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Basic	JRT Pascal
IF A$ = "V" OR A$ = "W" OR A$ = "X" OR A$ = "Y" OR A$ = "Z" THEN...	IF A IN ['V'..'Z'] THEN...

FLEXIBILITY JRT's wide variety of data types reduces programming restrictions. And the data types are not all fixed in size. There are *3 looping statements* (Basic has 1). With JRT, very large programs can be created and run, because program modules can be spread over many diskettes. Common modules can be used for several programs. Basic generally limits strings to 255 bytes; *JRT strings go up to 64K.*

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Data types	Usually 2 or 3	12
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PUBLISHER'S REMARKS

By Wayne Green

Portables—What Will The Future Bring?

The Osborne Generation

Is the Osborne's success due to the fact that it is portable, or because it is a bargain as far as a complete system is concerned? Most of the commonly needed software is provided, and the entire cost of the computer is not much more than the ordinary software cost.

Frankly, other than that chap who dragged an Osborne to Afghanistan as a word processor (see July 1982 *Microcomputing*), I'm not sure where portable computers really fit in. As a word processor, the Osborne has its plusses and minuses. But the tiny screen is not one of its big advantages.

With the new Brother portable, battery-operated typewriter ringing in at $200, I know I wouldn't consider lugging an Osborne to Afghanistan. I haven't even taken the Brother anywhere yet, but I will give it a try. So far I've found my portable word-processor needs have been more than adequately satisfied by the Sony Typecorder. It's so small (8½ × 11 × 1½ and only 3 pounds) it fits in my shoulder bag and can be whipped out in two shakes for typing—on a plane, in a waiting room, in the car. The window holds 40 characters at one time, with each line being 80 characters. The typed material is saved in RAM memory until a full page has been typed, at which time the Typecorder indicates that it is time to save the page on the built-in microcassette, which will hold more than 100 pages.

When the day comes when most of our businesses are computerized, it will be helpful for both executives and salesmen to have small, portable computers that can be used via the telephone to access the home office computer for data access and communications. A salesman who can call the office on a motel phone in the morning and get the latest information on a customer he is going to visit that day—open bills, sales records, lists of the names he should talk with, and so on—will be better armed than one who has only partial information.

A salesman could call from the customer's business and get immediate information on inventory, delivery dates and credit, and then place orders on the spot.

Executives making business calls would be able to get complete information on the people they are going to be visiting that day, product data, names and even copies of correspondence.

Portable computers will, obviously, have an important place. But I'm not sure they will take the form of the Osborne, or any of the other portable computers that have come along since. The KayPro, featuring a larger screen

NCC Piracy Panel

One of the high-powered panels at the National Computer Conference in Anaheim, CA (May 16–19), will feature industry heavyweights Adam Osborne of Osborne Computers, George Morrow of Morrow Designs, Bill Godbout of CompuPro, Gervais Davis of Digital Research and Peter Hipson of Copywriter, a Bangkok firm. The discussion will be entitled "Microcomputer Software Protection."

With the software industry being devastated by piracy, there is a desperate need for a workable protection system for software. There is a general agreement that legal recourse is almost useless and that software protection schemes are too easy to defeat. The only remaining hope is for some sort of hardware protection system.

The NCC panel, which I will be chairing, will address this situation. I am hoping that as a result of this panel there will be a clear direction for the industry to move and that we will be able to develop an industry standard of hardware protection of software.

The session will be Monday, May 16, from 1:30 to 3 p.m. in Salon 3 at the Anaheim Marriott. This could easily be the single most important panel of the conference . . . certainly it will have the brightest stars of the industry.

W.G.

than the O1's and more storage with the drives, gives a lot of computer for its price. The Jonos even has a hard disk available in the same relatively small package. Otrona seems to have packed the most into an even smaller package. Then there is the Teleram and the Grid, both higher in price.

There is going to be a good market for portable computers, but I suspect it is still not ready and that the success of the Osborne has been mostly in the bundling of hardware and software. If this is true we may see some response to the Morrow Micro Decision, which follows the same path. It's a lot of computer to start with, plus it has the popular business programs and an amazingly low price for the bundle. It is not a portable; it is a desktop unit.

The technology is heading in the direction of ever-smaller equipment, so I suspect that we will be seeing some developments that will make bulky portables obsolete. The work on LCD displays is progressing, so we should be seeing larger and larger screens. Several years ago, when I saw the first LCD watches, I predicted that with that technology we would see some portable computers shaped like a hardcover book someday. The LCD display would be in the lid, which would lift up for typing.

The Typecorder is a healthy step along this path, but it is still far too limited in display area. So is the Epson HX-20, though it certainly is going in the right direction, with a four-line display, small printer and built-in microcassette.

The 8½ × 11 size allows for a full-sized typewriter keyboard—a big plus. We should be able to see a full page in display, so the LCD cover would do the job fairly well. We want to have word processing functions and spreadsheets, plus the ability to harbor other needed programs. With channelized radio communications, our portable computer will be able to access nearby computers or even—via automatic relaying—the telephone lines or cable systems for remote data exchange.

Remember that hams have been able to communicate from almost anywhere in the country via small, handheld transceivers. Hams are so used to this that it doesn't surprise them. They take it for granted that they can keep in touch from just about anywhere. I've often surprised businessmen by whipping a small handtransceiver out of my pocket and talking a hundred miles with it via these relay systems which are almost everywhere in the country, and throughout much of the world. Well, with a little radio in a computer, it, too, can put you in contact with home base from just about anywhere in the world.

Thus, though I don't see a huge market for portable systems right now, there is no question in my mind that the day is coming when we will have briefcase portables about the size of the Typecorder and pocket portables with smaller keyboards and LCD screens, with radio communications tying 'em together with our larger systems.

Apple Discounting Discouraging Dealers

The Apple practice of giving quantity discounts to dealers has caused their marketing system increasing grief. It's like dominos falling.

Apple dealers, pushed to get additional discounts by increasing their orders over the limit of what they can sell through their stores, ordered extra Apples and then sold off the extras at around their cost to discount houses, which mark them up minimally and move 'em on out. The hooker, of course, is that the discount prices pulled down the prices for all dealers, thus giving them less profit and, in turn, discouraging them from selling Apples when they can make so much more profit on other computers.

Reports are coming in from all around the country that a growing number of Apple dealers are doing their best to convert every potential Apple sale into something more profitable. This, of course, makes even more Apples available to the discount houses, further eroding the price structure.

There is no way for a dealer to get off this circle other than to stop carrying the Apple. If he is going to stay in competition with the discount houses, he *has* to buy at the largest quantity he can, even though this means turning a growing percentage of the product over to discounters. The situation feeds on itself, becoming worse and worse.

Several months ago I brought this to the attention of the Apple people and suggested it was getting time to revamp quantity discounts. How serious does this have to become before a change is made? We are already seeing signs that the Apple IIe will quickly follow the same route. In fact, we know that it has to—and immediately—if quantity discounts are maintained.

Other approaches are possible, of course. Morrow does a lot to discourage the dumping of his computers by holding back a substantial percentage of the discount until after the sale. A dealer must show a customer name and address within so many miles of the store to get the added discount. Of course, in the case of a New York outfit this is no problem, with 47th Street Photo right around the corner and eager to buy almost unlimited computers. . . which they sell at outrageously low prices. I buy a lot of my stuff there.

With the pressure of a feature article in *The Wall Street Journal* on the subject, plus one a couple of days later in *Electronic News*, perhaps the decision-makers at Apple will be startled awake—before it is too late.□

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WHAT'S NEW, BIG BLUE?

By Thomas V. Bonoma

The Taste Of Crow

Straightening Out The "Basic Bug" Controversy

Getting Personal

A veritable Pandora's Box of new software, updates, revisions and advance previews will be presented this month. Your humble correspondent even eats a little crow—concerning the "undocumented Basic benefit" I pointed out in a previous column.

In addition, I'll dish out my first Software Awards.

I had a program adaption for Wordfreq.Bas ready for this month, but we had to postpone it because of space limitations. Check these pages in the next couple of months for that program.

Updates, News and Previews

In my January column, I talked about and adapted a program (Fracdec.Bas) to demonstrate a potential Basic buggie. The animal in question was an extra space included when using the LEN and STR$ functions in Basic or BasicA.

Well, the volume of mail generated was boundless, and it fell into three categories. The first, and largest, was exemplified by reader/consultant/programmer Joe Long, who patiently explained, "You overlooked the fact that all numeric values in Basic include a sign (positive vs negative). If the value is negative, the minus sign is printed, but if the value is positive, the sign is left blank . . . Nevertheless, the sign is there—a blank implies positive and is counted as a character by *the LEN(X$)* function.

"Similarly, when you convert a numeric value to a string value with STR$(X$), the minus sign will be the first character in the string value if the value is negative. If the value is positive, a space will be the first character.

"What apparently misled you was that the value started out as a string value, which does not include an automatic sign position; it was converted to a numeric value, *which* does. It was finally converted back to a string value, seemingly picking up an 'extra space' in the process.

"The error was included in the original program, either because the author did not understand that the 'sign' character would be counted by LEN(X$), or because of a misprint. You corrected the program properly."

