphics on IDS 440 printer --
  parallel interface version )

const
  pdata = 132; ( printer data port (output) 84H)
  pstat = 132; ( printer status port 84H )
  pirqt = 131; ( TUART interrupt address res 83H )
  pmask = 3; ( mask to get status bits )
  prdy = 1; ( pstat is this when ready )

  stx = 2;
  etx = 3;
  cr = 13;
  lf = 10;
  ff = 12;
  vt = 11;

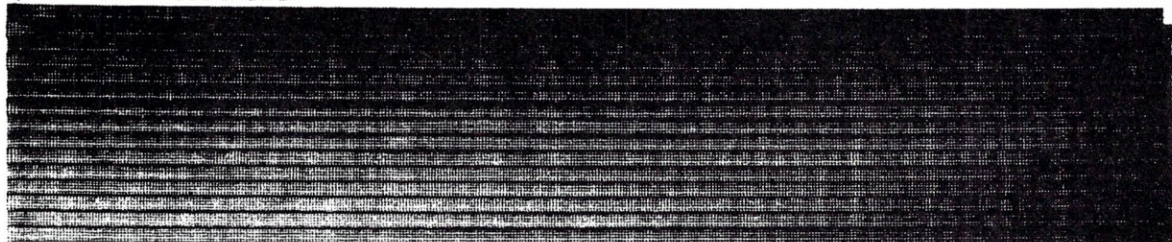
var
  i, j, k : integer;
  printer : text;

function portread(addr : integer) : integer; external;
procedure portwrite(addr : integer; data : integer); external;
function pand(param1, param2 : integer) : integer; external;

procedure printchar(ch : integer);
begin
  repeat ( wait until printer is ready )
    until (pand(portread(pstat),pmask) = prdy);
  ( first, write data with high msb as strobe )
  portwrite(pdata,(ch + 128));
  ( strobe msb low for a moment )
  portwrite(pdata,ch);
  portwrite(pdata,(ch + 128));
end; ( printchar )

```

starting test one



```

procedure test1;
begin ( test if printing of black is even --
      no over-printing and no un-even hammers --
      horizontal streaking indicates uneven hammer pressure )
  writeln(printer,'starting test one');
  printchar(etx); ( enable graphics )
  for i := 1 to 16 do begin ( for sixteen line )
    for j := 1 to 390 do ( for each column )
      printchar(63); ( print all six dots as black )
    ( terminate line )
    printchar(etx);
    printchar(vt);
  end; ( for i )
  ( return to normal printing mode )
  printchar(etx); printchar(stx);
end;

```

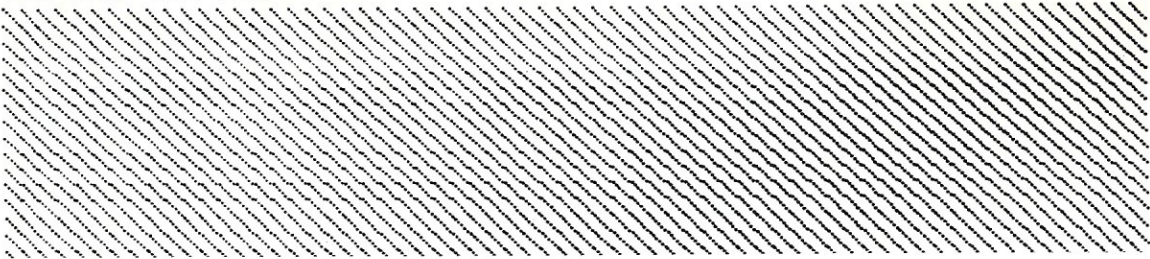

starting test two

```
procedure test2;
begin ( try to test density of hammers --
      if one column is darker or lighter than another, its
      hammer is striking too strongly or too lightly )
writeln(printer,'starting test two');
printchar(etx); ( enable graphics )
for i := 1 to 16 do begin ( for sixteen lines )
  for j := 1 to 66 do ( print lowest hammer 66 times )
    printchar(1);
  for j := 1 to 66 do ( print next higher hammer )
    printchar(2);
  for j := 1 to 66 do ( etc )
    printchar(4);
  for j := 1 to 66 do
    printchar(8);
  for j := 1 to 66 do
    printchar(16);
  for j := 1 to 66 do
    printchar(32);
  printchar(etx);
  printchar(vt);
end; ( for i )
( return to normal printing mode )
printchar(etx); printchar(stx);
end;
```

starting test three

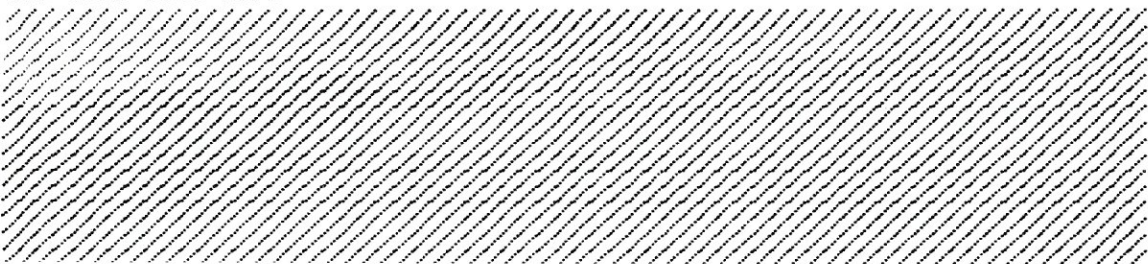
```
procedure test3;
begin( try to test density of hammers --
      if one column is darker or lighter than another, its
      hammer is striking too strongly or too lightly )
writeln(printer,'starting test three');
printchar(etx); ( enable graphics )
for i := 1 to 16 do begin
  for j := 1 to 11 do begin
    for k := 1 to 6 do printchar(1);
    for k := 1 to 6 do printchar(2);
    for k := 1 to 6 do printchar(4);
    for k := 1 to 6 do printchar(8);
    for k := 1 to 6 do printchar(16);
    for k := 1 to 6 do printchar(32);
  end; ( for j )
  printchar(etx);
  printchar(vt);
end; ( for i )
( return to normal printing mode )
printchar(etx); printchar(stx);
end;
```


starting test four



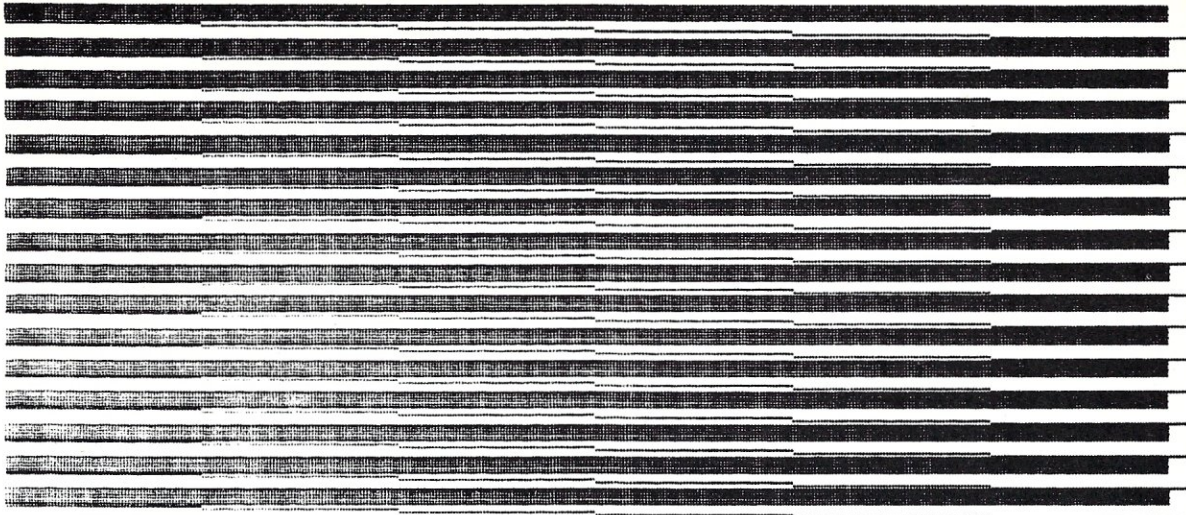
```
procedure test4;
begin ( lots of diagonal lines for linearity test --
      if lines are wavy, vertical paper motion is not even )
writeln(Printer,'starting test four');
printchar(etx); ( enable graphics )
for i := 1 to 16 do begin ( for each line )
  for j := 1 to 64 do begin ( print 64 diagonal strokes )
    printchar(1);
    printchar(2);
    printchar(4);
    printchar(8);
    printchar(16);
    printchar(32);
  end; ( for j )
  printchar(etx);
  printchar(vt);
end; ( for i )
( return to normal printing mode )
printchar(etx); printchar(stx);
end;
```

starting test five



```
procedure test5;
begin ( lots of diagonal lines for linearity test -- opposite direction --
      if lines are wavy, vertical paper motion is not even )
writeln(Printer,'starting test five');
printchar(etx); ( enable graphics )
for i := 1 to 16 do begin ( for each line )
  for j := 1 to 64 do begin ( print 64 diagonal strokes )
    printchar(32);
    printchar(16);
    printchar(8);
    printchar(4);
    printchar(2);
    printchar(1);
  end; ( for j )
  printchar(etx);
  printchar(vt);
end; ( for i )
( return to normal printing mode )
printchar(etx); printchar(stx);
end;
```


starting test six



```
procedure test6;
  besin; ( print one line with all six hammers printins, then a line
          with only one hammer at a time. Estimate whether vertical
          line spacins is even by comparing single hammer lines with
          dark lines )
  writeln(Printer,'starting test six');
  printchar(etx); ( enable graphics )
  for i := 1 to 16 do besin ( for each line )
    ( print first line with all six hammers printins )
    for J := 1 to 390 do ( for each column )
      printchar(63); ( print all black dots )
    printchar(etx);
    printchar(vt);
    ( print second line with one hammer at a time printins )
    for J := 1 to 66 do printchar(1);
    for J := 1 to 66 do printchar(2);
    for J := 1 to 66 do printchar(4);
    for J := 1 to 66 do printchar(8);
    for J := 1 to 66 do printchar(16);
    for J := 1 to 66 do printchar(32);
    printchar(etx);
    printchar(vt);
    end; ( for i )
  ( return to normal printins mode )
  printchar(etx); printchar(stx);
  end;

besin;
rewrite(Printer,'PRINTER:');
test1;
test2;
test3;
test4;
test5;
test6;
printchar(ff);
end. ( IDScheck )
```


The Other Processors for S-100 Systems

by Mokurai Cherlin

When I started looking last year for a computer system I wanted one that could support more than one of the popular microprocessors, because what I was after was not just a particular processor but the possibility of keeping up with newly released software as more advanced systems became available. There are several ways in which this can be done, each with some points of interest and various disadvantages. The systems I found include a variety of universal development systems, which can indeed support a wide range of processors but were meant for writing assembly language programs and such. They are all quite expensive, with a lot of irrelevant features and various lacks. There are also several hobby and small business systems that support more than one processor: the SS-50 bus now can be used with 6800, 6809, 68000 and Z80 processor boards, the last being a product of National Multiplex; Ohio Scientific offers a triple processor system with software switching between Z80, 6502 and 6800. There are even two Z80 processor boards for the Apple.

*It will be no surprise to readers
of this magazine that
the S-100 bus is the most
flexible of all available systems.*

But it will be no surprise to readers of this magazine that the S-100 bus is the most flexible of all available systems, as our editor loves to remind us. The July-August issue of S-100 Microsystems contains a partial list of S-100 processor boards, and I have found a great many more. There are still processors that do not seem to be available for S-100 systems, such as microNOVA, LSI-11, PACE, SC/MP, and 1802, so there is more to be done still. (The chip set for the LSI-11 is used in the AM-100 and WD16 Pascal microEngine, but the DEC microprogram is not available to us.)

That this wide selection is available to us is in part an accident which goes back to the origins of the S-100 bus. MITS used many fewer signal lines in the original Altair bus structure, but used a one hundred pin connector rather than spend more for one with just the number of lines they were using. It is because of this that we can now have extended addressing, master and slave processors, and the tremendous variety of boards for all sorts of functions that exists.

Mokurai Cherlin, Box 1131, Mount Shasta, CA 96067.

A price was paid for this accidental expandibility over the last few years as new uses for various lines turned out to be in conflict with each other. With the new IEEE standard, there should be very little of this in future, although the standard does not guarantee complete compatibility among boards. We should at least be able to find out the requirements of a particular board in standardized way in the future.

The Processors

8080, Z80, 6800 and 6502 processors are in wide use on a variety of buses, and the 6809, which combines 6800 assembler compatibility with superior addressing and some other enhancements is growing in popularity. Each of these has staunch adherents and a sizable base of software, much of it not available for the others. There are people who have bought an Apple just to run Visicalc; I don't know if it could be used on an S-100 bus 6502 system, but I know that there are people who would buy a board if it could.

The Signetics 2650 and Fairchild F8 are less well known to computer users, for the simple reason that their manufacturers have not supported them as computers. The F8 was never intended to be used in this way; it is really a programmable controller, and it is surprising to see a language such as LISP implemented on it. The 2650 could have been a good computer processor, except that it doesn't even have a very good assembler, and the only language for it is Basic.

8 bit microprocessors can do a lot of good work (the IBM 360/30 was an 8 bit machine with a 64K memory limit) but they are not quite what we need. 64K of address space, 8 bit word size, lack of arithmetic functions, primitive addressing modes, severely limited register space and (partly as a result) inadequate systems software have all held back the spread of microcomputers.

16 bit Processors

The second generation of microprocessors is well started and the third is coming into sight; soon all of these problems will be solved and we will see another huge leap in personal computing. We will have S-100 and other systems with many megabytes of memory, running 10 or more times faster than the 8 bit machines, supporting numerous users in timeshared, distributed and networked systems. The latest chips have provision for floating point instructions, implemented now by calls to an external floating point processor, and soon right on the chip. Improved addressing modes support position independent code, and multiple

stack pointers permit efficient data handling and sharable code. Most new processors maintain some degree of compatibility with one or more of their predecessors, often by allowing assembly code to be retranslated. The National Semiconductor 16000, in addition to its standard instruction set, can be switched into a mode in which it runs all 8080 object code unchanged.

Among 16 bit processors, the oldest and slowest is the Texas Instruments 9900. TI had the 16 bit market all to itself for several years, but has had no idea what to do with it. The 9900 is a microprocessor version of the 990 series minicomputer, which does not run all 990 code! If TI could have put all its 990 software into a desktop machine, instead of only Basic as they have done, they would have been years ahead of everyone.

Intel has caught on to such facts, and offers some real software support for the 8086; others will help out, notably Microsoft. Zilog and Motorola have exactly the same idea, so each of their processors will be serious contenders.

Western Digital was a little vague on its marketing, but has had a stroke of luck and a good idea. The luck came from Alpha Micro, which created a significant body of software and designed their own processor to go with it, by microprogramming the WD-16 to suit their own requirements. The AM-100 started out with Pascal, LISP, Basic and Forth, and now has APL and PILOT, a remarkable selection. Western Digital's good idea is of course the Pascal microEngine, a microprogrammed p-machine. The majority of Pascal compilers produce code for a hypothetical processor which is then simulated at run time by a p-code interpreter. This minimizes machine dependency, at some cost in running time. By microprogramming the p-codes as machine instructions, Western Digital has accelerated execution of Pascal programs by several times. This is not direct execution of Pascal, as Western Digital claims, since the Pascal program is still compiled, using exactly the same compiler. It is the intermediate p-code that is executed directly (but of course a Pascal compiler will execute faster on the Pascal Engine).

The last entry in the table is something else: a 2901 bit slice processor microprogrammed to execute Basic directly. 2901 bit slices, a product of Advanced Micro Devices, are not microprocessors, but rather building blocks for microprocessors. Each has 4 bits of a set of registers and some control logic, so that any number can be used side by side to make register of any desired length. The slices operate under control of a microprogrammed sequencer, which can emulate any existing instruction set or be set up to perform a wide range of actions as if they were single machine instructions. Alasda has created a processor which executes Basic programs several times faster than an ordinary processor, even with a compiler; the system operates in parallel with another processor that can run whatever operating system is desired.

Future Chips

Zilog, Motorola and National all have 32 bit processors on their chips, (Z8000, 68000 and 16000, respectively) with a 16 bit interface to the outside. When certain limitations such as the number of pins that can be put on a package are dealt with, they plan to have full 32 bit versions out. Intel is also working on a 32 bit design, which they say will execute the Ada language directly. Then, of course, every-

one will be working on 64 bit processors in 32 bit packages.

Datamation had a report that Intel, Motorola, IBM and possibly Fujitsu had microprogrammed the IBM 370 instruction set on a chip. The industry has been looking forward to this step for years, and now they will have to think of a new landmark goal for themselves. How about a Cray-1 on a chip? More to the point, how about a 370 on the S-100 bus? or a Univac, Burroughs or CDC emulator? Each of these systems has more software than all the current micros together.

Jamming more transistors on a chip is not all there is to computer architecture, however. There have been numerous developments in micros, and in particular S-100 systems, that have no parallel in large systems. It is now possible to attach a large number of essentially independent micros to a large capacity hard disk (Corvus); it is possible to run a large number of single board Z80 computers in the same S-100 box with all peripherals shared over the bus, while each processor executes at full speed out of its own memory and communicates with a separate terminal (Micromation). There is an implementation of Concurrent Pascal for multiple 8086's, with each process assigned to its own processor dynamically (not on S-100 yet; from Scicom, in England). Content addressable memory, also known as associative memory, can be plugged into an S-100 system to permit massive parallel processing (Semionics). In such a system, processing is done by the memory board itself, and all the data in memory can be operated on at once under the direction of a central processor.

Another important development is coprocessing between different processors, where one runs an operating system and another computes. There are three examples of this in the table, the Godbout 8085/8088 board, the Digicomp Z80 and Pascal Engine two board set, and the Alasda direct execution Basic board, which can be used with any other processor.

Software Prospects

There are three avenues of development in microprocessor software: writing new programs from scratch, recompiling existing software from other machines and bringing other machines onto the bus. There is now some useful system software for micros (operating systems, languages) and not a lot of good applications. Nearly all of what there is has been done new, right on the micros.

A relatively small amount of software has been brought over from larger computers, but there is one particularly important product that fits in here. The UNIX operating system, developed at Bell Labs and written in C, has been put on a Z8000. There are several C compilers for the Z8000, and several companies preparing to do their own translations of UNIX, notably Microsoft, who will probably put it on 8086 and 68000 processors as well. UNIX is a major operating system, about as much like CP/M as LISP is like Basic. The principal design consideration in writing UNIX was user convenience; it has been described as the only operating system that is a help to the user rather than an obstacle to be overcome. I don't think I need to say anything more.

Of course, if someone would put a PDP-11 emulator (not just an LSI-11) on the S-100 bus, we could use the original UNIX and all the languages and applications and what have you that it can run. We can expect a 370 board,

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Other Processors cont'd...

but then it depends on what semiconductor manufacturers and microprogrammers do after that. We will also see a number of processors for direct execution of high level languages and other systems: a database manager, word processor or operating system on a chip. There exist designs for direct execution of APL, LISP, Forth, ALGOL and other languages, some of which are being put on chips now while other are merely available.

Whatever products come out, we can certainly expect to see them on the S-100 bus, except where legal and marketing restrictions exist, as has been the case with DEC LSI-11 and Data General microNOVA processors. These companies apparently don't mind missing out on a market, while protecting what they have.

The S-100 bus is protected against obsolescence for as far ahead as we can now see, and will allow us to keep up with new hardware and software for years to come. No other kind of computer comes close.

References

Mokurai Cherlin, "High Level Languages for Microcomputers" Mini-Micro Systems, April 1980, pp. 89-110.

Sol Libes, "S-100 Processor Boards & Manufacturers" S-100 Microsystems, July/August 1980 p. 50.

Carol Ogden, "Sixteen-bit Micros" Mini-Micro Systems, Jan. 1979 pp. 64-72.

Max Schindler, "Pick a Computer Language that fits the Job" Electronic Design, July 19, 1980 pp. 62-78.

Processor: 6502
Company: CGRS Microtech, Inc., PO Box 368, Southampton, PA 18966
Phone: (215) 757-0284
Reference: BYTE 7/77 p. 115
Price: \$230.00

Processor: 6502
Company: California Computer Systems, 250 Caribbean, Sunnyvale CA 94086
Phone: (408) 734-5811
Reference: BYTE 6/79 p. 187
Price: \$329.00

Other Products: PET to S-100 adapter \$330. TRS-80 to S-100 adapter.
Comments: Developed by HUH? Electronics, which has been bought by CCS.

Processor: 6800
Company: MRS
Reference: BYTE 10/79 p. 207
Price: No longer sold
Comments: Out of business

Processor: 6800
Company: Datatronics, 208 E. Olive, Lamar, CO 81052
Phone: (303) 336-7956

Reference: Interface Age 8/78 p. 135
Price: \$269.00
Comments: Onboard I/O port and 1K ROM monitor

Name: Little Brain I
Processor: 6802
Company: BPI Electronics, 4470 SW 74th Ave., Miami, FL 33155
Phone: (305) 264-4496
Reference: BYTE 7/78 p. 200
Price: \$395.00
Comments: No longer sold; for in-house use only.

Processor: 6802
Company: MicroDaSys, PO Box 36051, Los Angeles, CA 90036
Phone: (213) 731-0876
Price: \$298.00
Other products: 6809 board, 68000 board, systems.
Comments: Can be upgraded to 6809. RAM, PROM, monitor, I/O, cassette! interface.

Processor: 6809
Company: Ackermann Digital Systems, 110N. York Rd., Suite 208, Elmhurst, IL 60126
Phone: (312) 530-8992
Reference: S-100 Microsystems 3/80 p. 12

Other products: Noisemaker sound board, 68000 board
Comments: IEEE. RAM, ROM, monitor

Processor: 6809
Company: MicroDaSys
Price: \$339.00
Comments: 6802 may be substituted. RAM, ROM, monitor, I/O, 2400 baud cassette interface, real-time clock.

Processor: 2650
Company: Central Data Corporation, 1207 North Hagan St., Champaign, IL 61820
Phone: (217) 359-8010
Reference: BYTE 5/79 p. 89
Other products: S-100 interface, other boards, systems.
Comments: Not a plug-in S-100 board. Single board computer using interface board to accept S-100 boards for expansion.

Processor: 2650
Company: C G Engineering
Reference: BYTE 7/79 p. 258
Comments: Single board computer; tape interface, parallel port, power control port, 3-7K ROM, 1-3K RAM. Out of business.

Name: Instructor 50
Processor: 2650
Company: Signetics Corporation, 811 E. Arques Ave., Sunnyvale, CA 94086
Phone: (408) 739-7700
Reference: BYTE 9/78 p. 23
Price: \$300.00
Comments: Single board computer system with S-100 interface. Not a plug board. Cassette interface.

Name: Slavemaster
Processor: 2650
Company: Victoria Micro Digital, 401 Dundee St., Victoria, TX 77901
Phone: (512) 575-3836
Reference: BYTE 6/79 p. 254
Price: \$199/1, \$398/2 board system
Other products: Analog board, IEEE 488 converter
Comments: Slavemaster dual processor system uses two 2650 boards with interleaved memory access and sharing of part of memory. Master board sold separately.

Processor: 2650
Company: Video Specialties, PO Box 136, Solana Beach, CA 92075
Phone: (714) 481-0073
Price: \$395.00
Other products: System \$2795

Name: F8S-100
Processor: F8
Company: Comptronics, 19824 Ventura Blvd., Woodland Hills, CA 91364
Phone: (213) 340-8843
Reference: BYTE 8/78 p. 184
Price: no longer sold
Comments: Going out of business. Remaining stock sold to Rowe International.

Processor: 9900
Company: Marinchip Systems, 16 St. Jude Rd., Mill Valley, CA 94941
Phone: (415) 383-1545
Price: \$700.00
Other products: PROM/RAM board, RAM board, I/O board, systems.
Comments: Price includes OS, Basic, Word Processor, more.

Processor: AM-100
Company: Alpha Micro, 17881 Sky Park North, Irvine, CA 92714
Phone: (714) 957-1404
Other products: Systems, software.

Processor: 8086, 8088
Company: ASAP Computer products

Inc., 11542-1 Knott St., Garden Grove, CA 92641
Phone: (714) 891-2663
Reference: BYTE 10/79 p. 283
Other products: 2901 bit slice board under development.
Comments: Promised soon.

Name: CompuPro Dual Processor Board
Processor: 8085 and 8088
Company: Godbout Electronics, Bldg. 725, Oakland Airport, CA 94614
Phone: (415) 562-0636
Reference: BYTE 6/80 p. 155
Price: \$325.00
Other products: Numerous.
Comments: IEEE. Can run 8086 programs under CP/M, by switching processors under program control.

Processor: 8086
Company: Lomas Data Products, 11 Cross Street, Westborough, MA 01581
Phone: (617) 366-4335
Reference: BYTE 6/80 p. 215
Price: \$399.99

Processor: 8086, 8088
Company: Microbyte, 2499 Cerritos Ave., Signal Hill, CA 90806
Phone: (213) 595-8571
Reference: BYTE 2/80 p. 215
Other products: System, \$4000.

Processor: 8086
Company: Seattle Computer Products, Inc., 114 Industry Drive, Seattle, WA 98188
Phone: (206) 575-1830
Reference: BYTE 1/80 p. 37
Price: \$695.00
Other products: 8/16 RAM dynamically switches between 8Kx16 and 16Kx8 depending on state of "Sixteen Request" line. CPU support card with ROM, vectored interrupt controller, I/O, timer/counters, clock.
Comments: IEEE

Processor: 8086
Company: Tecmar Inc., 23414 Greenlawn Ave., Cleveland, OH 44122
Phone: (216) 382-7599
Price: \$650.00
Other products: Reconfigurable RAM board, 16K by 8 or 8K by 16, \$395.00. PROM-I/O boards. Systems. Real-time video digitizer.

Processor: Z8000
Company: Ithaca Intersystems, 1650 Hanshaw Rd., PO Box 91, Ithaca, NY 14850
Phone: (607) 257-1090
Reference: BYTE 7/80 p. 46 ff.

Other products: Systems, boards, software.
Comments: IEEE

Processor: Z8000
Company: Quasar Data Products, 25151 Mitchell Dr., No. Olmsted, OH 44070
Phone: (216) 779-9387
Price: \$495.00
Other products: System \$6195. UNIX (TM) operating system promised.
Comments: IEEE, Z80 emulation.

Processor: 68000
Company: Ackermann Digital Systems
Phone: (312) 530-8992
Reference: BYTE 4/80 p. 37
Other products: Noisemaker sound board

Name: 68K Miniframe
Processor: 68000
Company: MicroDaSys
Price: \$2395.00
Other products: System \$3995.
Comments: Not a plug in S-100 board. S-100 adapter available (also SS-50, Motorola Exorciser, others). 256K RAM board, PROM, I/O, disk controller, more.

Processor: 68000
Company: Vandata, 17541 Stone Ave. N., Seattle, WA 98133 |
Phone: (206) 542-8370
Reference: Kilobaud Microcomputing 7/80 p. 202
Comments: Also emulates 280.

Name: DLX-10
Processor: AMD 2901 bit slice
Company: Alasda Computer Systems, PO Box 28517, San Diego, CA 92128
Phone: (714) 748-8640
Price: \$1250.00
Comments: Microprogrammed direct execution of Basic as coprocessor with another S-100 processor board running in parallel. Stack architecture using high speed on board RAM for working storage. Selectable precision up to 20 digits.

Name: Pascal-100
Processor: Pascal Microengine and Z80
Company: DigiComp Research Corp., Terrace Hill, Ithaca, NY 14850
Phone: (607) 273-5900
Reference: Interface Age 10/79 p. 118
figuration: \$250.
Comments: 2 board system, using Z80 for I/O. Optional addressing of one megabyte. Runs all 8080 and Z80 software. IEEE.
Interfaces: Interface Technology: all 990 and 9900 systems to S-100 California Computer Systems: PET and TRS-80

A "Label-Basic" Preprocessor

by Dr. G. Louis

*Speed up the execution of your Basic programs
with a Preprocessor program that strips away
all non-executable statements.*

I get frustrated and depressed when I have to write programs in Basic.

Now before half my readers turn away in disgust (not THAT old argument again!), let me hasten to agree that you can do in Basic (slowly) anything you can do in any other language, including write sound, readable, structured, and easily-maintained programs. All I say is that in any ordinary Basic, except for the expensive and sophisticated versions that take huge amounts of memory just to load, it isn't easy. The problem is, most micro Basics run extremely slowly even when stripped of all comments, superfluous blanks and what have you. That being so, the production version of any program HAS to be illegible no matter how well written, particularly when your variable names are limited to a letter and a number, and your branches are all to points with really meaningful designations like "3000".

Unfortunately, Basic is the only readily available and reasonably-priced language that can be used to do number-crunching. Full implementations of Pascal tend to be very expensive and to require large amounts of both disk and memory space, and Fortran is just as bad in both respects, so for the time being I'm stuck with Basic.

There is a way out of the dilemma. Since the runtime version of any Basic program, as noted above, has to be illegible to run with even a faint hope of a reasonable speed, let's simply consider the runtime version as a sort of glorified machine-coded. Let's write a pre-processor (a sort of mickey mouse compiler) that will take a sensible, legible program with all the necessary internal documentation in the source, and translate it into a stripped-down program in real Basic. That's what this article is about.

First of all, my pre-processor has to remove all unnecessary blanks and comments. That turns out to be quite easy: just ignore any blank not found between quotes, anything that starts with REM, and (for convenience and because Microsoft does it too) anything that starts with ' (again, not between quotes). More

specifically, if the pre-processor encounters a REM or a ' it skips to the end of the line.

On the other hand, there may be times when it really comes in handy to include a REM statement in the final program, even though it means losing some time. So if the pre-processor finds a statement beginning REM*, it includes the line in the translated version.

Next, there has to be a mechanism to allow the use of variable names that actually mean something related to what they are supposed to represent. The best way to do this is to check any character string for all possible Basic keywords and treat it as a variable name if no match is found. That's hard work especially if, as in my case, you want to use the program with two different versions of Basic. I compromised. Anything that begins with @ is treated as a variable name. That means the variable name symbol table is searched and if no match is found a new entry is made. The first variable name encountered is called A0 in translation, the second A1 and so on up to A9, then B0 and B9 and so on. Variable names must start with A-Z and may have up to 20 characters, but no embedded blanks or non-alphanumeric symbols such as + or -. To reduce the amount of typing, one can limit the length of the variable names. I don't often go over 8 characters myself.

Once we allow for 20-character variable names, it's obvious that single statements in Basic, especially of the type IF . . . THEN IF . . . etc. can get quite long. The pre-processor therefore permits continuation lines in the source code. If a right brace appears in column 1, the code is run together with the previous line (several examples appear in the sample listing).

Possibly even more useful is to have meaningful designations for branch destinations. I decided to use a label field beginning in column 1 of the source code (meaning that column 1 must be left blank unless you want a label or the line is a continuation as described above). The labels, unlike variable names, continue until the character / is encountered and you can embed anything you want except the characters [] / . Of course

this means that in branching statements the label has to be delimited, and I chose to use square brackets, i.e., [], for this purpose. A separate symbol table is maintained for labels.

Both symbol tables are naturally printed out during translation, for use in debugging at the runtime level. An important decision was to insist on line numbers in the source code, which are reproduced unchanged in the runtime version. This makes debugging a lot easier than if one's only guide to correspondence were the symbol table, and of course any text editor worth its salt either has automatic line numbering built in or allows you to write a macro to add line numbers before translation.

My Microsoft Basic has integer and double-precision variables in addition to the usual real and string types. Rather than try to remember to type \$, # or % after each occurrence of the name of a non-real variable, I decided to allow myself to declare all the non-reals at the start of the program (good practice anyway, right?) and to have the pre-processor take care of stuffing in the descriptor characters when needed.

That nearly completes the list of features. Of course the pre-processor flags errors such as no close quote, duplicate label and so on. Now for compromise number two. Rather than try to figure out the list of tokens for each of my two Basics and produce a directly executable Basic program as the result of translation, I decided to translate into ASCII, so that the program could be used independently of the token list of the Basic employed. (For those who need the information, Basic stores program lines with one-byte symbols, called tokens,

replacing all the keywords. When you type LIST, it translates the tokens back into keywords for display.) This necessitates a second step in translation, where the ASCII Basic program is fed into the Basic interpreter as if it were coming from the keyboard. In Microsoft Basic, which uses a simple polled keyboard-input routine, this is trivially easy but has to be done at the level of assembly or machine-language.

The other Basic I use is Polymorphic Systems' Version A00, which has a rather weird interrupt-driven keyboard input system. In this Basic, you can type ahead of the program and the input will be read in when the program is ready for it. You can also have the program write into its own input buffer, which allows you to perform command-level functions under program control. In this way it's possible to write a Basic program to retrieve the ASCII translation of a Label-Basic source file from memory and then scratch itself, leaving the translated program ready to run. By way of illustration, I show in Listing 1 the Label-Basic source for this program, and in Listing 2 the translated (runtime) version.

The Label-Basic preprocessor is written in 8080 assembly language and requires 1214H bytes including space for 60 labels and 100 variables. The code in listing 3 will require some modification to adapt the program to the host system. In particular, the program assumes a SYS8 or equivalent executive/editor package is being used. Thus the OS/editor interface will need rewriting in most cases. □

—PROGRAM BEGINS NEXT PAGE—

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LISTING 3
 LABEL-BASIC PREPROCESSOR ASSEMBLY LISTING