The second and third categories of mail were much smaller.

The second-category letters argued that the bug I mentioned was really a "documented benefit" in Basic, and that I was an idiot for not knowing it. The third class agreed that this was a bug, but claimed to have discovered it several years ago.

For the final word, we turned to a *Microcomputing* technical editor, who agreed with Joe Long. On the buggie, I stand corrected and chastised, but still displeased that the descriptions of LEN$ and STR$ in the Basic manual are not written more completely and clearly.

The cryptic remark in the IBM Basic manual that "unprintable characters and blanks are counted" isn't very useful without an example to remind the reader of the sign blank (which *is* documented at the front of the manual, but not where it would do some good).

To all of the good readers who wrote in, thank you.

Proof of Purchase

IBM has announced that update kits will be made available at your Personal Computer dealer for the COBOL Compiler and for the UCSD p-System. The updates provide "corrections and enhanced performance."

What you have to do is rip out the front inside cover page of your manual as proof of purchase and take it to your dealer on or before December 31, 1983. By the time you read this, the update kits should be in stock, so obtaining one should be a simple matter.

WordStar and MicroPro

WordStar 3.21 has been updated to a new version, 3.24. Interestingly, neither the new WS nor the new MailMerge are compatible with earlier releases of the products on the PC. What does that mean, exactly? I don't know yet—I'll get the new version and report on that later.

The only information contained in the press release about Version 3.24 is that it is incompatible with earlier versions, that it allows any printer (not just Epson's) to be used as a parallel device and that an error message is now displayed if a file is created using characters illegal to PC-DOS.

Additionally, MicroPro has rewritten its install programs to support the NEC 3550 printer.

Finally, from the same company, InfoStar (a DBMS program) is available for the IBM PC. I'll review that in the future.

The Rumor Mill

On the gossip front are a couple of tasty tidbits. Version 2.0 of the MBA will be out by the time you read this; it's rumored to be nothing short of excellent. This spreadsheet, graphics, DBMS and word processing program features added forms capabilities and telecommunications package.

For the first time since the advent of micros, it's possible to turn your computer on in the morning, boot a single software package and use MBA Version 1.91 for most management applications without change until night.

The software package PowerText, from Beaman Porter, has been updated to Version 1.91. The new version is rumored to contain a new and easier-to-use text editor, automatic bottom-of-the-page footnoting and a host of other features. A

Address correspondence to Thomas V. Bonoma, 45 Drum Hill Road, Concord, MA 01742.

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spelling checker will be made available as well. Version 1.91 will make a creative concept—the replacement of the secretary instead of the typewriter for word processing—even more useful.

Software

The torrent of clever ways for you to part with your loose change continues . . .

Games

I'm not much of a game player (at least not on the computer) so I may not be the easiest critic on a lot of these new entries. Still, I'll try to keep you up to date and to provide honest opinions.

Podlaserium (DP Computer Services, 5019 N. Washington Blvd., Arlington, VA 22205, $34.95 from "selected dealers") is a character graphics game written in compiled Basic for either color or monochrome monitors.

Alien characters, depicted by the number sign (#) and other PC characters, are placed randomly on the screen. The player's missile, a happy face at the bottom of the screen, has limited fuel and ammunition with which to blast the little devils.

At intervals, impenetrable (almost) shields are created by the aliens to protect themselves, and once in a while a bomb is seen somewhere on the screen. If hit, a bomb will destroy all of the pods (pods + laser + Latin ending = Podlaserium, I suppose).

PC magazine gave this game high marks, so I was excited about trying it. Well, it *is* acceptable, but the character graphics are clumsy, it has the slowness of Basic (even though it's compiled) and it's quirky (lowercase entries for disk drives, for example, are rejected). The documentation is good, and the game is challenging, but I'd recommend a demo before you buy.

On the other hand, Crossfire (Sierra On-Line, Inc., 36575 Mudge Ranch Road, Coarsegold, CA 93614, $34.95) is a game that looks un-fun at first boot. But it quickly grows on you.

The hi-res (color monitor required) screen is divided into squares (representing buildings) and spaces (representing roads). Your player can move anywhere on the roads and can fire in four directions.

The aliens hide behind buildings at the edge of the city; periodically, they pop up, shoot at you, make forays into the city and, in general, act to create mayhem. They strive mightily to get you into a crossfire; if they do, kiss one of your three plays goodbye.

The animation in Crossfire is smooth and the game is flawless (it's a translation of an Apple II game). It's good value for the money.

So is Ulysses (also Sierra On-Line, $59.95), part of Ken Williams' graphic adventures series. The normal-adventure two-word commands are in effect; your job is to retrieve the golden fleece.

You have to sail to your destination by first obtaining the king's blessing, a crew and a number of supplies. The hi-res graphics are novel, but not of the quality the IBM's resolution can display. Ulysses is supplied on two disks and requires 48K of memory and a color card/monitor.

Championship Blackjack (PCSoftware, 4155 Cleveland Ave., San Diego, CA 92103, $34) is a tutor/game program that allows you to change casino rules and that will accommodate multiplayer tournaments.

The program accommodates splits, doubles, insurance (are the gamblers listening? I don't know what I'm saying!) and lets you set up to play with Vegas Strip or Downtown, Atlantic City, or even Tahoe or Reno rules. You can also choose the number of decks the dealer will use.

Perhaps the most interesting part of Championship Blackjack is the statistics kept while you play; they're displayed at the end of play by use of the PC function keys. It's an exercise in humility.

In the simulation mode, you enter the number of deals you wish to play (up to 999,999). You also enter players and bankrolls.

You can view the hands as they are played; when the simulation ends, the statistics are available for viewing.

Oh, by the way, the program kibitzes while you play, telling you that your choice of "hit" or "stay" isn't consistent with the strategy you should be using.

Also from PCSoftware is PCrayon, a color drawing program requiring 64K, BasicA, one disk and a color graphics system. The program retails for $44.95, and it's worth it.

You can draw, write, create, store or display "vector symbols" (special designs supplied with PCrayon or created by you) and graphics symbols anywhere on the screen. You also can create "scenarios" or record the steps used in creating your displays.

All kinds of functions are implemented with two or three keystroke commands, including color/background choice, arcs and circles, painting, lines and text entry, in addition to the special vector and graphics symbols described above.

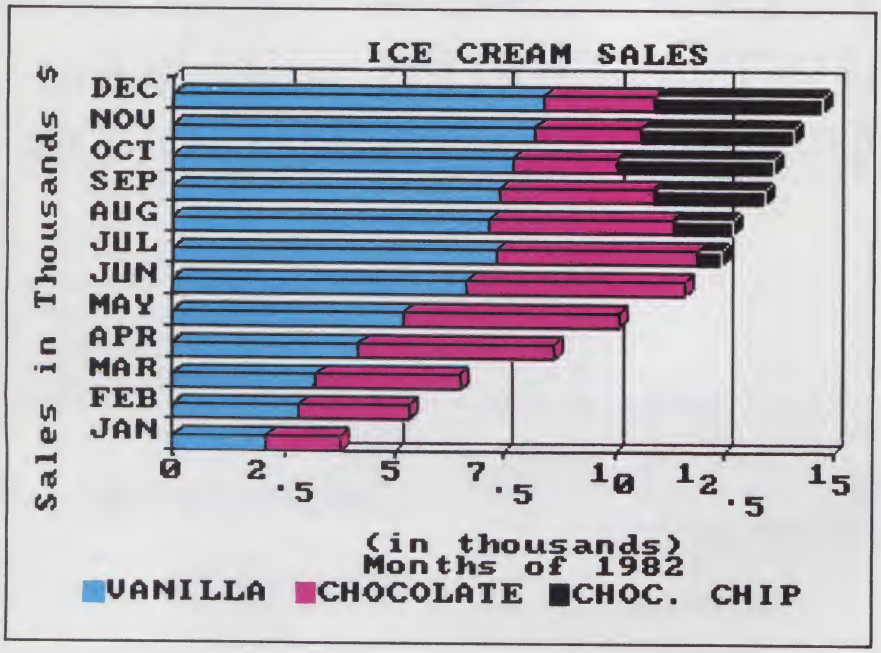
Drawing can be done in one of nine widths or sizes, and the program allows choice of the medium or the hi-res screens for your art. Full save to disk and restore of screens, symbols and the like is supported.

PCrayon is fully integrated with the PC's function keys; it's perfect for experimenting with your machine's graphics (if you've got the hardware to support it).

From International Software Marketing (Suite 421, University Building, 120 E. Washington St., Syracuse, NY 13202) comes Prism ($24.95), a "story disk" that promises to make one PC user wealthy.

Like the book that generated so much attention a year or so ago, ISM has hidden three golden keys somewhere in the world, and has written a story in which the hints that could help you find those keys are embedded. The story deals with a boy whose town loses its color because the magic Prism is lost.

The golden keys, according to the manual, are hidden "somewhere in the continental U.S. They will lie hidden until the cleverest and most enterprising among the treasure hunters unravel the many mysteries through the layers upon layers of meaning in this intriguing tale."



Example 1. Sample printout from Fast Graphs graphics and plotting program.

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☐ See Review in *Microcomputing,* January 1983, page 158.

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Word Processors, Data Processors, and Combination Programs

More word processors . . . unbelievable!

A real beauty comes from Satellite International (288 W. Center St., Orem, UT 84057). WordPerfect, they say, and it nearly is!

This $495 word processor, written in Forth, is "modeless." There's no edit mode that's separate from a print mode or from a command mode—it's all in one. There are no menus on the word input screen, and text is formatted to show exactly how it will be printed. Formatting codes are placed where you want them in the text file, but they're not shown on the screen.

Text can be entered anywhere on the page, a la Edix, without hitting any special keys. Reformatting is automatic.

Most of WordPerfect's functions are available as single-function keys. The program makes excellent use of the PC's special keys, all of them, and gives you two key overlays. The package has automatic footnoting and a sophisticated math package, and will deal with five columns on a page.

The processor, if all of this isn't enough, has a full set of macros that are definable by the user. A macro is a multikey sequence you type in once; the program remembers it and then executes at the touch of a single key.

From the same company, by the way, is P-Edit (P is for program). P-Edit essentially is a subset of WordPerfect. Unless you never write, or unless the price difference (P-Edit sells for $145) is important, buy WordPerfect. The only shortcomings of either package: neither supports my NEC 5520 Spinwriter, or the IDS Prism.

Synergistic Software's The Data Reporter (Quantum Software, 549 23rd St. N.E., Salem, OR 97031) is a solid DBMS program that accepts date, numeric, monetary and calculated fields in addition to alphanumeric ones.

The Data Reporter requires 64K and a single disk and is written in Basic and machine code. It comes unlocked and unprotected—a good approach.

Clearly, Data Reporter is not as sophisticated as TIM III, to stay within the Basic genre on DBMS programs, but it does have its advantages. For instance, it incorporates a "Soundex" routine, which allows you to find names when you know what they sound like but not necessarily how they're spelled.

The documentation is especially well-done, and includes a glossary as well as an index. It makes use of the PC function keys, and turns to machine language for sorts and other time-dependent tasks.

Combo Programs

On new combination programs, Ticom Systems (13470 Washington Blvd., Marina del Rey, CA 90291) makes available Final Copy, Final Form and Remcom as an integrated package ($885) written in Pascal for the PC.

Final Copy, needless to say, is a word processor that includes two segments. Letters or manuscripts (including mail-merge-type documents) are created under the Editor and printed under the Writer.

The Editor essentially is the standard Pascal text editor modified with a tab line and other enhancements.

The Writer is a text formatter/printer that accepts embedded commands (BT for Begin Titles) and reformats and prints the text accordingly. The Writer also is a sophisticated text reformatter, although this system means, of course, that you won't see your copy on the screen as it appears on the printer.

The Filer is the Pascal filer—period. Final Copy also includes a Calculator program for on-line or in-file calculations, and a report generator, which is a mail-merge-type facility.

If you stop there, you've spent $495. If you want Final Form (a forms processor

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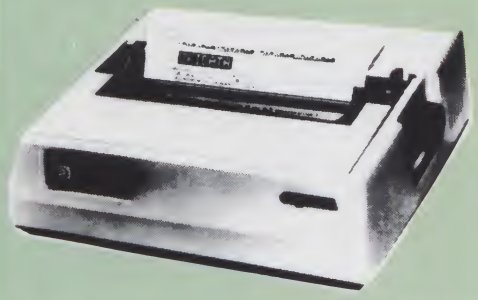

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and DBMS that is fully interactive with the other programs and with the Report Generator), you're going to spend another $295. And if you want Remcom, a remote communications program again integrated from a central menu with the other programs, figure on another $95.

How does it work? Well, the Editor is easy to use; the Pascal text editor is a good one, and Ticom had the good sense not to mess it up. The Writer text formatter has an extensive set of embedded commands, and will require a study of the manual before you master it.

The report generator works as advertised. I didn't spend a lot of time with Final Form because it's so complex.

Remcom is a worthwhile program that could use more explicit documentation. For example, my inability to get Remcom to log on the Source prompted a call to Ticom. An employee there explained that XON/XOFF protocol-checking must be manually disabled during log-on procedures. That's unnecessary, undocumented in Ticom's manuals and silly to boot. And because it does not custom-configure to the user's particular printer but tries to drive them all, the more advanced functions of some special printers are not supported.

Final Copy, Final Form and Remcom make up a solid beginning at an integrated word processing/DBMS/telecommunications package.

Finance

From binding to operation, one of the most impressive Basic packages to hit the streets has been the two-volume Money Decisions (Vol. I, $199; Vol. II, $299; both for $399 from Eagle Software Publishing, Inc., 110 W. Lancaster Ave., Wayne, PA 19087).

The manual is outstanding; it includes an executive summary of the programs available in graphics form. Each program (and there are several in the investments, loans and business-management areas) is consistent with all of the others in terms of input format, output format, screen display and prompts. If you can use one, none of the others will fool you. The manual is a work of art, clearly prepared *by* a manager *for* managers. Screen displays are sprinkled liberally throughout.

The programs themselves are useful to any businessperson. Under the investment category, for example, Vol. I allows computation of the future value of an investment (even or uneven cash flows), how much you'd have to invest in order to withdraw a given amount periodically and still not erode your principal, and the nominal interest rates on investments.

A thorough discussion of each concept is presented with the program documentation, and sample problems and output are provided.

Vol. I contains 11 investment programs, nine loan functions (programs in Money Decisions are called "functions"—see below), and ten business management programs, such as Lease/Purchase Analysis and Breakeven.

Vol. II, split into investments, statistics and forecasting, and business management, contains 16 more investment programs, including financial statement analysis and acquisitions/merger computations, nine forecasting/statistics programs, including some sophisticated Bayesian analysis, and 13 business management programs, such as production cost scheduling, job cost bidding analysis and profit-sharing contributions.

Each program in Vol. II is supported by graphics capability and works on the monochrome screen.

Money Decisions incorporates two more novel features. First, any function can pass and receive values from other selected functions so that cash flows input to a loans analysis, say, could be "carried forward" to another analysis at the push of a key.

The same principle is implemented between Money Decisions volumes. If you have Vol. I in the left disk drive and Vol. II in the right, passing between volumes is possible—and legal.

The Financier ($195, Financier, Inc., 11 Flanders Road, Westboro, MA 01581) is a financial record-keeping program. It is menu-driven, and exceptionally well-documented. You'll get a lot more from this system, which is written in Basic, than from other so-called home accounting programs.

If you want to be sloppy, the Financier will accommodate you in sloppy record-keeping and only mildly nudge you toward organization. If you're meticulous and picky, you can be as meticulous and picky as you want with this system.

The system can budget for you, write your checks and configure to your needs rather than forcing you into its rigid structure.

If you want a little more risk, Options-80 (Options-80, Box 471, Concord, MA 01742, $125) is a program for maximizing returns from option investing.

Options-80 is for the serious or beginning investor—it analyzes the buy and sell points of listed calls, puts, spreads and shares. It includes commissions, risk and dividends.

The program provides for hardcopy output and graphics. If you like, you can even use it for sophisticated modeling of possible alternatives. The manual is especially well-done, and includes a tutorial on options-investing.

Not for you, eh? You're the CPA type, and you want a financial modeling system complete with hi-res graphics? Then how about Micro-DSS/Finance (Ferox Microsystems, 1701 N. Fort Myer Drive, Arlington, VA 22209)?

DSS/F (Decision Support System/Finance) is a complete financial modeling system for the PC, and it's useful for budget planning, financial reporting, marketing forecasts and corporate modeling. At $1500, the program is by no means cheap, but it will do everything in the financial modeling arena (and usually with one command) except pay you.

The user creates and compiles Logic files, which essentially are cell titles and formulas like those with VisiCalc, but which are entered in a line editor and have a good deal more flexibility. The graphics package supplied with DSS/F, written in Pascal, allows bar, line and pie charting.

The system is supplied with three manuals: a tutorial, a reference guide and a manual of late changes in the reference guide.

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DSS/F isn't easy to use, but for the serious amateur, small-businessperson or financial analyst, it is outstanding once mastered.

The Consultant's Edge ($250), an add-on module for those who would develop applications for others using DSS/F, allows the modeler to create menu-driven turn-key models that even I can run and use.

Graphics

Enough, already! Let's have pictures. PC graphics has started to boom, and the initial explosion is satisfying.

Continuing with our Ferox friends for a moment, $295 buys GraphPower, a stand-alone graphics system written in Pascal for the IBM PC and the HP7470A plotter. You don't even need to read the documentation on this software to use all the beautiful but relatively inaccessible features of your plotter. You can almost set up your own graphics business with this software and the HP.

What if you don't have an HP, but still want outstanding graphs? Innovative Software, Inc. (9300 W. 110th St., Suite 380, Overland Park, KS 66210), makers of TIM III, has outdone itself with Fast Graphs ($295).

Fast Graphs is a complete graphics and plotting program designed especially for the IBM and a color monitor.

The program can compare up to six sets of data on a single graph. It allows you to use color or hi-res black and white and all of the function keys, and it has on-line help.