```

; --- FILE "LBLBAS.SRC" ---
; LABEL BASIC WITH TABLES -- POLY VERSION WITH
; ASSEMBLER IN ROM AT 0C000H -- G.LOUIS/791111
;
0006 = P EQU PSW
204D = IBUF EQU 204DH ; OS INPUT BUFFER
C01C = BLOCK EQU 0C01CH ; PUT VIDEO IN PAGE MODE
C022 = PRINT EQU 0C022H ; ENABLE PRINTER
C00A = WH1 EQU 0C00AH ; OUTPUT A TO CONSOLE
C034 = DEOUT EQU 0C034H ; OUTPUT DE IN HEX
C028 = CROUT EQU 0C028H ; OUTPUT CR AND LF
C031 = TABBER EQU 0C031H ; DO TAB ON CONSOLE
C013 = OSEQ EQU 0C013H ; OUTPUT STRING TILL CR
C003 = WARMST EQU 0C003H ; OS RE-ENTRY VECTOR
0C0E = CURPOS EQU 0C0EH ; ADDRESS OF ADDRESSABLE VIDEO CURS
2002 = BOFP EQU 2002H ; HOLDS ADDR OF START OF FILE
AD30 = AD30H ORG 0AD30H ; *** EXEC ADDRESS WILL BE 0BB00H
AD30 SYMTBL: DS 1201 ; 60 LABELS
BL11 VARTBL: DS 2301 ; 100 VARIABLES
BADE ABUF: DS 20
BAF2 COUNT: DS 1
BAF3 NCHR: DS 1
BAF4 CURR: DS 2
BAF6 VARNAM: DS 2
BAF8 SPACE: DS 8
BB00 C32CBC START: JMP BEGIN
BB03 202A2A2A20ERRMS: DB ' *** ERROR '
BB0E 0D DB 13
BB0F 204C494E45 DB ' LINE '
BB15 0D DB 13
BB16 46494C4520ENDMS: DB 'FILE STARTS AT '
BB25 0D DB 13
BB26 20414E4420 DB ' AND ENDS AT '
BB33 0D DB 13
BB34 E5 ZBUF: PUSH H ; ZBUF FILLS ABUF WITH BLANKS
BB35 D5 PUSH D
BB36 1E14 MVI E,20 ; PUTS 20 IN COUNT
BB38 21F2BA LXI H,COUNT
BB3B 73 MOV M,E
BB3C 2B DCX H
BB3D 3E20 MVI A,' '
BB3F 77 MOV M,A
BB40 2B DCX H
BB41 1D DCR E
BB42 C23CBB JNZ $-6
BB45 23 INX H
BB46 4D MOV C,L ; PUTS ABUF START ADDR IN BC
BB47 44 MOV B,H
BB48 D1 POP D
BB49 E1 POP H
BB4A C9 RET ; AND RETURNS WITH HL AND DE PRESET
BB4B 7E ACHK: MOV A,M ; RETURNS C IF [M]<'A' OR >'Z'
BB4C FE41 CPI 'A'
EB4E D8 RC
BB4F FE5B CPI 'Z'+1
BL51 3F CMC
BB52 C9 RET
BB53 7E DCHK: MOV A,M ; RETURNS C IF [M]<'0' OR >'9'
BB54 FE30 CPI '0'
ER56 D8 RC
BB57 FE3A CPI '9'+1
RB59 3F CMC
BB5A C9 RET

```

```

0010 ' LISTING 1
0020 ' PROGRAM TO RECOVER PREPROCESSED FILES FROM MEMORY
0030 ' INTO POLY A00 BASIC VIA THE TYPE-AHEAD BUFFER
0040 '
0050 ' RENUMBER THIS PROGRAM: REN 1,1 AFTER TRANSLATION
0060 ' IN ORDER TO ENABLE THE SELF-DESTRUCTION FEATURE
0070 '
0080 ' INSTRUCTIONS FOR USE:
0090 ' PREPARE SOURCE FILE WITH LINE NUMBERS STARTING
0100 ' ABOVE 8 SO AS NOT TO INTERFERE WITH THIS PROGRAM.
0110 ' LOAD THE PREPROCESSOR AND EXECUTE BY JUMPING TO
0120 ' LABEL "START".
0130 ' COPY THE CONVERTED FILE INTO HIGH MEMORY ABOVE THE
0140 ' FIRST BYTE AVAILABLE TO BASIC.
0150 ' LOAD BASIC AND THIS PROGRAM AND POKE THE START
0160 ' ADDRESS OF THE CONVERTED CODE INTO YOUR
0170 ' "PNTRBUFR" (48896=BF00 IN THIS VERSION).
0180 ' TYPE "RUN".
0190 '
0200 RECOVER FILE\ @CR=13 \ @ONE=49 \ @EIGHT=56
0210 '
0220 ' FIRST GET THE FILE POINTER FROM "PNTRBUFR"
0230 ' @PNTRBUFR=48896 \ @POINTER=PEEK(@PNTRBUFR)+
0240 ' PEEK(@PNTRBUFR+1)*256
0250 '
0260 ' NEXT WRITE A WHOLE LINE INTO THE TYPE-AHEAD BUFFER
0270 GET CHARACTER\ @CHAR=PEEK(@POINTER) \
0280 ' IF @CHAR>127 THEN [SELFDESTRUCT]
0290 ' (CHAR>127 MEANS THE EOF MARK WAS REACHED)
0300 ' @POINTER=@POINTER+1 \ OUT 0,@CHAR \
0310 ' IF @CHAR <> @CR THAN [GET CHARACTER]
0320 ' (OUT 0 WRITES THE CHARACTER TO THE INPUT BUFFER)
0330 ' (LOOP TILL THE WHOLE LINE IS IN THE BUFFER)
0340 '
0350 ' NOW SAVE THE FILE POINTER IN "PNTRBUFR" AGAIN
0360 ' @HIGHPNT=INT(@POINTER/256) \
0370 ' POKE @PNTRBUFR+1,@HIGHPNT \
0380 ' POKE @PNTRBUFR, @POINTER-256*@HIGHPNT
0390 '
0400 ' LASTLY WRITE "RUN<CR>" INTO THE BUFFER AND STOP
0410 ' @ASC=82 \ @ASCU=85 \ @ASCN=78 \
0420 ' OUT 0,@ASC \ OUT 0,@ASCU \ OUT 0,@ASCN \
0430 ' OUT 0,@CR \ STOP
0440 '
0450 ' DELETE LINES 1 THRU 8 VIA THE TYPE-AHEAD BUFFER
0460 SELFDESTRUCT\ FOR @CHAR=@ONE TO @EIGHT \
0470 ' OUT 0,@CHAR \ OUT 0,@CR \ NEXT
0480 STOP

```

LISTING 2
 THIS IS THE PROGRAM OF LISTING 1 AS IT APPEARS
 AFTER TRANSLATION BY THE PRE-PROCESSOR

```

200 A0=13\A1=49\A2=56
230 A3=48896\A4=PEEK(A3)+PEEK(A3+1)*256
270 A5=PEEK(A4)\IFA5>127THEN460
300 A4=A4+1\OUT0,A5\IFA5<A0THEN270
360 A6=INT(A4/256)\POKEA3+1,A6\POKEA3,A4-256*A6
410 A7=82\A8=85\A9=78\OUT0,A7\OUT0,A8\OUT0,A9\OUT0,A0\STOP
460 FORA5=A1TOA2\OUT0,A5\OUT0,A0\NEXT
480 STOP

```



```

BBD6 BE          SEAR:  CMP      M
BBD7 C2E4BB     JNZ      INCB   ; NOT A MATCH IF NZ
BBDA 23         INX      H
BBDB 03         INX      B
BBDC 1D         DCR      E
BBDD CAD3BB     JZ       SEAR-3 ; Z AT THIS POINT => MATCH
BBE0 0A         LDAX    B
BBE1 C3D6BB     JMP      SEAR
BBE4 03         INCB:  INX      B ; SKIP TO 20 CHARS
BBE5 1D         DCR      E
BBE6 C2E4BB     JNZ      INCB
BBE9 3AF3BA     LDA      NCHR  ; ALSO SKIP FIELD FOLLOWING
BBEC 03         INX      B
BBED 3D         DCR      A
BBEE C2E9BB     JNZ      $-5
BBF1 C3C8BB     JMP      COMS+2
BBF4 21DEBA     ACOPY:  LXI     H,ABUF ; COPY ABUF INTO WHERE BC POINTS
BBF7 1E14       MVI     E,20
BBF9 7E         MOV     A,M
BBFA 02         STAX   B
BBFB 23         INX      H
BBFC 03         INX      B
BBFD 1D         DCR      E
BBFE C2F6BB     JNZ      $-8
BC01 C9         RET
BC02 E5         ENTR1:  PUSH   H ; PUT VARIABLE IN TABLE
BC03 F5         PUSH   P ; SAVE TERM CHR (BL,%,$,#)
BC04 21F6BA     LXI     H,VARNAM ; GET CURRENT BASIC VARIABLE
BC07 34         INR     M ; INCREMENT IT
BC08 3E39       MVI     A,'9'
BC0A BE         CMP     M
BC0B D213BC     JNC     ENTR
BC0E 3630       MVI     M,'0'
BC10 23         INX      H
BC11 34         INR     M
BC12 2B         DCX     H
BC13 E5         ENTR:  PUSH   H
BC14 D5         PUSH   D
BC15 CDF4BB     CALL   ACOPY ; PUT NAME WHERE B POINTS
BC18 D1         POP     D
BC19 E1         POP     H
BC1A 23         INX      H ; FOLLOW BY BASIC VAR
BC1B 7E         MOV     A,M
BC1C 02         STAX   B
BC1D 2B         DCX     H
BC1E 03         INX      B
BC1F 7E         MOV     A,M
BC20 02         STAX   B ; AND TERM CHR
BC21 03         INX      B
BC22 F1         POP     P
BC23 02         STAX   B
BC24 03         INX      B
BC25 AF         XRA     A
BC26 02         STAX   B
BC27 46         MOV     B,M
BC28 23         INX      H
BC29 4E         MOV     C,M
BC2A E1         POP     H
BC2B C9         RET

```

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BB5B 3E51     ERRQ:  MVI     A,'Q'
BB5D C371BB   JMP     ERROR
BB60 3E4D     ERRM:  MVI     A,'M'
BB62 C371BB   JMP     ERROR
BB65 3E44     ERRD:  MVI     A,'D'
BB67 C371BB   JMP     ERROR
BB6A 3E4C     ERRL:  MVI     A,'L'
BB6C C371BB   JMP     ERROR
BB6F 3E53     ERRS:  MVI     A,'S'
BB71 E5       ERROR:  PUSH   H
BB72 F5       PUSH   P
BB73 2103BB   LXI     H,ERRMS ; ISSUE ERROR WARNING
BB76 CD13C0   CALL   OSEQ
BB79 F1       POP     P
BB7A CD0AC0   CALL   WHI
BB7D 23       INX      H
BB7E CD13C0   CALL   OSEQ
BB81 2AF4BA   LHLD   CURR ; WITH LINE NO.
BB84 7E       MOV     A,M
BB85 23       INX      H
BB86 FE20     CPI     ' '
BB88 CA8EBB   JZ      $+6
BB8B CD0AC0   CALL   WHI
BB8E C381BB   JMP     $-13
BB91 3E0D     MVI     A,13
BB93 CD0AC0   CALL   WHI
BB96 E1       POP     H ; SKIP REST OF LINE
BB97 2B       DCX     H
BB98 3AF9BA   LDA     SPACE+1 ; PASS INDICATOR
BB9B B7       ORA     A
BB9C CABDBC   JZ      NOLAB
BB9F 7E       MOV     A,M
BBA0 23       INX      H
BBA1 FE0D     CPI     0DH
BBA3 CA6ABE   JZ      EOL
BBA6 12       STAX   D
BBA7 13       INX      D
BBA8 C39CBB   JMP     $-12
BBAB CD34BB   ALPS:  CALL   ZBUF ; SCAN ALPHAMERIC INTO ABUF
BBAE CD4BBB   CALL   ACHK
BBB1 DC53BB   CC      DCHK
BBB4 D8       RC
BBB5 3AF2BA   LDA     COUNT
BBB8 3D       DCR     A
BBB9 32F2BA   STA     COUNT
BBBC FA6ABB   JM      ERRL ; >20 CHARS => TOO LONG
BBBF 7E       MOV     A,M
BBC0 23       INX      H
BBC1 02       STAX   B
BBC2 03       INX      B
BBC3 C3AEBB   JMP     ALPS+3
BBC6 E5       COMS:  PUSH   H ; COMPARE ABUF WITH TABLE POINTED TC
BBC7 D5       PUSH   D ; BY BC
BBC8 21DEBA   LXI     H,ABUF
BBCB 1E14     MVI     E,20
BBCD 0A       LDAX   B
BBCE B7       ORA     A ; Z => END OF TABLE, NO MATCH
BBCF C2D6BB   JNZ     SEAR
BBD2 3C       INR     A ; CLEAR Z TO SHOW NO MATCH
BBD3 D1       POP     D
BBD4 E1       POP     H
BBD5 C9       RET