The data can be input from TIM, VisiCalc or any other .DIF data file, or from the keyboard. You can plot line, point, bar or pie graphs quickly, easily and accurately. You also can edit the graphics screen either before or after graphing, and add shadow text, your company logo, or whatever you want with your graph.

So where does it fall down? It doesn't. The problem with graphics packages is getting the lousy graphs off the machine and into your hands. If you've got the peripheral, this software supports it.

The Prism (see Example 1 for a Prism-generated Fast Graphs sample), an HP or Hi-Plot plotter, the old Epson and a variety of other printers are supported directly from Fast Graphs. Awesome.

My only complaint is that the designers should have taken more advantage of what the plotters can do, instead of settling for point-for-point transferral of the screen to the plotter. And, using the Prism is slow . . . it took about 20 minutes to print Example 1.

Other Stuff

A piece of hardware that buffers your printer? Gives you a dot matrix graphics screen dump? Acts as an RS-232 dumb *terminal emulator so you don't* need software? Yup. It's called the I-C-Magic ($85, Micro Business Industries Corp., 1019 8th St., Golden, CO 80401).

This little chip goes into the empty ROM slot on your motherboard and delivers all it promises. The documentation is terrible—small type, unreadable and unclear—but, the product works as advertised.

Be careful, though . . . I-C-Magic may not be compatible with all your add-ons. Check with MBI if you have a hard disk, for instance.

ICR FutureSoft (PO Box 1446, Orange Park, FL 32073) has released a new program generator—QuikPro Plus—and it's quick, fast, accurate and colorful. That's right, colorful; it lets you choose colors for your data entry fields.

You can even write a database program that looks like Jacob's coat. I know . . . I did it!

The benefits of QuikPro Plus are its speed, simplicity and ease of use. Unlike other program generators you may have heard about, this one is not harder to use than it is to learn Basic. In fact, if you know nothing, you'll still get a reliable and useful customized DBMS program in less than ten minutes.

The only negative I could find was that the application programs written by QuikPro clear the entire record when you choose the "update" option. That's not right . . . usually, when you want to change a record, you only want to change one field. With this program, you have to reenter the entire record.

QuikPro comes with a machine-language ISAM (indexed sequential access method) file, which you transfer to your applications disks and load before running your application. This makes sorts lightning-fast.

Doggone it, I forgot to tell you about the Basic Development System ($99, SofTool Systems, Suite 179, 8972 E. Hampden Ave., Denver, CO 80231).

BDS is a set of software tools that greatly increases your efficiency as a Basic programmer. You can single-step through a program and trace the execution, cross-reference all variables, dump their values at any point to check why you're getting errors in your results, and renumber in such a way that you can put lines 100–200 before 10–90 if you want.

All this can be called with single keystrokes from Basic—if you'll modify your Basic.Com by running an automatic modifier supplied. Oh, BDS will also allow you to compress your programs, really squash them, and then uncompress them again.

I really like this system; I was using it more and more until the Davong blew up again.

First Software Awards

Well, the hardware's going to wait yet another month. But not the software awards, even if *Microcomputing* doesn't renew my contract. Can I help it if there's more stuff out there to review than rice in China?

The awards will be given in five categories—Word Processing, Database Management, Spreadsheet, Combination Programs and Other. I'd like to reserve judgment until next year on graphics and finance.

As for games, if there were an award to be given it would go to Infocom for Deadline and to Med Systems for Asylum. But let's concentrate on work. Drumroll . . .

Word Processing—Three-way tie between WordStar, PowerText and WordPerfect. Any one of these gets the job done with elegance, utility and value for the money. Each implements a different word processing concept. The choice you'd make would depend on your philosophy.

Honorable mentions go to EasyWriter II and Select.

Database Management—Three important packages, in this order: dBase II if you need a complete full-function DBMS (although it's embryonic in its degree of adaptation to the PC); VersaForm if you need business processing and don't have to worry about portability of the Pascal files to DOS; and TIM III for all-around quality of coding and portability of data.

Condor, EasyFiler (from I.U.S.) and LogiQuest get honorable mentions. Condor might have won if its documentation was better.

Spreadsheet—Multiplan, SuperCalc and VisiCalc. The major differences are in the philosophies of these superb packages.

Combination—The MBA. The best there is, so far.

Other—PC-Talk, by Andy Fluegelman/Freeware; Volkswriter, from Lifetree; The Basic Compiler, from IBM; and Edix, from Emerging Technology.

Rating Reasons

Now, what were the criteria?

First, my subjective estimates of excellence, completeness, ease of use and value for the money counted heavily. Next, going that extra inch for the user with utilities and customization to the PC was important. The third criterion was the potential for what the program's concept could become if it continues to evolve along its current path. This was important for the MBA, Volkswriter and PowerText.

The final criterion for the best software, obviously, was that I saw it, used it and knew it. This means that software that hit the market after this was written was not included for this year's awards but will be for next.

Now, you've heard *my* choices—what are yours?□

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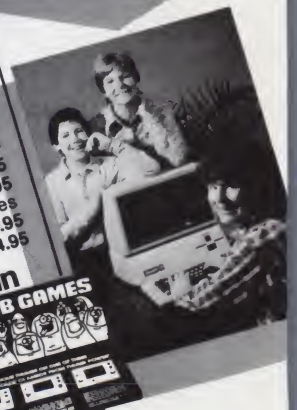

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By Frank J. Derfler, Jr.

Tandy Model 100 Ready to Roll

Radio Shack's New Portable—Out of the Bag

Welcome to the Overview. This new column has grown out of Dial-up Directory, which appeared in this space from January 1980 until last month.

Microcomputer and data communications systems have changed a great deal in the past three years, and the coverage here has changed with the systems. This column's new name indicates that we are broadening our focus to allow more coverage of industry trends, new technologies, the impact of various products on the market, and developments such as robotics and computer-assisted instruction.

Along with the new focus, you will continue to find the coverage you're used to seeing—on modems, information utilities and data communications systems. We're not giving up our bread and butter, we're just adding a little jelly.

In this issue, we'll see if we can get any stimulation out of simulation. But first, we'll take a look at the Model 100, Radio Shack's new portable.

Radio Shack's New Portable

The biggest little secret in Texas is now out of the bag. Tandy Radio Shack has entered the portable computer market with a system whose accent is on portability and ease of use.

The Model 100 portable computer is another in a line of so-called "briefcase" computers, like the Epson HX-20. It features a full-sized keyboard, but the real eye-grabber is the size of the screen display. The scrollable LCD screen display features eight lines by 40 characters and promises to be a welcome relief from the much smaller screens usually found in portables: No squinting necessary.

The Model 100's forte is its word processing ability. It's so easy to use for word processing that you can type away on it while stretched out in bed (try that with a 35-pound portable!). And, if you feel an attack of narcolepsy coming on, you can shut off the lights for the night and rest assured that your text will be there in the morning, stored in the computer's nonvolatile memory.

The Model 100 features Microsoft Basic, high-resolution graphics and a built-in modem, with the capability to automatically dial the phone when you enter the person's name into the computer.

The system comes with 8K for $795; the 24K version costs $995.

Games and Simulations

Games usually are simulations of life, but the degree of agreement between game and reality can vary widely.

The Adventure series presents games that we would all agree are pretty far separated from real life (*I* haven't had any trolls shoot arrows at me lately). If you factor in the effects of inflation, Monopoly is a simplistic simulation of real estate transactions and banking. The Three Mile Island microcomputer game that was popular a few years ago was a reasonably accurate simulation of the technical steps needed to control a particular type of nuclear power plant.

Playing games on microcomputers is a popular activity; it could become more practical if we add realism to our game formulas to create more useful simulations.

The cost of learning how to control complex processes can be high. You can read the information you need to base a skill on, but the closer you come to actually performing the activity, the more you'll learn (although it might be difficult to get the opportunity to experience complex tasks, such as flying a plane, running a business, performing medical procedures or managing a disaster response team).

Microcomputers can help to provide useful experience and training through realistic and interactive simulations. One of the best examples of useful simulation is found in flight training. So if you're ready, let's go flying!

Microsoft Flight Simulator

Modern flying, like so many other activities, is a technical process. Technical procedures and knowledge are more important than physical coordination or reaction speed.

This "view" is from nearly 4000 feet over the Lake Michigan shoreline. We're in a right bank and moving northward at 110 knots.

A great deal of the work in flying today consists of turning knobs, pushing buttons and reading various displays. It's quite possible for the pilot of even a single-engine private aircraft to fly for 1000 miles without touching the control wheel. Modern avionics devices move the control surfaces of the aircraft and make it bank, turn, climb and descend in response to digital inputs from the pilot.

The technical work involved in much of modern flying can be simulated nicely on a microcomputer.

A micro can teach you what the flight indicators look like and how various indicators relate to each other; it also can allow you to learn how different inputs to electronic devices affect the flight of the aircraft.

The Microsoft Flight Simulator ($49.95 from Microsoft Corp., 10700 Northup Way, Bellevue, WA 98004) is a software package with amazing capabilities; it can turn an IBM PC equipped with a color graphics video card into the cockpit of a single-engine, light aircraft.