```


BCBA AF	XRA	A	; MARK END OF TABLE	BC2C 3A5120	BEGIN: LDA	IBUF+4	; CHECK FOR PRINT OPTION
BCBB 02	STAX	B		BC2F FE50	CPI	'P'	
BCBC E1	POP	H		BC31 C41CC0	CNZ	BLOCK	
BCBD CDC3BC	NOLAB: CALL	SKIP	; SKIP TO END OF LINE	BC34 CC22C0	CZ	PRINT	
BCC0 C347BC	JMP	PASS1	; ROUND AGAIN	BC37 AF	XRA	A	; CLEAR SYMBOL TABLES
BCC3 7E	SKIP: MOV	A,M	; SKIP TO END OF LINE	BC38 32E1B1	STA	VARTBL	
BCC4 23	INX	H		BC3B 3230AD	STA	SYMTBL	
BCC5 FE0D	CPI	13		BC3E 32F9BA	STA	SPACE+1	; PASS-1 INDICATOR
BCC7 C8	RZ			BC41 CD28C0	CALL	CROUT	
BCC8 C3C3BC	JMP	SKIP		BC44 2A0220	LHLD	BOFP	; START OF FILE
BCCB 7E	SKIPL: MOV	A,M	; SKIP OVER LABEL	BC47 7E	PASS1: MOV	A,M	; LENGTH BYTE
BCCC 23	INX	H		BC48 FE01	CPI	1	; 1 => EOF
BCCD FE5C	CPI	'\'		BC4A CA3FBD	JZ	PASS2	
BCCF C8	RZ			BC4D 23	INX	H	; POINT TO LINE NO.
BCD0 C3CBBC	JMP	SKIPL		BC4E 22F4BA	SHLD	CURR	
BCD3 32F8BA	PUT: STA	SPACE	; SAVE LAST CHAR	BC51 3E05	MVI	A,5	; SKIP IT
BCD6 12	STAX	D	; PUT IN TEXT	BC53 85	ADD	L	
BCD7 13	INX	D		BC54 6F	MOV	L,A	
BCD8 C30AC0	JMP	WH1	; DISPLAY OR PRINT	BC55 D256BC	JNC	+\$1	
BCDB 7E	SBLK: MOV	A,M	; SCAN TO NONBLANK CHAR	BC58 24	INR	H	
BCDC 23	INX	H		BC59 7E	MOV	A,M	; CHECK FIRST CHAR
BCDD FE20	CPI	' '		BC5A FE20	CPI	' '	; IF BL, TAB, } OR @ DO NOTHING
BCDF CADBBC	JZ	SBLK		BC5C CABDBC	JZ	NOLAB	
BCE2 FE09	CPI	9		BC5F FE09	CPI	9	
BCE4 CADBBC	JZ	SBLK		BC61 CABDBC	JZ	NOLAB	
BCE7 C9	RET			BC64 FE7D	CPI	'}'	
BCE8 23	DECLAR: INX	H	; SPECIAL PROCESSING FOR DECLARATIO	BC66 CABDBC	JZ	NOLAB	
BCE9 CD4BBB	CALL	ACHK	; MUST START WITH ALPHA	BC69 FE40	CPI	'@'	
BCEC DA6FBB	JC	ERRS		BC6B CABDBC	JZ	NOLAB	
BCEF CDABBB	CALL	ALPS	; GET VARIABLE NAME	BC6E CD4BBB	CALL	ACHK	; LABEL MUST START WITH ALPHA
BCF2 FE3A	CPI	':'	; MUST END WITH COLON	BC71 DA6FBB	JC	ERRS	
BCF4 C26FBB	JNZ	ERRS		BC74 CDABBB	CALL	ALPS	
BCF7 23	INX	H		BC77 FE0D	CPI	0DH	; END OF LINE NOT LEGAL
BCF8 CDDBBC	CALL	SBLK		BC79 CA6FBB	JZ	ERRS	
BCFB FE23	CPI	'#'	; MAY BE MARKED # OR D	BC7C FE5C	CPI	'\'	; \ => END OF LABEL
BCFD CA25BD	JZ	OK		BC7E CA84BC	JZ	+\$6	
BD00 FE24	CPI	'\$'	; \$ OR S	BC81 CDB5BB	CALL	ALPS+10	; ACCEPT ANY OTHER
BD02 CA25BD	JZ	OK		BC84 C374BC	JMP	-\$16	
BD05 FE25	CPI	'&'	; & OR I	BC87 0130AD	LXI	B,SYMTBL	; CHECK FOR DUPLICATE LABEL
BD07 CA25BD	JZ	OK		BC8A 3E04	MVI	A,4	
BD0A FE49	CPI	'I'	; REST OF LINE IS IMMATERIAL	BC8C 32F3BA	STA	NCHR	
BD0C C211BD	JNZ	+\$5		BC8F CDC6BB	CALL	COMS	
BD0F 3E25	MVI	A,'&'		BC92 CA65BB	JZ	ERRD	; IF MATCH FOUND, ERROR
BD11 C325BD	JMP	OK		BC95 E5	PUSH	H	; COPY LABEL INTO LIST
BD14 FE53	CPI	'S'		BC96 CDF4BB	CALL	ACOPY	
BD16 C21BBB	JNZ	+\$5		BC99 110430	LXI	D,3004H	
BD19 3E24	MVI	A,'\$'		BC9C 2AF4BA	LHLD	CURR	; FOLLOW BY LINE NO.
BD1B C325BD	JMP	OK		BC9F 7E	MOV	A,M	
BD1E FE44	CPI	'D'		BCA0 23	INX	H	
BD20 C26FBB	JNZ	ERRS		BCA1 BA	CMP	D	; SKIP LEADING ZEROES
BD23 3E23	MVI	A,'#'		BCA2 CAA5BC	JZ	+\$3	
BD25 32FFBA	OK: STA	SPACE+7	; SAVE DESCRIPTOR (% , \$ OR #)	BCA5 15	DCR	D	; STOP SKIPPING WHEN NONZERO FOUND
BD28 01E1B1	LXI	B,VARTBL	; CHECK VARIABLES FOR DUPLICATE	BCA6 02	STAX	B	
BD2B 3E03	MVI	A,3		BCA7 03	INX	B	
BD2D 32F3BA	STA	NCHR		BCA8 1D	DCR	E	; COUNT 4 CHARS
BD30 CDC6BB	CALL	COMS		BCA9 C29CBC	JNZ	-\$13	
BD33 CA65BB	JZ	ERRD		BCAC 3E2C	MVI	A,'0'-4	
BD36 3AFFBA	LDA	SPACE+7	; GET DESCRIPTOR	BCAE BA	CMP	D	
BD39 CD02BC	CALL	ENTR1	; PUT IN VARIABLE LIST	BCAF CAB7BC	JZ	+\$8	; AFTER NUMBER,
BD3C C3D5BD	JMP	COMNT	; SKIP REST OF LINE	BCB2 3E20	MVI	A,' '	; PUT IN 1 BL FOR EACH LEADING 0
BD3F 32F9BA	BD3F: STA	SPACE+1	; MARK PASS 2: XLT BEGINS	BCB4 02	STAX	B	
BD42 214039	LXI	H,'@9'	; SET UP BASIC VARS	BCB5 03	INX	B	
BD45 22F6BA	SHLD	VARNAM	; TO BEGIN WITH A0	BCB6 15	DCR	D	
BD48 2A0220	LHLD	BOFP	; START OF FILE	BCB7 C3A9BC	JMP	-\$14	
BD4B 5D	MOV	E,L	; START OF TEXT				
BD4C 54	MOV	D,H					

BDD0 F1	NOREM:	POP	P	; NOT REM SO PUT IN R & PROCEED	BD4D 7E	LINE:	MOV	A,M	; LENGTH BYTE
BDD1 E1		POP	H		BD4E FE01		CPI	1	; 1 => EOF
BDD2 C3A0BD		JMP	CHAR		BD50 CAA0BE		JZ	TERM	
BDD5 CDC3BC	COMNT:	CALL	SKIP	; SKIP TO END OF LINE	BD53 23		INX	H	
BDD8 C36ABE		JMP	EOL		BD54 EB		XCHG		
BDDB CDD3BC	QUOTE:	CALL	PUT	; PUT IN THE " OR CHAR	BD55 22F4BA		SHLD	CURR	; POINT TO LINE NO IN TEXT
BDDE 7E		MOV	A,M		BD58 EB		XCHG		
BDFF 23		INX	H		BD59 010430		LXI	B,3004H	
BDE0 FE0D		CPI	13	; EOL WITHOUT FINAL "	BD5C 7E		MOV	A,M	
BDE2 CA5BBB		JZ	ERRQ		BD5D 23		INX	H	
BDE5 FE22		CPI	" "		BD5E B8		CMP	B	
BDE7 CAA0BD		JZ	CHAR	; PUT IN FINAL QUOTE WHEN FOUND	BD5F CA63BD		JZ	\$+4	; SKIP LEADING ZEROES
BDEA C3DBBD		JMP	QUOTE	; ELSE ROUND AGAIN	BD62 05		DCR	B	
BDED CD4BBB	VAR:	CALL	ACHK	; VAR NAMES BEGIN WITH ALPHA	BD63 CDD3BC		CALL	PUT	
BDF0 DA6FBB		JC	ERRS		BD66 0D		DCR	C	
BDF3 CDABBB		CALL	ALPS	; GET NAME	BD67 C259BD		JNZ	\$-14	
BDF6 01E1B1		LXI	B,VARTBL		BD6A 3E20		MVI	A,' '	; PUT ONE BL AFTER LINE NO
BDF9 3E03		MVI	A,3		BD6C CDD3BC		CALL	PUT	
BDFB 32F3BA		STA	NCHR		BD6F AF		XRA	A	
BDFE CDC6BB		CALL	COMS	; IN TABLE ALREADY?	BD70 32F8BA		STA	SPACE	
BE01 C214BE		JNZ	\$+19		BD73 23		INX	H	
BE04 0A		LDAX	B	; IF SO, GET AND STORE BASIC NAME	BD74 7E		MOV	A,M	; GET FIRST CHAR
BE05 03		INX	B		BD75 FE40		CPI	'@'	; VAR NAME IN COL 1 => DECLARATION
BE06 CDD3BC		CALL	PUT		BD77 CAE8BC		JZ	DECLAR	
BE09 0A		LDAX	B		BD7A FE20		CPI	' '	
BE0A 03		INX	B		BD7C C4CBBC		CNZ	SKIPL	; SKIP LABEL IF NECESSARY
BE0B CDD3BC		CALL	PUT		BD7F CDDBBC	SCANL:	CALL	SBLK	
BE0E 0A		LDAX	B	; GET DESCRIPTOR	BD82 FE52		CPI	'R'	
BE0F FE20		CPI	' '		BD84 CAA6BD		JZ	REMCK	; R MAY BE START OF REM
BE11 CA7FBD		JZ	SCANL		BD87 FE27		CPI	' '''	; SINGLE QUOTE IS COMMENT INDICATOR
BE14 C3A0BD		JMP	CHAR	; STORE IF %, \$ OR #	BD89 CAD5BD		JZ	COMNT	
BE17 3E20		MVI	A,' '	; NOT IN LIST SO ADD IT	BD8C FE22		CPI	' '''	
BE19 CD02BC		CALL	ENTR1	; WITH BL AS DESCRIPTOR	BD8E CADBBB		JZ	QUOTE	; COPY ALL BETWEEN DOUBLE QUOTES
BE1C 79		MOV	A,C	; PUT IN NEW BASIC VARIABLE NAME	BD91 FE40		CPI	'@'	
BE1D CDD3BC		CALL	PUT		BD93 CAEDBD		JZ	VAR	; @ SIGNALS VAR NAME
BE20 78		MOV	A,B		BD96 FE5B		CPI	'['	
BE21 C3A0BD		JMP	CHAR		BD98 CA24BE		JZ	REF	; [] ENCLOSSES LABEL
BE24 CD4BBB	REF:	CALL	ACHK	; REFS BEGIN WITH ALPHA	BD9B FE0D		CPI	13	
BE27 D22EBE		JNC	\$+7		BD9D CA6ABE		JZ	EOL	
BE2A EB		XCHG			BDA0 CDD3BC	CHAR:	CALL	PUT	; ANYTHING ELSE PUT IN AS IS
BE2B 365B		MVI	M,'['	; COPY ANYTHING ELSE VERBATIM	BDA3 C37FBD		JMP	SCANL	
BE2D EB		XCHG			BDA6 E5	REMCK:	PUSH	H	;CHECK IF REM
BE2E C3A0BD		JMP	CHAR		BDA7 F5		PUSH	P	
BE31 CDABBB		CALL	ALPS	; GET REF	BDA8 7E		MOV	A,M	
BE34 FE0D		CPI	ODH	; EOL ILLEGAL	BDA9 23		INX	H	
BE36 CA6FBB		JZ	ERRS		BDA A FE45		CPI	'E'	
BE39 FE5D		CPI	' '	; => END OF REF	BDAC C2D0BD		JNZ	NOREM	
BE3B CA41BE		JZ	\$+6		BDAF 7E		MOV	A,M	
BE3E CDB5BB		CALL	ALPS+10		BDB0 23		INX	H	
BE41 C331BE		JMP	\$-16		BDB1 FE4D		CPI	'M'	
BE44 23		INX	H		BDB3 C2D0BD		JNZ	NOREM	
BE45 0130AD		LXI	B,SYMTBL	; CHECK IF IN TABLE	BDB6 7E		MOV	A,M	; REM SO CHECK IF REM*
BE48 3E04		MVI	A,4		BDB7 FE2A		CPI	'*'	
BE4A 32F3BA		STA	NCHR		BDB9 CABEBD		JZ	\$+5	
BE4D CDC6BB		CALL	COMS		BDBC F1		POP	P	
BE50 C260BB		JNZ	ERRM	; UNDEFINED LABEL IF NOT	BDBD E1		POP	H	
BE53 0A		LDAX	B	; GET CHAR FROM LINE NO	BDBE C3D5BD		JMP	COMNT	; IF REM TREAT AS COMMENT
BE54 FE20		CPI	' '	; DONE IF BL	BDC1 F1		POP	P	; IF REM* COPY WHOLE LINE AS IS
BE56 CA7FBD		JZ	SCANL		BDC2 E1		POP	H	
BE59 CDD3BC		CALL	PUT	; SAVE	BDC3 CDD3BC		CALL	PUT	
BE5C 03		INX	B		BDC6 7E		MOV	A,M	
BE5D 3AF3BA		LDA	NCHR		BDC7 23		INX	H	
BE60 3D		DCR	A	; MAX 4 CHARS	BDC8 FE0D		CPI	13	
BE61 CA7FBD		JZ	SCANL		BDCA C2C0BD		JNZ	\$-10	
BE64 32F3BA		STA	NCHR		BDCD C36ABE		JMP	EOL	
BE67 C350BE		JMP	\$-23	; ELSE ROUND AGAIN					