Under the control of the Flight Simulator, the PC's screen can show a 360-degree view from the cockpit windows as well as an extremely accurate display of the aircraft's instrument panel. While the graphics are impressive, it's the interaction of the graphics and the flight conditions that really make the program valuable.

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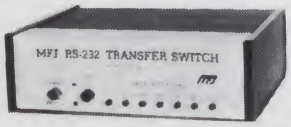

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When you're "flying" Microsoft's simulator, the gauges of the instruments react identically with those of a real aircraft. The engine RPM reading builds slowly after you advance the throttle, and the airspeed indicator starts to move as you taxi down the runway.

As you taxi, the runway, surrounding buildings and other features pass by the windows. The flight controls are not responsive until you've built sufficient airflow over the wings. If you overcontrol, you'll crash—convincingly.

The Microsoft Flight Simulator teaches not only the basic actions of flying (such as applying power, controlling the flight and using flaps) but also the advanced techniques (such as cross-country navigation and flight in bad weather conditions).

Leaving on a Computer Plane

The program has several modes of operation. In the demonstration mode, you can just sit back and let the computer be the pilot The aircraft will take off, assume level flight and demonstrate its capabilities. All of the controls and indicators will perform normally, so you'll have the opportunity to see the way things *should* be before you try it.

The actual flight mode puts you in the left seat (the command pilot's). You are free to take off and fly with the birds, within the realistic limits of the aircraft.

After you master the take-off (don't get the nose too high!) and cruise around for a while, you can try and figure out where you are. The Microsoft Simulator contains navigation information to allow you to fly in and between five major areas of the United States—Seattle, Los Angeles, Chicago, Boston and New York.

The navigation equipment in your airplane provides the modern basics needed for radio communication, but not much more. It consists of a VOR receiver able to give you the bearing from a known point. This kind of receiver, however, gives only the bearing from the selected station; you have to tune in another station, get another bearing and find your position by triangulation.

The simplest way to travel is by going directly from station to station, even if it means you have to follow a zig-zag path over the earth.

Ground Control

Bruce Artwick, the author of the Flight Simulator, built many features into the program to make it more interesting and useful. An instructor, using the program for formal training, can set various parameters, such as winds, aircraft performance, and mechanical problems into the program.

You also can indulge in a little nostalgia by selecting a mode that makes you the pilot of an aircraft over the front lines in World War I. In this mode, you can dogfight, bomb and strafe, but you'll be surprised at the limited power and maneuverability of a small aircraft. It isn't an F-15, and it's easy to push it beyond its limits and crash.

The Microsoft Flight Simulator has many other features, but I've told you enough to support my contention that, at $50, it's a worthwhile value. It requires the color graphics board and is most effective when viewed on a composite video (not RGB) color monitor.

Feedback and Futures

The Flight Simulator shouldn't be called a game—it's a true simulator. The reward in using this simulator is not as superficial as scoring points or saving the galaxy. The reward is the more mature and longer-lasting psychic income that comes from mastering a complex technical skill.

What does the future hold for simulation? First, we need a change in thinking to match our capabilities. We need to get away from the text format we still see in simulation models and to use the graphics our modern microcomputers are capable of providing. We need to use voice synthesis and voice recognition to add another dimension to computer/human interaction.

Second, we need to create simulations with market value. Skills that can be learned and must be practiced are found in many areas. Medicine, accounting, electronic troubleshooting and emergency response management are just a few of the varied skill areas that could benefit from simulations.

Attempts have been made to use computers for medical diagnostics, but they also can be useful for training and practicing diagnostic and emergency treatment skills. Accountants are often faced with a variety of options and business practices; simulations with internal coaching and references could save them costly mistakes.

Electronic systems are found in every kind of device from automobiles to home appliances. Repairing these devices usually involves finding the right module and replacing it. Wrong decisions would be costly in terms of time and manpower.

Time spent practicing electronic troubleshooting decisions can build techniques for effective and profitable work. Persons who coordinate and direct emergency and disaster operations seldom get an opportunity to practice the decision-making skills that they'll need in a crisis.

Realistic simulations involving the coordination of people and resources in emergency situations would be welcome at every level of government, from town and village to federal.

If you're thinking of using your programming skills to write another shoot-'em-up space game, you might consider doing something more meaningful and working with a person in some profession to build a simulation. The rewards, both economic and personal, could be high. □

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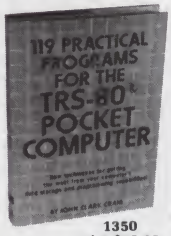

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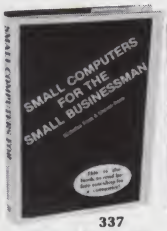

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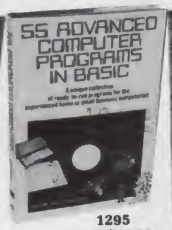

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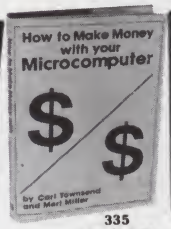

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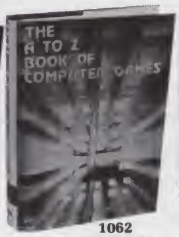

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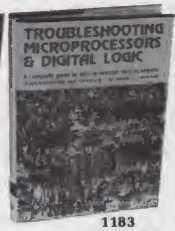

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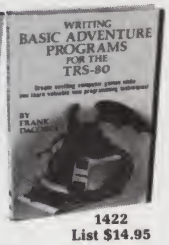

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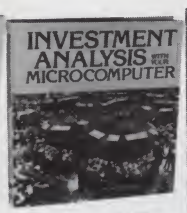

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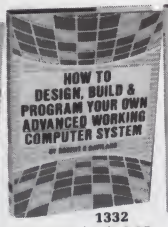

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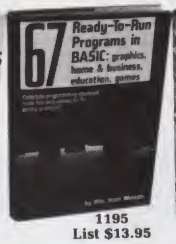

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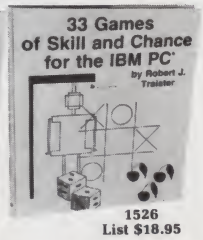

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By Robert W. Baker

A Well-Kept Secret: 8023P

Sizing up Software From Taylormade, Nufekop, Briley

8023P Printer

Recently, I acquired a Commodore 8023P printer, and so far, I've been pleased with the unit. Unfortunately, little has been said about this printer, so not too many people know about the additional features it offers.

Looking first at the normal specifications, the 8023P is a 150-character-per-second, bidirectional, logic-seeking printer. Characters are 5×8 dot matrix with 136 per line in normal mode or 250 per line in condensed mode. It prints the full Commodore character set, including graphics.

Print throughput rates range from 110 lines per minute (lpm) with 34 characters per line (cpl) to 40 lpm with full 136-character lines. Paper feed is switch-selectable between tractor and friction feed and will accept 5- to 15-inch-wide paper.

Format Control Features

Besides its faster print speed and wider print carriage, the 8023P has 19 format control options. Each is selected via unique secondary addresses in the Basic Open command.

The first 11 options are the same as those provided with the 4022 and other Commodore printers. They allow you to control data formatting within a line, set the number of lines per page or the spacing between lines, select upper- and lower-case or ASCII/graphics character sets, define a programmable character, control diagnostic messages or reset the printer under program control.

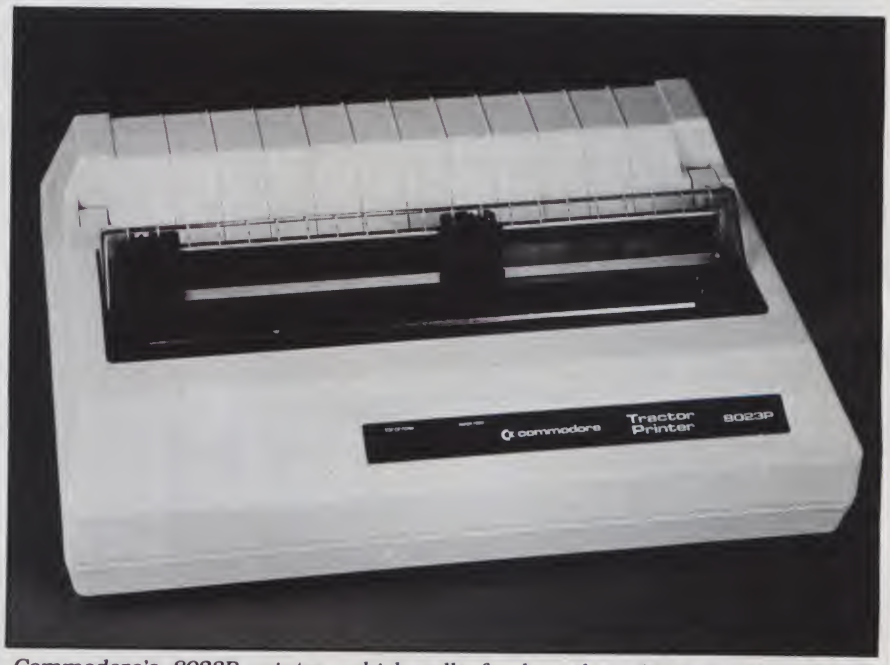
The eight additional options on the 8023P allow you to select uni- or bidirectional printing and condensed or pseudo letter-quality printing. In addition, you can control bit data for full-point plot graphics.