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BEE1 EB          XCHG
BEE2 CDF2BE     CALL OUT20 ; NOW SHOW FIELD
BEE5 3E04       MVI A,4
BEE7 CDEDBE     CALL ADR ; NOW NEXT NAME
BEEA C3C8BE     JMP SYMOUT ; ROUND AGAIN
BEED 85         ADR: ADD L
BEEE 6F         MOV L,A
BEEF D0         RNC
BEF0 24         INR H
BEF1 C9         RET
BEF2 0E14       OUT20: MVI C,20 ; SHOW 20 CHARS
BEF4 7E         MOV A,M
BEF5 23         INX H
BEF6 CD0AC0     CALL WH1
BEF9 0D         DCR C
BEFA C2F4BE     JNZ OUT20+2
BEFD 3A0E0C     LDA CURPOS ; GET POS OF ADDRESSABLE CURSOR
BF00 E63F       ANI 3FH
BF02 FE20       CPI 20H
BF04 DA31C0     JC TABBER ; TAB IF 1ST HALF OF SCREEN
BF07 C328C0     JMP CROUT ; ELSE CR
BF0A 21E1B1     VARST: LXI H,VARTBL ; LIST VARIABLES
BF0D 114039     LXI D,'@9'
BF10 CD28C0     CALL CROUT
BF13 CD28C0     CALL CROUT
BF16 7E         OUTVAR: MOV A,M
BF17 B7         ORA A ; Z => END OF TABLE
BF18 CA03C0     JZ WARMST
BF1B 7B         MOV A,E ; INCREMENT BASIC VAR NAME
BF1C 3C         INR A
BF1D 5F         MOV E,A
BF1E FE3A       CPI '9'+1
BF20 DA26BF     JC OUTDE
BF23 1E30       MVI E,'0'
BF25 14         INR D
BF26 7A         OUTDE: MOV A,D ; DISPLAY BASIC NAME
BF27 CD0AC0     CALL WH1
BF2A 7B         MOV A,E
BF2B CD0AC0     CALL WH1
BF2E E5         PUSH H
BF2F 3E16       MVI A,22 ; GET DESCRIPTOR
BF31 CDEDBE     CALL ADR
BF34 7E         MOV A,M
BF35 CD0AC0     CALL WH1 ; SHOW IT
BF38 E1         POP H
BF39 CD31C0     CALL TABBER
BF3C CDF2BE     CALL OUT20 ; DISPLAY SOURCE NAME
BF3F 23         INX H ; SKIP BASIC NAME
BF40 23         INX H
BF41 23         INX H
BF42 C316BF     JMP OUTVAR ; ROUND AGAIN
BF44 =         LB EQU $-1
                ENDS

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BE6A E5         EOL:  PUSH H ; CR FOUND
BE6B 7E         MOV A,M
BE6C FE01       CPI 1 ; EOF?
BE6E CA83BE     JZ EOL1
BE71 23         INX H ; ELSE CHECK FOR CONTINUATION LINE
BE72 23         INX H
BE73 23         INX H
BE74 23         INX H
BE75 23         INX H
BE76 23         INX H
BE77 7E         MOV A,M ; GET COL 1
BE78 FE7D       CPI ']' ; => CONTINUATION
BE7A C283BE     JNZ EOL1
BE7D 23         INX H
BE7E E3         XTHL
BE7F E1         POP H
BE80 C37FBD     JMP SCANL
BE83 E1         EOL1:  POP H
BE84 3AF8BA     LDA SPACE ; CHECK IF ANYTHING STORED
BE87 B7         ORA A
BE88 CA90BE     JZ $+8
BE8B 3E0D       MVI A,13 ; IF SO, PUT IN CR AND CONTINUE
BE8D CDD3BC     CALL PUT
BE90 C34DBD     JMP LINE
BE93 3E18       MVI A,18H ; ELSE CAN LINE NO ON SCREEN
BE95 CD0AC0     CALL WH1
BE98 EB         XCHG
BE99 2AF4BA     LHL D CURR ; GET BACK START-OF-LINE POS
BE9C EB         XCHG
BE9D C34DBD     JMP LINE ; AND ROUND AGAIN
BEA0 3EFF       TERM:  MVI A,OFFH ; EOF: MARK WITH OFFH
BEA2 12         STAX D
BEA3 D5         PUSH D
BEA4 2A0220     LHL D BOFF
BEA7 EB         XCHG
BEA8 2116BB     LXI H,ENDMS ; DISPLAY START-END ADDR
BEAB CD28C0     CALL CROUT
BEAE CD13C0     CALL OSEQ
BEB1 CD34C0     CALL DEOUT
BEB4 23         INX H
BEB5 CD13C0     CALL OSEQ
BEB8 D1         POP D
BEB9 CD34C0     CALL DEOUT
                ; SYMTBLS
BEEC CD28C0     CALL CROUT
BEEF CD28C0     CALL CROUT
BEC2 2130AD     LXI H,SYMTBL
BEC5 1144AD     LXI D,SYMTBL+20
BEC8 7E         SYMOUT: MOV A,M ; LIST SYMBOL TABLE
BEC9 B7         ORA A ; Z MARKS END
BECA CA0ABF     JZ VARST
BECD 0E04       MVI C,4
BECF 1A         LDAX D ; LINE NO FIRST
BED0 13         INX D
BED1 CD0AC0     CALL WH1
BED4 0D         DCR C
BED5 C2CCBE     JNZ $-9
BED8 CD31C0     CALL TABBER
BEDB EB         XCHG
BEDC 3E14       MVI A,20
BEDE CDEDBE     CALL ADR ; NEXT LINE NO

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Reading UCSD Pascal Disk Directories

by Jon Bondy

A utility program to list UCSD Pascal file names in alphabetical order. Further, it provides the volume name, block size, date file was set, the amount of disk space used and the amount still available.

Although I like the UCSD Filer utility program, it lists the file names on volume in the order in which they occur on the diskette, rather than in alphabetical order. After searching for one file amidst the others on a rather full diskette, I decided to try to read the disk directory myself, writing the directory list in my own way.

One of the nice things about UCSD Pascal is that they offered the source of the operating system and interpreter for the first few versions of the system free of charge. If you purchased versions 1.4 or 1.5, you probably have the Pascal code for the operating system, which gives you enough information to read the directory of a disk directly and process it. A partial listing of those portions of the operating system code which pertain to disk directories is given below. This code is copyright (C) 1979 by the Regents of the University of California, San Diego Campus, and is used with their permission.

```
CONST
  MAXDIR = 77;      (*MAX NUMBER OF ENTRIES IN A DIRECTORY*)
  MAXUNIT = 12;    (*MAX NUMBER OF UNITS *)
  VIDLENG = 7;     (*NUMBER OF CHARS IN A VOLUME ID**)
  TIDLENG = 15;    (*NUMBER OF CHARS IN TITLE ID**)
  FBLKSIZE = 512;  (*STANDARD DISK BLOCK LENGTH*)
  DIRBLK = 2;     (*DISK ADDR OF DIRECTORY*)

TYPE
  UNITNUM = 0..MAXUNIT;
  VID = STRING(VIDLENG); (* volume name (I.D.) *)
  DIRRANGE = 0..MAXDIR; (* number of entries (files) in a directory *)
  TID = STRING(TIDLENG); (* title (file name) I.D. *)
  FILEKIND = (UNTYPEFILE,XDSKFILE,CODEFILE,TEXTFILE,
              INFOFILE,DATAFILE,GRAFFILE,FOTOFIELD,SECUREDIRE);
  DATEREC = PACKED RECORD
    MONTH: 0..12;      (*0 IMPLIES DATE NOT MEANINGFUL*)
    DAY: 0..31;       (*DAY OF MONTH*)
    YEAR: 0..100;     (*100 IS TEMP DISK FLAG*)
  END (*DATEREC*);
  DIRENTRY = RECORD
    DFIRSTBLK: INTEGER; (*FIRST PHYSICAL DISK ADDR*)
    DLASTBLK: INTEGER; (*POINTS AT BLOCK FOLLOWING*)
    CASE DFKIND: FILEKIND OF
      SECUREDIRE,
      UNTYPEFILE: (*ONLY IN DIRECJ...VOLUME INFO*)
        (DVID: VID; (*NAME OF DISK VOLUME*)
         DEOVBLK: INTEGER; (*LASTBLK OF VOLUME*)
         DNUMFILES: DIRRANGE; (*NUM FILES IN DIR*)
         DLOADTIME: INTEGER; (*TIME OF LAST ACCESS*)
         DLASTBOOT: DATEREC); (*MOST RECENT DATE SETTING*)
      XDSKFILE,CODEFILE,TEXTFILE,INFOFILE,
      DATAFILE,GRAFFILE,FOTOFIELD:
        (DTID: TID; (*TITLE OF FILE*)
         DLASTBYTE: 1..FBLKSIZE; (*NUM BYTES IN LAST BLOCK*)
         DACCESS: DATEREC); (*LAST MODIFICATION DATE*)
    END (*DIRENTRY*);
var
  DIRECTORY: ARRAY [DIRRANGE] OF DIRENTRY;
```

The definitions add up to the following: there are a maximum of 77 entries in each disk directory (MAXDIR), and a maximum of 12 Units in the system (MAXUNIT), where a Unit is a disk drive, a printer, or another I/O device. The length of a Volume name is 7 characters (VIDLENG (stands for Volume ID LENGTH)); that of a file title (name) is 15 (TIDLENG). There are 512 bytes of data in each disk 'block' (actually four 128 byte CPM sectors), and the directory starts at logical block number two (FBLKSIZE and DIRBLK, respectively).

The UCSD Pascal system packs dates into a single 16-bit word as a four bit field (month), a five bit field (day of month), and a seven bit field (year in the century). This is shown in the definition of the DATEREC Type. The Types for a volume id (VID) and title id (TID) are defined as strings of characters of the appropriate lengths, and the number of directory entries is defined to be a range of integers (DIRRANGE). The various kinds of files are defined in a Pascal user defined Type FILEKIND. A CODEFILE is an object file (compiler output), a TEXTFILE is a file of characters (like this article, a DATAFILE is a non-text output file of a program, GRAFFILES and FOTOFIELDS are used in the UCSD graphics system, and a SECUREDIRE file is a directory entry which contains information about the volume (diskette) on which it is written (i.e., it really doesn't have any information about a file in it).

For those of you who have not seen a Pascal 'record' before, let me say a few words about them. Pascal has arrays, like other languages, and they consist of collections of data items of identical characteristics. For instance, a collection of integers could be an array (of integers!). If one wanted to collect an integer and a character together, however, an array would not be an appropriate way to collect them, since the first element of this hypothetical array would be completely different than the second. Pascal allows such collections to be defined, but they are defined as records, not arrays.

Since a record is a collection of dissimilar objects, it should not surprise you that one accesses different elements in the record in a different manner than one would access elements in an array. With an array, say 'A', if one said 'A [1] ' or 'A [2] ' or even 'A [i] ', they all would be

UCDS Disk Directories cont'd...

of identical Type, perhaps of Type integer. In order to distinguish the differences in records, Pascal requires that you state which element of a record you want to access explicitly. In the case of the DATEREC record, one would have to first declare a variable of Type DATEREC, then one could access the month stored in DATE by stating 'DATE.MONTH'. Similarly, the day of the month and year would be accessed by stating 'DATE.DAY' and 'DATE.YEAR' respectively.

The Type DIRENTRY defines the record which describes a file on the volume. It always has two fields, DFIRSTBLK and DLASTBLK, which are the (512 byte) block numbers of the first and last blocks in the file being described. Note that UCSD Pascal files must be contiguous on the disk (unlike CPM files) and so the first and last block numbers define the position of the data on disk uniquely. Notice also that DLASTBLK points to the first block AFTER the file, so that the difference between the two values is the number of blocks in the file.

A DIRENTRY entry contains other information, but that information depends on the kind of file which is being described. If the DFKIND is SECUREDIRENTRY or UNYPEDFILE, then it describes a volume, and contains the following data. It contains the volume id (DVID) as a string of 7 characters; the number of the last block on the volume (DEOVBLK), in order to allow varying sizes of diskettes (up to a maximum of 16 MBytes); the number of files which currently exist on the volume (DNUMFILES); the time of the last access (DLOADTIME), (only valid on systems which have a real-time clock); and the most recent (current) date, DLASTBOOT. NOTE: Although the directory structure allows up to 16 MB of data on each UCSD Pascal volume, the calculations in the Version 1.5 interpreter limit the actual number of bytes to about 848 KB due to 8-bit arithmetic when converting the 'blocks' into tracks.

If the DFKIND is any of the other kinds of files, the 'other' information consists of the name of the file (DTID), the number of bytes actually used in the last block of the file (DLASTBYTE), and the date which the file was written (DACCESS).

Finally, the VAR definition statement defines a directory to be an array of DIRENTRYs, so we wind up with an array of records as our directory structure. If we copy the above definitions into a program, we can read the UCSD Pascal directory off of disk and process it.

UCSD Pascal allows one to read an arbitrary block on a volume with the UNITREAD intrinsic. It accepts as parameters the unit number to be read, an array into which it will place the data read, the number of bytes to be read, and the number of the block to be read. Since the directory starts at block two (see DIRBLK above), we can read the directory into memory by simply stating:

```
UNITREAD(unit,directory,sizeof(directory),dirblk);
```

where the 'sizeof' intrinsic returns the number of bytes in the data structure which it is sent and the 'unit' is number of the unit to be read. Once the directory is in memory, we can print the volume name by printing 'DIRECTORY(0).DVID'.

If we wanted to print the date setting for the volume, we would have to convert the integer values in the DATEREC 'DIRECTORY(0).DLASTBOOT' into numbers and names of months. This is not really difficult to do if we

first define an array of character strings to contain the names of the months. The array definition would look like the following:

```
VAR
  monthname : array[1..12] of string[3];
```

The code to initialize the array would look like:

```
monthname[1] := 'Jan'; monthname[2] := 'Feb'; monthname[3] := 'Mar';
monthname[4] := 'Apr'; monthname[5] := 'May'; monthname[6] := 'Jun';
monthname[7] := 'Jul'; monthname[8] := 'Aug'; monthname[9] := 'Sep';
monthname[10] := 'Oct'; monthname[11] := 'Nov'; monthname[12] := 'Dec';
```

The code to print a date on the screen would look like this:

```
with directory[i] do
  write(daccess.day:2,'-',monthname[daccess.month],'-',daccess.year);
```

and would result in a date of the form '2-Feb-80'.

Now that we can see how some of the data in a directory entry could be printed, we can consider how to sort the directory entries. Although it would be possible to sort the entries themselves (by moving each DIRENTRY record around in the DIRECTORY array), we might want not to modify the ordering of the directory data itself, since the files are stored in the directory in the order in which they appear on the diskette. Instead, we might want to create a list of indices to the entries and sort these indices, allowing us to access the DIRECTORY in both its original order and the sorted order. This is a standard indirect sort, and in my program I used indirect Shell sort (named after Donald L Shell, who invented it in 1959). The sort used in my program is given below:

```
procedure sort;
  ( shell sort directory indirectly via 'index' array )
var
  jump, m, n, temp : dirrange;
  alldone : boolean;
begin
  ( set up index array for sort )
  for i := 1 to maxdir do index[i] := i;
  jump := directory[0].dnumfiles - 1;
  while (jump > 1) do begin
    jump := jump div 2;
    repeat
      alldone := true;
      for m := 1 to (directory[0].dnumfiles - jump) do begin
        n := m + jump; ( sort by file ID )
        if (directory[index[m]].dtid < directory[index[n]].dtid) then begin
          ( swap indices to file ID's to put them in order )
          temp := index[n];
          index[n] := index[m];
          index[m] := temp;
          alldone := false ( remember that a swap was done )
        end ( if )
      end ( for )
    until alldone
  end ( while )
end ( sort )
```

This sort is a modified bubble sort, where the distance between items which are compared ('jump') starts out fairly large and decreases throughout the sort. This allows items which start out far from their eventual position to move rapidly at first, decreasing sort time over a bubble sort.