The 8023P normally operates in the bidirectional mode—unless there are Commodore graphics on the line. For any line with graphics characters, the printer will switch to unidirection mode, always printing from left to right.

The condensed printing mode allows for up to 250 cpl while the normal mode prints only 136 cpl. To use the pseudo letter-quality mode, you must also set the condensed mode.

In the pseudo letter-quality mode, the characters are small and text is hard to read. One solution is to add a CHR$(1) to the start of each line to enhance each character. The characters will then be printed in double width. You'll be limited to 125 cpl, but printed text will be of high quality.

Besides all the normal print modes, the 8023P can also do full-point plot graphics in both normal and condensed print modes. A secondary address of 17 allows



Commodore's 8023P printer, which sells for less than $600, knocks off 150 characters per second and offers 19 format control options.

Address correspondence to Robert W. Baker, 15 Windsor Drive, Atco, NJ 08004.

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SUPER-10"

ABCDEFGHIJKLMNOPQRSTUVWXYZ
ABCDEFGHIJKLMNOPQRSTUVWXYZ 1234567890

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you to store bit-image data into the print buffer.

You can control 816 dots per line (dpl) in normal print mode or 1020 dpl in condensed mode. Actually, you specify eight rows of bits or one character line at a time when writing data into the print buffer. The line is automatically printed when the buffer overflows or can be controlled via secondary address 18.

Considering its typical mail order price of less than $600, the 8023P is a great buy if you need a full-width printer.

Taylormade Software

Taylormade Software is offering a number of VIC programs that are well-documented and moderately priced. The programs are being sold through dealers or directly through mail order. Here's a look at three Taylormade offerings:

VIC Lemonade

In this program, two graphics people compete in lemonade-selling. Profits are based on the weather reports and temperatures (chosen at random), the selected selling price for your lemonade, the number of advertising signs and the number of glasses of lemonade you make. A winner is declared after 15 "days," unless someone goes broke first.

The color graphics and sound effects are superb on this $14.95 VIC program.

Morse Code Trainer

This $19.95 program is great for practicing or learning Morse Code. You can set the desired words-per-minute rate anywhere from four to 35. You also can type your own message and hear it sent, or select from four levels of random text (simple one- and two-element characters; one-, two- and three-element characters; all letters; and all letters, numbers and punctuation).

In each mode, up to 50 characters are sent in five character groups; the letters then appear on the screen so you can check your copy.

Characters are clean and crisp at slow and moderate speeds, but a little harder to distinguish at the top of the range. Still, it's a useful program for all levels.

Aerobics Points Calculator

Now you can use your VIC-20 to monitor your fitness program. Learn your exact aerobics points and calories used for any time and distance, and your combined point totals for several activities.

For distance activities, your yards-per-minute, miles-per-hour and minutes-per-mile rates are provided. Using your tape datasette, you can save your weekly, monthly and year-to-date aerobics point totals.

The aerobics points earned will agree with those presented in Kenneth H. Cooper's *The Aerobics Way* if you enter the same time and distance given in the tables (for all activities except Treadmill).

Two programs come on one tape. One is for the VIC-20 to calculate aerobics points for running, walking, cycling and swimming. The second program requires a 3K memory expansion (or more) and will calculate aerobics points for more than 25 different activities.

Aerobics Points Calculator includes an initializing program that allows you to initialize a new data tape for each year, or to save records for several people. The program (which retails for $24.95) can be used without data-saving, but the screen plot of your average weekly aerobics points will not be available.

For more information on this and other programs for the VIC-20, write Taylormade Software, PO Box 5574, Lincoln, NE 68505.

Nufekop Software

Nufekop offers a number of VIC-20 programs through local dealers and mail order.

Most of the games feature interesting graphics and sound effects. They're usually simple but challenging, and most are one-player games. Separate versions for joystick or keyboard control are available (but I don't know why anyone would not want to use joysticks).

Here's a rundown of some Nufekop games for the VIC-20:

Alien Panic

In Alien Panic, you must move a human figure from level to level, climbing ladders and digging traps for the alien that's chasing you.

When the alien falls into a trap, you have to fill it in before he gets out. When trapped, the alien falls one or more levels. The game ends when you've dropped three aliens to the bottom of the screen.

Alien Panic's graphics, play action and sound effects are superb.

Collide

This game is similar to the arcade game Dodge'em. The object is to run over as many dots as you can while circling the four-lane raceway and while avoiding the computer-controlled happy face.

You can change lanes at the four intersections but you cannot control your speed or direction. If you hit a divider while changing lanes, you bounce off and momentarily lose control.

Your score is based on how many dots you run over before losing your three cars.

Escape

You're lost in a maze and all you see are long corridors and endless doorways. Can you find the way out?

After loading Escape, you'll see an overhead view of the maze as it's being created. You get a few seconds to see where you are, then you're dropped into the maze, and you see everything from ground level. By pressing N, S, E or W, you select your direction.

If you have trouble escaping, you can even cheat and sneak a quick overhead look at the maze.

Invasion

An enemy ship is trying to get past your rockets and bombs to take your energy pods. The invader moves horizontally past your rockets at the bottom of the screen and bombs at the top of the screen.

You get two chances to hit the enemy as he goes to and from the energy pods, but timing is everything. The game ends when you've lost all four energy pods.

Journey

You're descending into the depths of a cavern, trying to get as far down into the cave as you can. You descend at a fixed speed, which means you have to concentrate only on going left and right.

When your fuel supply dwindles, just bump into one of the objects marked Fuel for a fill-up. The game ends when you crash into an obstacle or run out of fuel.

Krazy Kong

Krazy Kong is just what you'd expect—a simplified version of the popular arcade game.

With this game, you have to run and climb up a graphics structure while jumping over barrels that come rolling at you. (The running and jumping take up energy, so you have to act quickly.) When you get to the top and save the fair maiden, you progress to the next screen, which has a much tougher staircase.

The game ends if you hit a barrel or the gorilla Kong or if you run out of energy—or when you've rescued all three maidens.

Quirk

The object of this game is to catch sad faces that fall from the top of the screen. By doing so, you score points and work your way up and down the multicolored levels.

Watch out, though; each level has moving holes in the floors that get larger when your score reaches 300.

The game ends when you fall onto spikes at the bottom of the screen or when five sad faces make it to the bottom.

Raceway

This car-race game is designed for one or two players. With one player, you simply race against the clock while the second car sits still (you don't race against the computer). In the two-player mode, you compete, obviously, with your opponent. You can select a 1- to 20-lap race on either of two race tracks.

While the graphics and sound effects are superb, the keyboard commands are

hard to manage—and there are no provisions for joystick controls.

Search

The object of Search is to find as many money bags (there are 18 of them) as you can while avoiding the deadly blob. The setting is a maze, but only one room in the maze is displayed at a time. If you hit the blob, you go back to the room where you started.

The game ends if you find all of the money or if you run out of fuel.

Rescue From Nufon

This is a slightly complicated game where you're on a mission to rescue 30 humans trapped in a five-story alien building. Four different races of hostile aliens must be avoided.

Each time you play the game, the building is different, which means that different game plans are required.

The game ends if you run out of time, if you use all of your energy or if you manage to rescue all of the humans.

For More Info . . .

Besides the games mentioned here, Nufekop also offers Vikman, Spelit, Tank, Six Gunner, Target and Bomber, all for the VIC-20. All programs are supplied on cassette tape with printed instructions.

For more information, write to Nufekop, PO Box 156, Shady Cove, OR 97539.

Briley Software

Briley Software offers a wide selection of programs for all Commodore systems. And several of its recent offerings have versions written specifically for the VIC-20.

A Fortnight of Food Plans

Dinner's On is a program that picks, at random, from a list of your favorite meals, planning your menu for up to 15 days. The program makes sure that at least two days go by before the same meal is scheduled again. If you don't like the menu selected, you can try again.

Once you've decided on the menu you like, Dinner's On will provide a sorted shopping list showing all the ingredients needed.

Because meal selections and ingredients are stored internally in data statements, you don't need data files on tape or disk.

One requirement: meals must be planned for the same number of people; the program doesn't make adjustments to ingredient quantities.

The VIC version of Dinner's On retails for $12.95. The PET version, which has a dessert variety and a 25-day range, retails for $14.95.

Grocery Mart is a worthwhile program for the VIC-20 or for other Commodore systems, but it's useless without a printer. It provides a master shopping list for reference, and later lets you create quick and easy shopping lists. The lists can even be printed in the order you like to shop through the store.

First you need to spend time in the store jotting down items and prices. Then these items must be stored in data statements within the program. This becomes the database for your master shopping list; there's room for about 150 items in an 8K system.

If you include prices on your master list, you can predict grocery costs before going shopping. There's even a prompt for entering coupons before computing your total costs.

Grocery Mart is available for VIC and PET systems; the retail price is $14.95.