Finally, I felt that unless I added some other features to the program, the user would probably have to use the normal filer directory listing commands, so I calculated the number of unused blocks on the volume, as well as the largest single unused area on the volume. I did this by realizing that if the first block of a file lies after the last block of the previous file in the directory, then some unused space lies between the two files. This allowed me to calculate the unused space, and from that the items described above. A sample output from the program is given below, and the program itself is given after that. □

—PROGRAM BEGINS NEXT PAGE—


```

Volume name is ART'S
1. CGS-808.D.TEXT      34 18-Feb-80
2. CGS-808.TEXT       30 18-Feb-80
3. CRT.TEXT           30 2-Dec-79
4. DRAFT.CODE         25 7-Jan-80
5. DRAFT.MISC.TEXT    4 6-Jan-80
6. MONART.D.TEXT      30 18-Feb-80
7. MONART.TEXT        24 18-Feb-80
8. MONITOR.CODE       5 27-Jan-80

```

```

Program dirlist;

```

```

( Program to read a UCSD directory and print the contents in
  order, sorted by file name. Written 1/8/80 by Jon Bondy. )

```

```

CONST

```

```

MAXDIR = 77;          (*MAX NUMBER OF ENTRIES IN A DIRECTORY*)
MAXUNIT = 12;        (*MAX NUMBER OF UNITS *)
VIDLENG = 7;         (*NUMBER OF CHARS IN A VOLUME ID*)
TIDLENG = 15;        (*NUMBER OF CHARS IN TITLE ID*)
FBLKSIZE = 512;      (*STANDARD DISK BLOCK LENGTH*)
DIRBLK = 2;          (*DISK ADDR OF DIRECTORY*)
screenlength = 23;  (* number of lines per screen, minus one )

```

```

TYPE

```

```

DATAREC = PACKED RECORD
  MONTH: 0..12;      (*0 IMPLIES DATE NOT MEANINGFUL*)
  DAY: 0..31;        (*DAY OF MONTH*)
  YEAR: 0..100;      (*100 IS TEMP DISK FLAG*)
END (*DATAREC*);
UNITNUM = 0..MAXUNIT;
VID = STRING(VIDLENG); (* volume name (I.D.) )
DIRRANGE = 0..MAXDIR; (* number of entries (files) in a directory )
TID = STRING(TIDLENG); (* title (file name) I.D. )
FILEKIND = (UNTYPEFILE,XDSKFILE,COFFILE,TEXTFILE,
  INFOFILE,DATAFILE,GRAFFILE,FOTOFIle,SECUREDIRE);
DIRENTRY = RECORD
  DFIRSTBLK: INTEGER; (*FIRST PHYSICAL DISK ADDR*)
  DLASTBLK: INTEGER;  (*POINTS AT BLOCK FOLLOWING*)
  CASE DFKIND: FILEKIND OF
    SECUREDIRE,
    UNTYPEFILE: (*ONLY IN DIRCOJ..VOLUME INFO*)
      (DVID: VID;      (*NAME OF DISK VOLUME*)
        DEOVBK: INTEGER; (*LASTBLK OF VOLUME*)
        DNUMFILES: DDIRRANGE; (*NUM FILES IN DIR*)
        DLOADTIME: INTEGER; (*TIME OF LAST ACCESS*)
        DLASTBOOT: DATAREC; (*MOST RECENT DATE SETTING*)
        XDSKFILE,COFFILE,TEXTFILE,INFOFILE,
        DATAFILE,GRAFFILE,FOTOFIle:
          (DTID: TID;   (*TITLE OF FILE*)
            DLASTBYTE: 1..FBLKSIZE; (*NUM BYTES IN LAST BLOCK*)
            DACCESS: DATAREC) (*LAST MODIFICATION DATE*)
      )
    )
  )
END (*DIRENTRY*);

```

```

var

```

```

DIRECTORY : ARRAY [DIRRANGE] OF DIRENTRY;
index : array[DIRRANGE] of DIRRANGE; (* index into directory for sort )
ch: char;
unum : integer; (* unit number of unit to have its directory listed )
fname : string; (* file name on which to write the directory list )
list : text; (* output file the directory list file itself )
i : integer;
monthname : array[1..12] of string[3];
totblks : integer; (* total blocks used on volume )
maxcontis : integer; (* largest contiguous series of blocks on volume )
numfiles : integer; (* number of valid files on volume )

```

```

Procedure sort;

```

```

( shell sort directory indirectly via 'index' array )

```

```

var

```

```

  JUMP, m, n, temp : DIRRANGE;
  alldone : boolean;
begin
  ( set up index array for sort )
  for i := 1 to MAXDIR do index[i] := i;
  JUMP := directory[0].dnumfiles - 1; (* initialize 'JUMP' )
  while (JUMP > 1) do begin
    JUMP := JUMP div 2;
    repeat
      alldone := true; (* assume it is in order already )
      for m := 1 to (directory[0].dnumfiles - JUMP) do begin
        n := m + JUMP; (* calculate which entries to compare )
        if (directory[index[n]].dtid < directory[index[m]].dtid) then begin
          ( entries out of order, so swap indices )
          temp := index[n];
          index[n] := index[m];
          index[m] := temp;
        end
      end
    until alldone;
  end
end

```


UCSD Disk Directories cont'd...

```

        alldone := false ( remember that a swap was made )
        end ( if )
    end ( for )
until alldone
end ( while )
end; ( sort )

Procedure init;
begin
    monthname[1] := 'Jan'; monthname[2] := 'Feb'; monthname[3] := 'Mar';
    monthname[4] := 'Apr'; monthname[5] := 'May'; monthname[6] := 'Jun';
    monthname[7] := 'Jul'; monthname[8] := 'Aug'; monthname[9] := 'Sep';
    monthname[10] := 'Oct'; monthname[11] := 'Nov'; monthname[12] := 'Dec';
end; ( init )

Procedure Printentries;
begin
    for i := 1 to numfiles do ( Print all entries in the directory )
        with directory[index[i]] do begin
            writeln(list,i:2,'. ',dtid,' ':(17-length(dtid)),
                (dlastblk-dfirstblk):4,' ',daccess.day:2,'-',
                monthname[daccess.month],'-',daccess.year);
            ( Process special case for screen )
            if ((i mod screenlength) = (screenlength-1)) and
                (length(fname) = 0) then begin
                write('Enter <space> to continue');
                read(keyboard,ch); ch := '1';
                gotoxy(0,screenlength);
            end; ( if )
        end; ( for/with )
    if (length(fname) <> 0) then writeln(list);
    writeln(list,totblks, ' blocks used (',(directory[0].deovblk-totblks),
        ' free) out of ', directory[0].deovblk);
    writeln(list,'Largest contiguous space is ',maxcontis);
end; ( Printentries )

Procedure calc;
var
    temp : integer;
begin
    ( calculate total blocks used and largest contiguous set of blocks )
    ( start max contiguous with the block from last file to end of volume )
    maxcontis := directory[0].deovblk - directory[numfiles].dlastblk;
    ( start total blocks with blocks used for first file )
    totblks := directory[1].dlastblk - directory[1].dfirstblk;
    for i := 2 to numfiles do begin
        totblks := totblks + directory[i].dlastblk - directory[i].dfirstblk;
        temp := directory[i].dfirstblk - directory[i-1].dlastblk;
        if (temp > maxcontis) then maxcontis := temp;
    end; ( for )
end; ( calc )

begin ( dirlist )
init;
repeat
    gotoxy(0,0);
    Write('SRD: enter volume number of disk (<CR> to end) > ');
    repeat
        read(ch)
        until (ch in ['4','5',' ']);
    if (ch <> ' ') then begin
        writeln;
        unum := ord(ch) - ord('0');
        unitread(unum,directory,sizeof(directory),dirblk,0);
        repeat ( do this until a valid file name is given )
            write('Enter output file (<CR> for console) : ');
            readln(fname);
            ($I-)
            if (length(fname) = 0) then rewrite(list,'console:');
            else rewrite(list,fname);
            ($I+)
            until (ioresult = 0);
        writeln(list,'Volume name is ', directory[0].dvid);
        numfiles := directory[0].dnumfiles;
        calc; ( calculate free space, largest contiguous space )
        sort; ( sort file names indirectly )
        printentries; ( print all information )
        close(list,lock);
    end; ( if )
until (ch = ' ');
end.

```


Tarbell Disk Controller Mods

by George Holz

More improvements for the Tarbell single density Disk Controller.

The following are some modifications I have made to improve the performance of a system which uses a Z80 CPU with Tarbell Disk Controller.

First of all, as owners of Z80 systems who are using early versions of the Tarbell single density disk controllers (MD 1011A) are painfully aware, the Tarbell Controller will not boot from the on-board ROM in virtually all Z80-based systems. Tarbell's suggestions to cope with this problem are either to add another ROM (on another

board) or make modifications to the controller card which involves cutting several tracks, adding many jumpers and adding another IC.

I have studied the situation and have come up with a simple solution that involves less work. The RAM board for page zero must have a Phantom circuit, which disables the RAM during the boot process. The changes to the controller board are shown in Figure 1. In addition, be sure to remove IC's U18, U19 and resistors R29 (2.2Kohms).

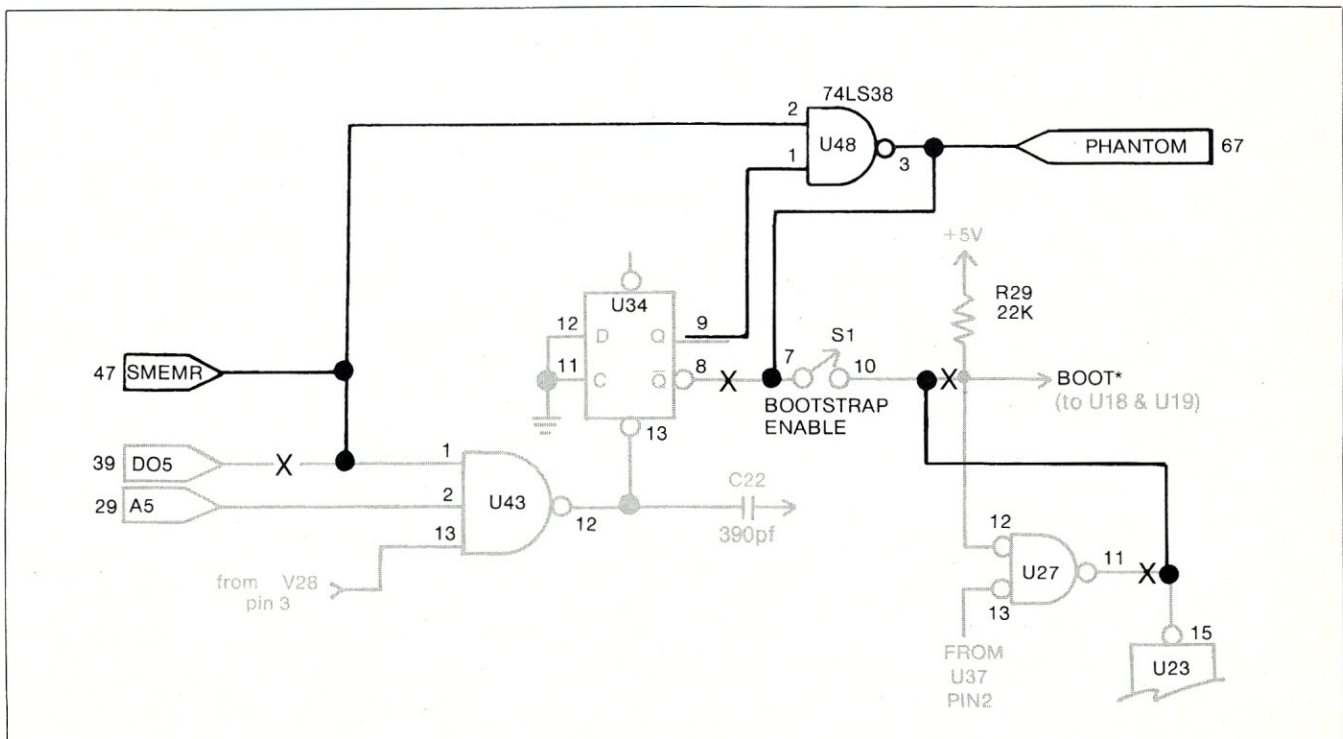


Figure 1

Disk Controller Mods cont'd...

Secondly, I have also made some other changes which you may find worthwhile. I added a circuit which causes the head load delay to be activated when switching between drives A and B. The 1771 controller chip does not recognize the drive change as requiring time to load the head. This results in infrequent but annoying errors when the switching occurs, just prior to a disk write operation. This delay may also be added in the driver software, as was done in Marty Nichols' Tarbell CP/M* BIOS, which appeared in Volume 1, No. 2 of MICROSYSTEMS. If the hardware patch is used, the software delay may be removed,

saving a small amount of valuable BIOS space. The hardware patch is shown in Figure 2.

I also added a power-on boot circuit so that CP/M automatically boots up when power is applied to the system with a CP/M disk mounted in drive A. The circuit for this is shown in Figure 4. The delay is to allow the disk to come up to speed before booting. The front panel may also require modification to insure that the system turns on in the run mode and starts when Reset is released.

Lastly, I added the circuit shown in Figure 3 to disable the disk boot when I am using the top half of memory. This is where my ROM monitor and I/O driver software is located. □

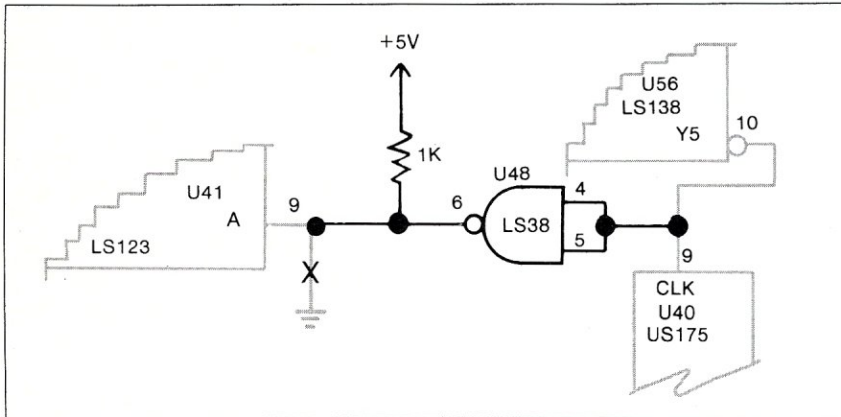


Figure 2

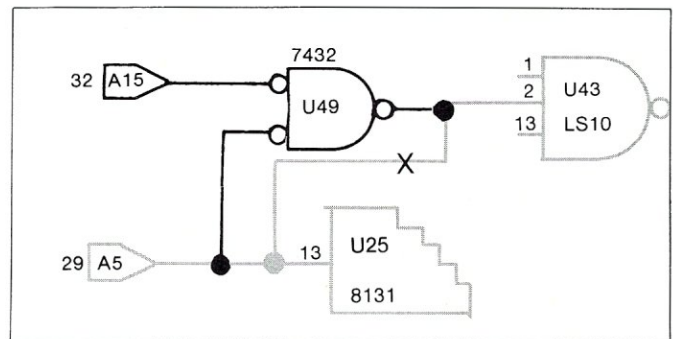


Figure 3

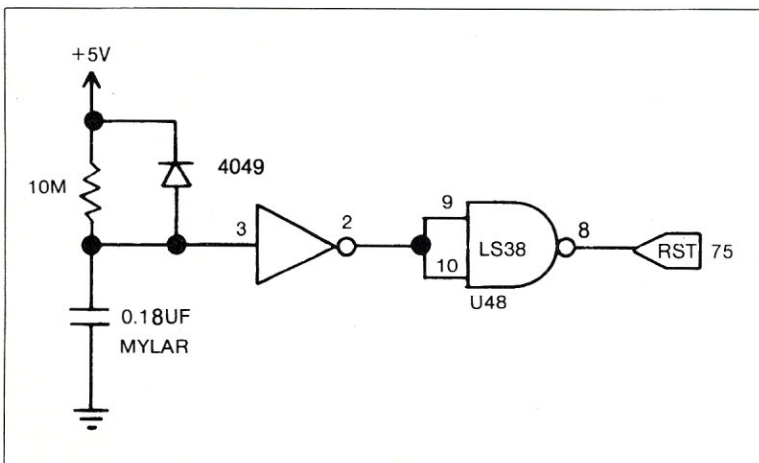
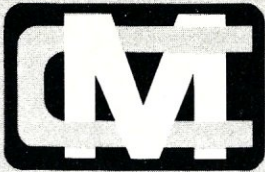


Figure 4



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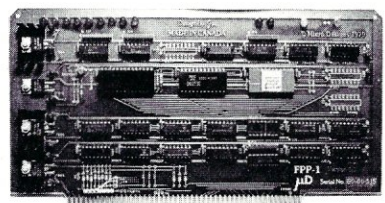
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SOFTWARE DIRECTORY