For more information on these programs, contact Briley Software, PO Box 2913, Livermore, CA 94550-0291. You'll probably want to send for a copy of Briley's latest software catalog, the "Briley Software Gazette." (If you have a Commodore-64 system, be sure to let the Briley people know so they can indicate which programs will run on your system.)

Basic Quirk

Here's another quirk of the Commodore Basic interpreter that was documented by Mike Todd in the January 1983 ICPUG (Independent Commodore Products User Group) newsletter. It occurs on older 32K PETs and unexpanded VIC-20s, where the screen RAM immediately follows the Basic program RAM space.

Enter and run this little one-line program:

```
10 A = VAL(TI$) : GOTO 10
```

You should see a flickering "@" in the top left-hand corner of the screen. The top left character is constantly being changed to "@" and then restored to what it was.

This problem stems from how the VAL function works. It first evaluates the expression in the brackets (in this case, the string associated with TI$). The resulting sequence of digits then needs to be converted to a floating-point number. Since the operation is exactly the same as the handling of a string of digits during Read or Input, the same ROM routine is used by the VAL function.

The conversion routine reads and converts the ASCII digits until a nonnumeric terminator character (it could be a comma, a colon or a zero byte, depending on the circumstances) is encountered.

The VAL function, unfortunately, puts a zero byte terminator at the end of the string to be converted. It does, thankfully, save the original value of this byte; it restores it after the conversion has been done.

Going back to the example using TI$, the six characters of TI$ will be placed in the last six bytes of program RAM—then the terminator is tagged on. The terminator actually goes into the first byte of the screen RAM, so a zero is effectively poked onto the screen, causing the "@" to appear in the upper left corner.

Since the VAL function restores the original byte, the "@" will then disappear when the VAL function terminates. The TI$ string is needed only when it is accessed, so it doesn't become a "permanent fixture" in the string memory space. The next time it is set up, it appears in the same place along with the terminator, so you get a constantly flickering "@."

This can only occur when a VAL function is executed on a string at the top of program memory; consequently, it's rarely noticed and, in fact, is quite harmless.

I would assume the same thing would happen on a Commodore-64 when it is reconfigured to emulate a PET. This problem does not occur on systems that use the newer Basic 4.0 ROMs.

(By the way, ICPUG is located in England. The January issue of its newsletter was almost 90 pages, and it's packed with detailed information about Commodore equipment and products. It's a first-class newsletter; unfortunately, membership and subscription information isn't included in the January newsletter, but we'll pass on the details as they become available.)□

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LETTERS TO THE EDITOR

An Offer You Can't Refuse

After a great deal of difficulty, I now have Ward Christensen's Modem-7 program working on the Heath/Zenith H-89. This is a public-domain-terminal program that allows communications and file transfers between two computers equipped with the program. One of them may be an unattended bulletin board system.

This is one of the best modem programs available, but it is extremely difficult for anyone, let alone beginners, to get configured and working on a new system. Therefore, I'm offering to provide a copy already patched for the Heath system to anyone who will send me a disk, a mailer and $5 to cover return postage and handling. I can provide 5¼-inch hard or soft sector, or eight-inch standard copies. This program is for CP/M only, not HDOS.

This free program can send an entire disk, including .COM files, with one command in batch mode. Error-checking and retransmission is provided. I demonstrate this by whistling into the phone while a file is being sent. The program simply resends the trashed sector and goes on. I hope to save other Heath/Zenith owners the hassles I had getting this fine program to work.

Paul Pennington
2912 Palmetto Drive
Martinez, GA 30907

Thanks

I would like to thank you for publishing James Callaghan's article "How Video Displays Work" in January (p. 104) and February (p. 90) 1983. The article provided technical data on the 6845 CRT controller chip, along with the programming data for it.

This is of particular interest to me because Commodore used the 6545 chip, which is functionally identical in my CBM 8032. With the data given, I am able to adjust the screen parameters without going through the pain of hardware modifications.

The 6545 is addressed at $E880 (hex) or 59520 (decimal). I think it is write-only, as I get only zeros out. If anyone can help me with that, I would appreciate it.

Now those people with 80-column screens can use programs that poke to the screen simply by executing POKE 59520,1:POKE59521,20. This makes the left half of the screen have the addresses of 32768-33768, like the 40-column models. The firmware still thinks of the screen as 80 columns, so you don't see anything on the bottom half of the memory page. However, if you execute a POKE59520,1:POKE59521,40 statement, you are back in 80-column mode. Now the only task is to convert the print statements to correspond with the new screen format.

Bill Nickless
Box 1
Dillingham, AL 99576-0001

Calling All VIC Owners

I would like to hear from VIC-20 owners or computer clubs for the purpose of publishing a newsletter for sharing ideas, tips and programs.

Such a newsletter could be instrumental in bringing together those with mutual interests, or in locating those in specific geographic areas interested in forming a VIC computer club.

Glenn D. Fuqua
D.I.Y. Publications
PO Box 161
Keller, TX 76248

Is Anybody Out There?

Is there anyone out there who owns or uses an Epson HX-20, for whatever purpose, and would like to share his ideas and help others realize the full potential of their machine?

If anyone is interested, please contact the HX-20 User's Group. When doing so, enclose your name, address, what you use the machine for, and your occupation.

If you have any ideas on what you would like the HX-20 User's Group to do for you, please include your suggestions.

HX-20 User's Group
C/O 14 Courtleigh Gardens
London, N.W.11 9JX, England

Sports Pay, Do Computers?

It made me both sad and angry to read your comments on education, sports and computers ("Publisher's Remarks," February 1983, p. 6).

Granted, there are some things wrong with the emphasis the American public puts on sports, but it seems extreme to blame the educational system for this shortcoming. Computers are important, but one only needs to consider the audience of professional sports to realize where most Americans are going to put their bucks.

Furthermore, if you will investigate, you will find that sports are not financed primarily by tax dollars. Such things as uniforms, buses and meals are paid for from revenues generated by sports events. In many school districts, even such large expenses as stadium repairs are raised by booster clubs and other parent organizations.

What is needed are ways to make computer education pay its own way.

Surely you must know that computers are becoming more common in schools. Courses for teachers that deal with computer literacy at the University of Akron (typical, I believe) are among those closed out early every semester.

Computer use in schools is a high priority both for teachers and administrators. They are investing a lot of time and money to learn how to handle the machines and how to use them effectively in schools. However, it seems foolish to think that every student who learns how to operate a computer is going to own an electronics business.

Finally, your article is self-serving and inaccurate in many respects. Your opinions are undoubtedly centered on your own poor educational background. It is a shame that your schooling did not teach you to investigate the facts before you write.

June Crabtree
Canton, OH

Reply:

Your intemperate letter arrived. I was rather disappointed that instead of devoting much time to arguing with what I said, you chose to attack me personally.

Since I have been consulting for several colleges, I am not unfamiliar with where money comes from and where

it goes.

Technicians and engineers are needed to invent, design, help produce, install, operate and service electronics, communications and computers. With about 70 percent of the available supply being taken away from private industry by armed service contracts, the situation is losing more and more business to Asia. . . and we are unlikely to be able to get it back once it is entrenched. Even our military is turning to Asia for research and development, as I'm sure you've read in the headlines recently.

Wayne Green

Do Your Homework

I am the happy owner of Volkswriter. I liked some of the comments that Thomas Bonoma made about the program ("What's New, Big Blue?", *Microcomputing*, February 1983, p. 8), but I think he should have done his homework.

In Table 1 (p. 10), he indicates that the Epson is the only printer useable. To the contrary, Volkswriter 1.2 lists more than ten printers that are supported.

Mr. Bonoma also states that Volkswriter has no headers or footers—wrong! Volkswriter 1.2 has both, and offers numerous options for their use.

Ross M. Roberts
N. Little Rock, AR

Reply:

Mr. Roberts, perhaps you do not know that my columns are prepared four to six months before publication. That is the nature of magazines and deadlines. So, when it is winter, I am usually writing early summer columns. At the time the column and the review of Volkswriter you object to was written, version 1.2 of that good software had not yet been released.

When version 1.2 was released, I reviewed it for the next month's column (March 1983, p. 8).

I stand by the review of Volkswriter 1.1 and the review of version 1.2 contained in the March issue.

Tom Bonoma
Concord, MA

An Unsolicited Testimonial

What has happened to your magazine? The once large issues with long, quality articles have been replaced with stapled pamphlets advertising business-oriented minicomputers. What has happened?

Kilobaud was a unique magazine several years ago, because you aimed it toward smaller-scale hardware and software efforts. Now, apparently, you have decided that this philosophy is not profitable (or is there another reason?).

I hope more readers will respond with dissatisfaction. I wish to withdraw my subscription beginning this month. It is not worth the trip to my mailbox for a low-grade pamphlet.

Robert Anderson
Kalamazoo, MI

Reply:

Mr. Anderson, we suggest that you move your mailbox closer to your house.

Editors

What's Bugging You?

I read Tom Bonoma's "What's New, Big Blue?" column in the January 1983 issue of *Microcomputing* (p. 14). I would like to inform him that the "bug" in Microsoft Basic is not a bug at all.