Program Name: SORT 2.0
Hardware System: CP/M
Minimum Memory Size: 48K bytes
Language: Microsoft Basic
Description: General purpose disk sort/merge system for sequential files. User defined SORT task can sort on any number of fields, located anywhere on the record, on ascending or descending sequence.
Release: Currently available
Price: \$295; License Agreement Required
Included with price: Diskette, manual, examples support
Author: The Software Store
Where to purchase it:
The Software Store
706 Chippewa Square
Marquette, MI 49855

Program Name: BEEFUP
Hardware System: Dual Drive CP/M with 132 Col. Printer
Minimum Memory Size: 48K
Language: CBasic2
Description: A cow/calf herd-management performance data system, providing two constantly updated reports. Cowprint shows each significant item of data on every calf of every cow currently in the herd (999 max), with calf ratings. Lifetime cow data is at your fingertips, at the office or in the field, in seconds! Cafprint shows cumulative calf data (1000 males, 1000 females per disk) with ratios by sex and year, plus herd sire summaries and ratings.
Release: October 1980
Price: \$350; Manual only \$20
Included with price: Disk and manual
Where to purchase it:
St. Benedict's Farm
Box 366,
Waelder TX 78959

Program Name: MENU
Hardware System: CP/M
Minimum Memory Size: 48K bytes
Language: Microsoft Basic
Description: MENU Job Stream Control links programs together to form a continuous processing sequence. Displays user defined job stream descriptions and help screens. User programs can be incorporated onto a job stream along with Application Utilities to form complete 'turnkey' systems.
Release: Available now.
Price: \$95; License Agreement Required
Included with price: Diskette, manual, examples, support
Where to purchase it:
The Software Store
706 Chippewa Square
Marquette, MI 49855

Program Name: DisAsmb
Hardware System: PolyMorphic Systems 8813 single density
Minimum Memory Size: 32K (40 recommended)
Language: PolyMorphic Basic Versions B08C thru C011
Description: This program is an 8080A Disassembler which disassembles machine language programs back to assembly language. It reads the system library file for system labels and creates other labels as needed. It outputs to a file and produces re-assemblable formatted output with SYSTEM labels.
Release: Available now
Price: \$35
Included with price: Support programs and data files. Also includes a Hexadecimal dumper and some reference files.
Where to purchase it:
Ralph E. Kenyon Jr.
145-103 S Budding Ave
Virginia Beach, VA 23452

Program Name: BILLING
Hardware System: CP/M
Minimum Memory Size: 52K bytes
Language: Microsoft Basic
Description: BILLING is an integrated accounts receivable system capable of managing a large volume of accounts. The balance forward method of posting is used and supports four aging periods. It supports multiple billing cycles, optional interest charges, audit reports, batch transaction proof listings with checksums, totals by transaction code and many other features. BILLING requires the ENTRY, EDIT, UDE-SEL, UDE-PRT, MENUU and SORT application utilities.
Release: Available now.
Price: \$195; License Agreement Required
Author: The Software Store
Where to purchase it:
The Software Store
706 Chippewa Square
Marquette, MI 49855

Program Name: SPDES
Hardware System: North Star
Minimum Memory Size: 16K
Language: Basic
Description: The design of a small signal RF amplifier using S-parameters. Calculation of load and source reflection coefficients; gain and stability circle calculations and analysis; single frequency matching network design.
Release: 1979
Price: \$50
Included with price: User notes and disk.
Author: Fred O. Kask
Where to purchase it:
Kask Labs
1207 E. Secretariat Drive
Tempe, AZ 85284

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Small Computer Systems Handbook

Sol Libes. The emphasis throughout this primer is on the important practical knowledge that the home computer user should have to be able to intelligently purchase, assemble, and interconnect components, and to program the microcomputer. Only a minimal knowledge of electronics is required to use this book. 196 pp. \$8.45 [11D].

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Poole & Borchers. Includes program listings with remarks, descriptions, discussion of the principles behind each program, file layouts, and complete step-by-step instructions. Covers accounts payable and receivable in regard to invoice aging, general ledger, progress billing, partial invoice payments, and more. 375 pp. \$20.00 [10V].

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Rodnay Zaks. A complete and detailed introduction to microprocessors and microcomputer systems. Some of the topics presented are: a comparative evaluation of all major microprocessors, a journey inside a microprocessor chip, how to assemble a system, applications, interfacing (including the S-100 bus) and programming and system development. 416 pp. \$9.95 [10S].

Programming in PASCAL

Peter Grogono. This book is an excellent introduction to one of the fastest growing programming languages today. The text is arranged as a tutorial containing both examples and exercises to increase reader proficiency in PASCAL. Contains sections on procedures, files, and dynamic data structures such as trees and linked lists. 359 pp. \$11.50 [10A].

The CP/M* Handbook

Rodney Zaks. A step by step guide to CP/M and MP/M. Covers the operation of CP/M, the editor and assembler. Covers all versions of CP/M including CDOS. Numerous examples, operating hints, a handy reference with tables. 250pp. \$13.95.

Some Common BASIC Programs

Poole & Borchers. This book combines a diversity of practical algorithms in one book: matrix multiplication, regression analysis, principal on a loan, integration by Simpson's rule roots of equations, chi-square test, and many more. All the programs are written in a restricted BASIC suitable for most microcomputer BASIC packages and have been tested and debugged by the authors. \$12.50 [7M].

CP/M* Summary Guide

Rainbow Associates. A 60 page booklet covering the features of CP/M (Ver.1.4&2.X) and 2 totally alphabetical listings of the commands, functions and error codes of MICROSOFT BASIC-80 Ver. 5.0 and CBASIC -2. Areas summarized are: DIR, ERA, REN, SAVE, TYPE, USER, ASM, DDT, DUMP, ED, LOAD, MOVCPM, PIP, STAT, SUBMIT, SYSGEN and XSUB. Other utilities included are DESPOOL, MAC, and TEX. About the size of a paperback book, the guide is handy to hold. Our convenient guide is a proven necessity to the CP/M user. 60 pp. \$4.95

The Art of Computer Programming

Donald Knuth. The purpose of this series is to provide a unified, readable, and theoretically sound summary of the present knowledge concerning computer programming techniques, along with their historical development. For the sake of clarity, many carefully checked computer procedures are expressed both in formal and informal language. A classic series. Vol. 1: Fundamental Algorithms, 634 pp. \$23.50 [7R]. Vol. 2: Seminumerical Algorithms, 624 pp. \$23.50 [7S]. Vol 3: Sorting and Searching. 722 pp. \$23.50 [7T].

BASIC With Business Applications

Richard W. Lott. This book focuses on the BASIC language and its application to specific business problems. Part One introduces the BASIC language and the concept of logical flowcharting. Part Two presents problems and possible solutions. Topics include: interest rate calculations, break-even analysis, loan rates, and depreciation. This book is a great aid to the beginner wanting to learn BASIC without having a technical or scientific background. 284 pp. \$11.95 [10Z].

To order: send check or credit card number and expiration date (Visa, Master Card or American Express) plus \$2.00 per order for shipping and handling to: MICROSYSTEMS, P.O. Box 789-M, Morristown, NJ 07960.

Program Name: CBS Version 1.1
Hardware System: CP/M system with 200K bytes of mass storage
Minimum Memory Size: 48K
Language: Assembler
Description: Customized accounting systems, including payables, receivables, inventory control and order entry, are provided through the new Configurable Business System, (CBS Version 1.1) set up without using any programming language. CBS can be used to define an application such as an inventory control system by specifying master files to describe the inventory, customer and vendor files. Transaction files are used to describe specific activities, ie., purchases, sales, etc.

A simple procedure provided by the entry program is used to enter customer, vendor, inventory sales and purchasing information. After data entry is completed, an update program processes the transactions against the master files, updating account balances and inventory data. CBS features a comprehensive report generator for producing invoices purchase orders, re-order reports, special reports, and mailing labels.

The new enhanced CBS Version 1.1 improvements include the capability to produce and read ASCII data files, thus permitting external programs access to file data for specialized processing and/or preparing input data for updating CBS files. Other new features include: Menu Chaining to enable the user to create a "menu of menus", that permits one main entry point to be used for access to all application routines; batched updating enables the user to update a master data base and create new records in master files—including updating of external data files.

Release: September 1980
Price: \$395 with \$25 for updates; \$40 for documentation
Included with price: Disk with documentation
Where to purchase it:
 Lifeboat Associates
 1651 Third Avenue
 New York, NY 10028

Program Name: TAPEDISK, DISKTAPE, MFDT
Hardware System: CP/M and Processor Technology SOL or CUTS cassette I/O and SOLOS or CUTER monitor program.
Minimum Memory Size: 16K CP/M (about 30K for MFDT)
Language: 8080 assembly except MFDT is compiled from C.
Description: CP/M file distribution via cassette tapes. Transfer and sizes and types of CP/M files to and from CUTS format cassette tapes. Allows trading between systems with different disk types and provides archival storage.
 DISKTAPE writes one file to tape.
 TAPEDISK reads entire tape to disk.
 MFDT is optional but allows unattended writing of tapes from a list of ambiguous file names with spooling of console input and output to/from disk.
Release: Already in the field.
Price: \$10 (\$20 with MFDT).


Included with price: COM, DOC and source files on CUTS cassette with paper instructions to make tape load itself. Or send Micropolis Mod II diskette.
Where to purchase:
 Richard Greenlaw
 251 Colony Ct.
 Gahanna, Ohio 43230

Program Name: VSelect
Hardware System: PolyMorphic Systems 8813 single density
Minimum Memory Size: 8K
Language: 8080A Machine Language
Description: This program selects data file records. It is a general file utility program which searches an input data file of fixed length records for a specified character string. This program is an en-

hanced version of select which allows variable length fields within each data record. Use it to pick out all names beginning with a given letter, or to pick out everyone in a data list with a particular code. The output is versatile; a copy of the data record containing the match, or just its position in the file. You also have the choice of output to the screen, the printer or to create an output data file containing the output. The output files are compatible with Basic. Limited to 9999 records.
Release: September 1980
Price: \$85
Included with price: Disk
Where to purchase it:
 Ralph E. Kenyon Jr.
 145-103 S. Budding Ave
 Virginia Beach, VA 23452

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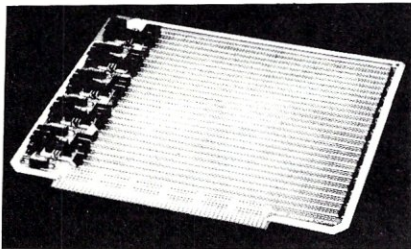
NEW PRODUCTS

S-100 Wire-Wrap Prototype Board

Inner Access Corp. has introduced a 9" deep prototype wire-wrap board which accommodates wire-wrap sockets on .3" or .6" centers. The board has the following features:

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- Silk screened letters indicate rows (A-M) and columns (0-8).

The price is \$98 each or 3 for \$270 (FOB Belmont, CA). Write or call: Inner Access Corporation, P.O. Box 888, Belmont, CA 94002, (415) 591 8295.



2650 S-100 CPU Board

The "Target" CPU card is an S-100 board using the Signetics 2650 microprocessor. It has an RS-232C serial port, an emulator port and a console port. Included are cables to interface to a terminal and another CPU. The company also offers a console unit with monitor firmware, cassette I/O, printer port, PROM programmer, debug hardware, 500 bytes of RAM and cassette with software.

Video Specialities, Box 136, Solana Beach, CA 92075, (714) 481-0073.

SSM Introduces Z-80 EPROM Monitor

SSM Microcomputer Products is introducing a Z-80 monitor in one single voltage 2716 EPROM. Supporting SSM's CB2 Z-80 Microcomputer Board, the new EPROM monitor allows operators to display, substitute or fill memory; perform hexadecimal arithmetic; establish two program breakpoints; set and examine registers; assign I/O devices; input and output from or to an I/O port; and offers other capabilities permitting board level programming. The built-in scanning allows the monitor to review the memory capacity and set its stack. An I/O vector jump table is included.

Price is \$89.00; SSM Microcomputer Products, 2190 Paragon Drive, San Jose, CA 95131, (408) 946-7400.

Lifeboat Associates Named Distributor of T/Maker Software

A powerful new software system that facilitates analysis and presentation of complex tabular and numerical data and text material is now available from Lifeboat Associates under a new distribution agreement with its developer, Peter Roizen.

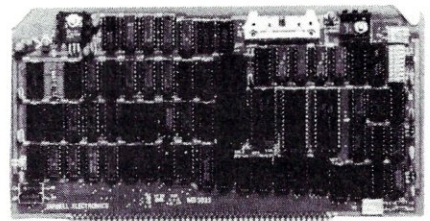
The unique new tool for a CP/M systems—called T/Maker—goes "a step beyond the similar and widely-hailed Visical application program in offering text processing capability as well as numerical computational functions for rows and columns of tabular data", says Lifeboat president Tony Gold.

T/Maker applies analysis and reporting functions to a variety of tasks, including financial statements, balance sheets, statistical tables, growth and projections, profitability reports, revenues and expenditures, portfolio analysis, price lists, rate structures, inventory valuation.

T/Maker with documentation and a quick-reference card is \$275. Documentation alone is \$25. For information contact: Lifeboat Associates, 1651 Third Avenue, New York, NY 10028. Phone: (212) 860-0300, Telex 220501.

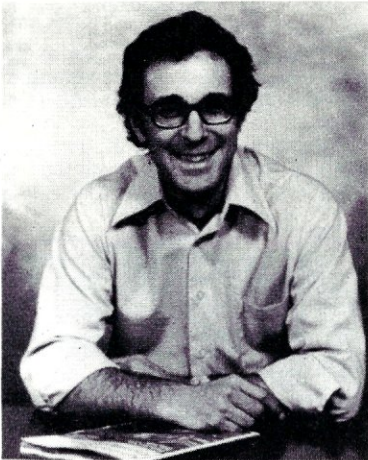
New Tarbell Memory Management CPU Board for S-100

Memory-management hardware that allows dynamic mapping of logical to 1 Megabyte of physical memory in 4K blocks—this is the outstanding feature of a new CPU board for the S-100 bus developed by Tarbell Electronics. A fast on-board memory of 16 bytes holds a table. The 4-bit address of this memory comes from the upper four address lines of the Z-80. Four of the eight output lines go to the A12 and A15 bus address lines. The other four go to the A16 to A19 extended address lines of the IEEE standard S-100 bus. If no memory management is desired, a jumper block may be inserted in place of each of the two memory IC's. The on-board table memory may be loaded by the programmer or system software with I/O commands.



The Tarbell Z-80 S-100 CPU board is especially designed to make it easier to implement multi-user operating systems, such as MP/M from Digital Research. It can run at 2 or 4MHz, jumper selectable. It has two RS-232 Serial Ports, with full handshaking capability. There is a crystal-controlled programmable timer (8253), which can be used for time-of-day clock and for time-slicing multi-tasking operations. Programmable priority masked vectored interrupt hardware is another useful feature. The Tarbell CPU board is priced at \$450.

For further information contact Don Tarbell at: Tarbell Electronics, 950 Dovlen Place, Suite B, Carson, CA 90746. Or call (213) 538-4251.



David Ahl, Founder and
Publisher of *Creative Computing*

Creative Computing

"The beat covered by *Creative Computing* is one of the most important, explosive and fast-changing." — Alvin Toffler

You might think the term "creative computing" is a contradiction. How can something as precise and logical as electronic computing possibly be creative? We think it can be. Consider the way computers are being used to create special effects in movies—image generation, coloring and computer-driven cameras and props. Or an electronic "sketchpad" for your home computer that adds animation, coloring and shading at your direction. How about a computer simulation of an invasion of killer bees with you trying to find a way of keeping them under control?

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Computers are not creative per se. But the way in which they are used can be highly creative and imaginative. Five years ago when *Creative Computing* magazine first billed itself as "The number 1 magazine of computer applications and software," we had no idea how far that idea would take us. Today, these applications are becoming so broad, so all-encompassing that the computer field will soon include virtually everything!

In light of this generality, we take "application" to mean whatever can be done with computers, *ought* to be done with computers or *might* be done with computers. That is the meat of *Creative Computing*.

Alvin Toffler, author of *Future Shock* and *The Third Wave* says, "I read *Creative Computing* not only for information about how to make the most of my own equipment but to keep an eye on how the whole field is emerging.

Creative Computing, the company as well as the magazine, is uniquely light-hearted but also seriously interested in all aspects of computing. Ours is the magazine of software, graphics, games and simulations for beginners and relaxing professionals. We try to present the new and important ideas of the field in a way that a 14-year old or a Cobol programmer can under-

stand them. Things like text editing, social simulations, control of household devices, animation and graphics, and communications networks.

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As the premier magazine for beginners, it is our solemn responsibility to make what we publish comprehensible to the newcomer. That does not mean easy; our readers like to be challenged. It means providing the reader who has no preparation with every possible means to seize the subject matter and make it his own.

However, we don't want the experts in our audience to be bored. So we try to publish articles of interest to beginners and experts at the same time. Ideally, we would like every piece to have instructional or informative content—and some depth—even when communicated humorously or playfully. Thus, our favorite kind of piece is accessible to the beginner, theoretically non-trivial, interesting on more than one level, and perhaps even humorous.

David Gerrold of *Star Trek* fame says, "*Creative Computing* with its unpretentious, down-to-earth lucidity encourages the computer user to have fun. *Creative Computing* makes it possible for me to learn basic programming skills and use the computer better than any other source.

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At *Creative Computing* we obtain new computer systems, peripherals, and software as soon as they are announced. We put them through their paces in our Software Development Center and also in the environment for which they are intended—home, business, laboratory, or school.

Our evaluations are unbiased and accurate. We compared word processing printers and found two losers among highly promoted makes. Conversely, we found one computer had far more than its advertised capability. Of 16 educational packages,

only seven offered solid learning value.

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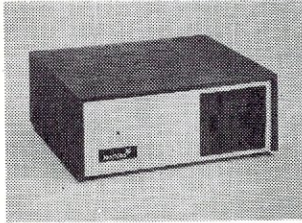
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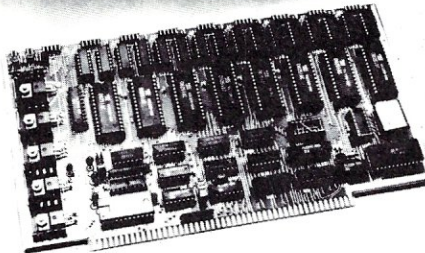
New Products cont'd...

Konan Introduces New 8 Port Serial I/O Boards

Konan Corporation has announced the introduction of two new asynchronous serial I/O boards for the multiport and networking systems.

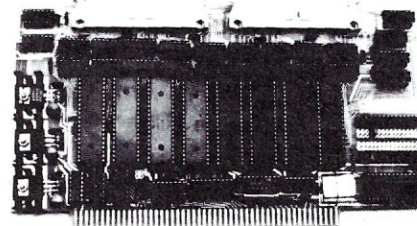
Its new 8 and 16 port boards, dubbed OCTOBOARD™ and OMNIPOINT™, connects line printers modems, CRT's and all types of RS232 or current loop terminals to S-100 Bus based microcomputers and can also be used to interconnect computers with computers in networking systems.

OCTOPOINT™ has 7 lines plus ground per port versus 2 lines plus ground per port for many typical models. This enables OCTOPOINT™ to be used for modem control.



OCTOPOINT™ has a real time clock with selectable rates at 12 1/2, 25, 50, and 100 milliseconds. It also has support for vectored interrupts for 8080 and Z-80 mode 2. Vectored interrupt lines can be read through the onboard 8 bit general purpose input port—a very useful feature in determining what any specific port is doing when in the polled mode. OCTOPOINT™ has 12 individually selectable baud rates from 110 to 19.2 kilobaud, as well as individually selectable interrupt priorities. The interrupts can be used by external boards via vectored interrupt lines on the S-100 Bus.

Konan's OMNIPOINT™, a 16 port asynchronous serial I/O board features 16 selectable baud rates from 75 to 19.2 kilobaud; 16 asynchronous channels with full handshake; a 4 character buffer on each channel, including the receive register; all operations except the interrupt enabled with push-on jumpers.



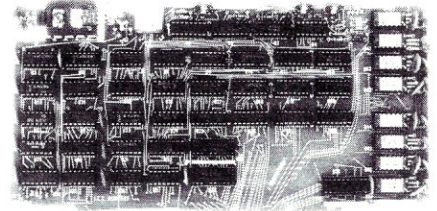
Konan's boards meet all IEEE S-100 Bus specifications, are fully tested and burned in for 24 hours, and carries Konan's one year conditional factory warranty. OCTOPOINT™ is \$595 and OMNIPOINT™ is \$800 O.E.M, quantity two.

Attractive quantity discounts available. Cables sold separately. Konan Corporation, 1448 N. 27th Avenue, Phoenix, Arizona, 800-528-4563.

High Density Color Graphics From J.E.S.

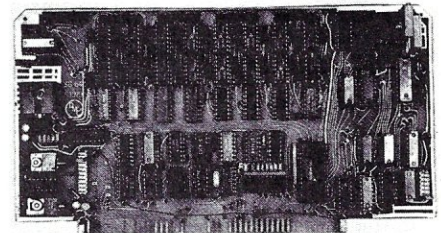
J.E.S. Graphics has introduced an S-100 color graphics board called Compuprism that is capable of 144 X 192 H dot resolution with 16 colors. Each byte controls 2 dots; sequential bytes control sequential dots. Each dot is independently controllable. Can also be used as a 16K RAM.

Price: \$50 (bare board), \$240 (kit) or \$280 (A&T). J.E.S. Graphics, Box 2752, Tulsa, OK 74101. Phone: (918) 894-3510.



64 DACs on S-100 Card

The SB-64 from Digital Multi-Media Control provides 64 channel digital-to-analog converters accomplished by multiplexing a single 8-bit DAC. It has the following features: 0.4% accuracy from 0V to 10.625V and each output can drive a 1Kohm load. Meets IEEE proposed specifications. The price is \$514 assembled; manual is \$5. Available from: Digital Multi-Media Control, 2338 Patterson #12, Eugene, OR 97405.



Switchable Isolator

Electronic Specialists announces the Model ISO-6 as the newest addition to their popular Isolator filter line. It features input Spike/Surge Suppression together with three individually switched and filtered sockets.

Total Isolator Load capability is 1875 watts MAX, with each switched, filtered socket capable of handling a 1 KW Load. Each switch has an associated pilot light.

Model ISO-6 Switchable Isolator is \$128.95 from Electronic Specialists, Inc., 171 S. Main Street, Natick, Mass. 01760. Phone: (617) 655-1532.



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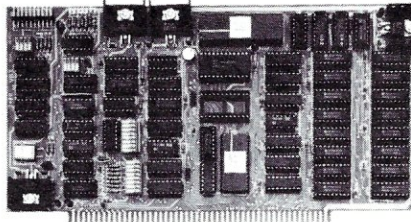
Provar Inc.: Specialists in multi-user and networking systems. Currently marketing an MP/M utility package. Experienced in Assembler, Pascal, and Basic. We also design and build process control systems. Contact Mark Winkler, 6217 Kennedy Ave., Hammond, Ind. 46323; (219) 844-0370.

New Products cont'd...

SSM Introduces 80 Character Video Board

SSM Microcomputer Products has introduced the new VB3 Video Board.

The new board may be programmed for up to forty-eight 80 character lines featuring upper and lower case letters with true descenders. The VB3 features a second RAM which contains "attribute" bytes which allow any character to appear as a standard alphanumeric upper/lower case font or user-programmed font, in low intensity, reverse video as well as added print functions such as underscore, strike-through, thin line or dot graphics. While the VB3 is memory-mapped, its banked switching occupies memory only when activated. The board generates both U.S. and European TV rates and includes a keyboard input.



Software for the VB3 Video Board includes a CP/M compatible driver routine and a powerful terminal simulator routine. Software controlled options include software controlled timing, top and bottom margins and horizontal position, inverted video, (2X4) graphic character, one-level of gray, blinking character, underline, blank-out character and cursor. From SSM Microcomputer Products, 2190 Paragon Drive, San Jose, CA 95131, (408) 946-7400.

S-100 Front Panel Cards

These pair of cards are a DMA front panel card system for any S-100 Bus computer. The package contains two cards. One card is the bus interface card that sits in the bus, the other is the switch/display card that may be mounted most anywhere in or near to the computer under test. The two cards are connected together by ribbon cables.

The interface card contains all the bus buffers, LED drivers, an up/down counter for the address bus and circuitry for an I/O port at the fixed address OFF Hex. Note that separate switches are used for the address and data bus inputs and separate LEDs are used for the displays.

The cards may be used in two modes of operation. In the panel mode, the contents of I/O ports and memory locations can be examined and/or changed. The panel indicators monitor the address and control bus's and the data display/switches become an I/O port at address location OFF Hex. A single step switch is available to single step the 8080 through programs, monitoring the address, control and data bus for each cycle of the instruction being carried out. Note the DMA feature may not work with dynamic memory cards.

Prices: Bare boards and documentation \$80, kit \$325, assembled and tested \$399. Interface card only can be obtained at \$45 BB&Doc, \$245 kit and \$299 assembled and tested. For information contact: Snow Micro Systems, Inc., P.O. Box 1704, Silver Spring, MD 20902.

Single Board S-100 Computer

Transam Components Ltd, London, England, has introduced a single board computer system with five S-100 card slots. The main board includes a 4 MHz Z80 CPU, 8K ROM (2K monitor, 2K Editor and 8K Basic in ROM available as options), 64 X 16 Video circuit (128 characters and 32 graphics characters, video or UHF video interface, tape I/O, RS-232 I/O, 8-bit parallel I/O, 8K RAM. It is available in a basic kit or as an assembled and tested unit in an enclosure with two mini-disk drives, keyboard and power supply. The basic kit is £195 (£ 230 with video components). For information: Transam Components Ltd., 12 Chapel Street, London, England NW1 5DH; tel: 01-402-81377.

Integrated S-100 Microcomputer

Microprogramming, Inc. has introduced the MARK-100 Computer. In an enclosure it includes a Shugart S-100 mainframe with two dual density 8" disk drives. The unit employs a Z80, 4MHz. CPU, 48K static RAM (expandable to 56K), two RS-232 ports and a busy channel, and CP/M 2.0 operating system. All hardware is IEEE compatible. The retail price is \$5995 and dealer and OEM discounts are available.

Available options include: 16 bit reconfigurable memory, 28 megabyte hard disk, multiuser network and several different languages. For more information: Microprogramming, Inc., 1351 Larc Industrial Blvd., Burnsville, MN 55337, tel: (612) 894-3510.

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— D. Scott Secor, General Manager

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"MDS-100" Marksman disk system, DAT-100 controller, cabling, etc. **40 Mb system \$5599.00** **20 Mb system \$4999.00**

"KNX-500" Western Dynex 10 Mb cartridge disk drive (5 fixed - 5 removable), KNX-500 controller, cabling, etc. **\$5650.00**

"Enhancer" 9-track tape system with CDC 2400' tape unit, BIT-100 controller, cabling, etc. (800/1600 bpi) **\$6999.00**

"SMC-100" CDC cartridge disk drive system (16 Mb removable), SMC-100 controller, cabling, etc. (the ultimate answer to your storage problems) **96 Mb system \$11250.00** **32 Mb system \$7999.00**

SHUG-100 ST-506 disk controller **(\$1250 list) \$1099.00**

SMC-100 SMD disk controller **(\$1650 list) \$1399.00**

KNX-500 winchester disk controller **(\$1695 list) \$1525.00**

BIT-100 9-track tape controller **(\$1595 list) \$1399.00**

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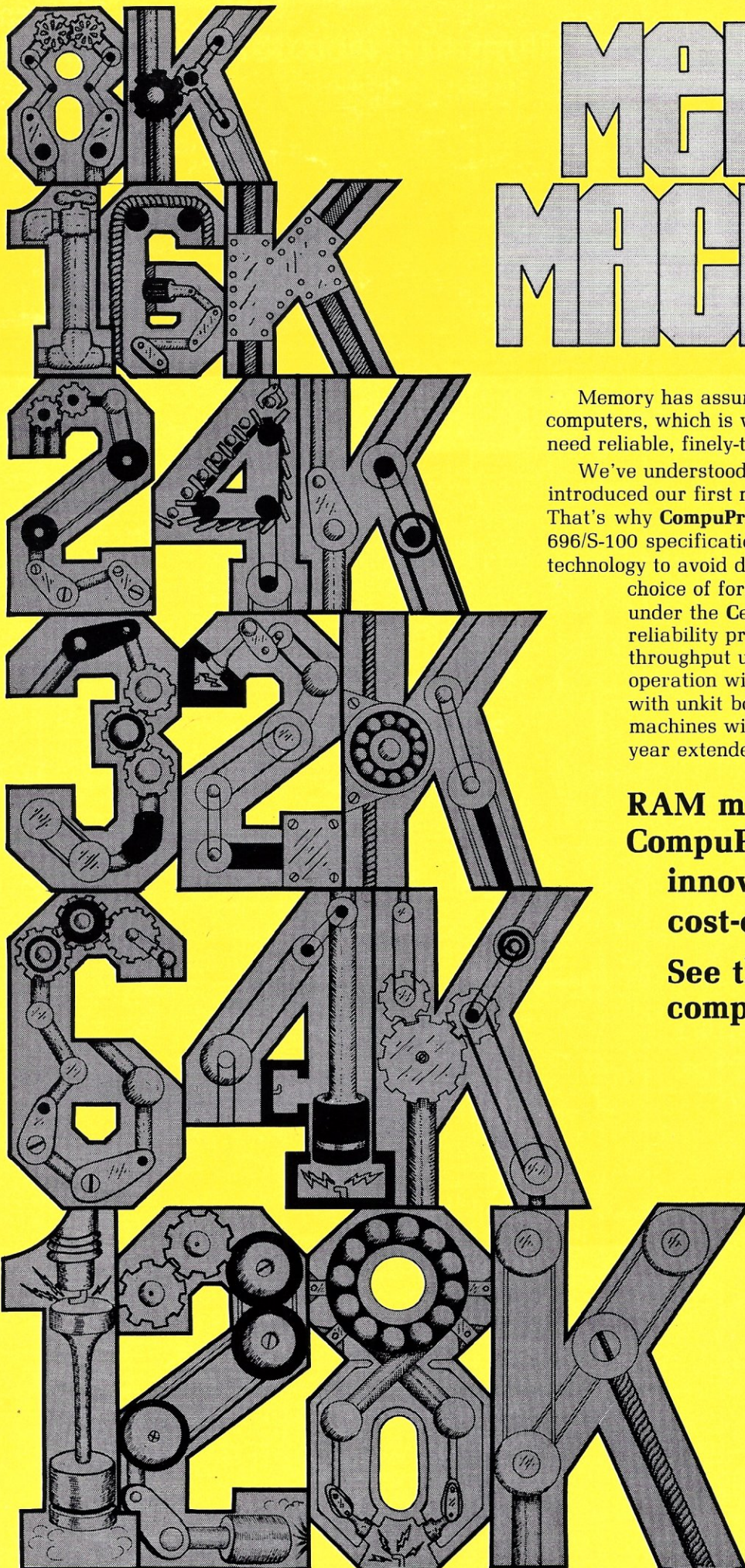
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