Mr. Bonoma overlooked the fact that all numeric values in Basic include a sign (positive vs. negative). If the value is negative, the minus sign is printed, but if the value is positive, the sign is left blank, according to common practice in mathematics.

Nevertheless, the sign is there—a blank implies positive—and is counted as a character by the LEN(x$) function. Similarly—when you convert a numeric value to a string value with STR$(x)—if the value is negative, the minus sign will be the first character in the string value. If it is positive, a space will be the first character.

This can be seen if you try entering negative values, such as −3/5, in your program. The function works just as expected, giving a length of two characters for the −3. The function counts the number three as two characters, because it is really +3.

What apparently misled Mr. Bonoma was that the value started out as a string value, which does not include an automatic sign position; it was converted to a numeric value, which does. It was finally converted back to a string value again—seeming to pick up an extra space in the process.

The error was in the original program, either because the author did not understand that the "sign" character would be counted by LEN(x$), or because of a misprint. Mr. Bonoma's revision corrected the program properly.

Joe Long
Madison, AL

Editor's note: Tom Bonoma responds to the "Basic Bug" question in his "What's New, Big Blue?" column in this issue.

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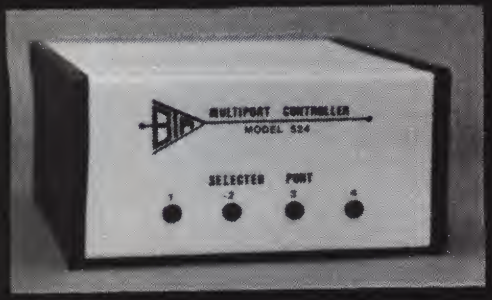

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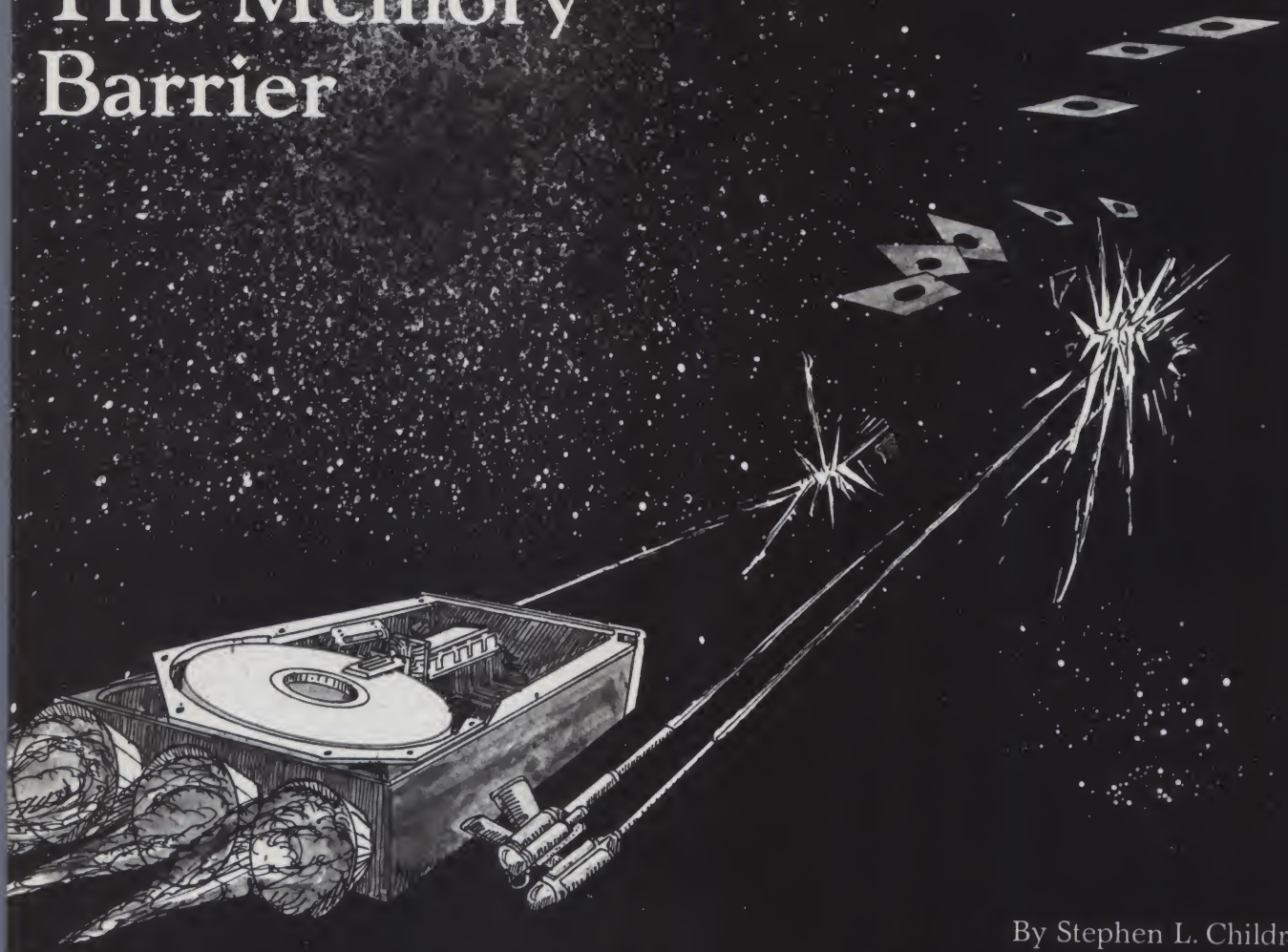

By Stephen L. Childress

They were coming in waves, their numbers overwhelming, no two alike. But to my view they were indistinguishable. I would have thinned their ranks, but I was afraid of destroying one of real value.

No, this isn't an arcade game description—it's a picture of my floppy disk chaos. Seems as though I had acquired millions of the little buggers over the years. I spent so much time juggling them in and out of the drives that I decided I might more correctly call them swappy disks. Moreover, I had on several occasions swappied (sic) the wrong disk, losing many hours' work.

So I began to look seriously at Winchester hard disks, which had been on the market for some two years. Cost was a driving factor, but I wrestled with priorities and settled on the following criteria.

I wanted a minimum of 10 megabytes, not on removable media, and a disk drive from a company with a solid track record. The disk controller was to have a simple, byte-parallel computer-interface, rather than a bus-oriented design. This would permit portability between my SS50, Apple and other computers, with only an inexpensive interface card for each. Finally, I wanted the whole works self-sustaining, with a case and power supply.

With these goals, I scrutinized ads and noticed that the technology was evolving rapidly, causing price wars between the four or five biggies in the business. Now the problem was to gauge the right time to buy.

The Classic Multivendor Box

I finally found the right package: 11+ megabytes on a Tandon drive, a Western Digital (WD) controller card with a simple interface, a nice box to house it all and an Apple II interface card by Xiten Systems. All this went by the name of

Gallium 10. From reading about the Western Digital 1000 controller, I determined that the interface was quite simple, involving a couple of eight-bit parallel ports. For the clincher, the unit was on sale at less than $2000. Sold!

The drive is the Tandon TM603SE Winchester. It has three platters, with six heads, one on each side of each platter. The six surfaces provide the advantage of six equivalents to a floppy disk track at each step of the head-positioning stepper motor. Since there are 32 256-byte sectors per track on each surface, there are six times 32, or 192, sectors available without a time-consuming head movement. The drive moves the head at three milliseconds per track when changing tracks, which is several times faster than inexpensive floppy disks.

On multisurfaced hard disks, the term "cylinder" refers to a specific track which is present on both sides of each of the platters. The Tandon drive has 230 cylinders, so the disk capacity is 32 sectors per track times 230 cylinders times 6 surfaces times 256 bytes per sector, a total of 11,304,960 bytes. As I suspected, the drive is being surpassed by newer designs with higher densities and faster head positioners—thus the low price.

The WD 1000 controller is a collection of logic ICs and analog circuitry on a single PC card. Based on the WD 1000 LSI chip for Winchester disks, this controller is at least an order of magnitude smarter than the FD1771 type of floppy disk controller. It takes care of handling everything associated with reading or writing a sector. It moves the head to the appropriate cylinder, locates the desired sector on the specified surface and reads the data into or out of a data buffer within the controller itself. Indeed, the controller even takes care of retries to correct soft errors.

The advantage of such a smart controller is that it simplifies the CPU software driver for the Winchester. As I will show later, the driver for the operating system I use is smaller and simpler than the floppy-disk drivers.

Testing With the Apple

My plan of attack was first to plug the Gallium into the Apple to prove the thing worked and to marvel at its speed, then to design an interface for

Address correspondence to Stephen Childress, c/o Microcomputing, 80 Pine St., Peterborough, NH 03458.

Winchester Hard Disk Drive Technology—A Capsule Profile

As originally conceived (reportedly by people at IBM), hard disk drives would store 30 megabytes of memory on 30 tracks. This suggested to someone the famous 30-30 Winchester rifle, and the name stuck.

As a generic term, Winchester usually refers to the technology of "fixed" hard disks (factory-sealed within a super-clean air-tight housing). It is sometimes also (loosely?) applied to removable hard disks. Whether fixed or not, hard disks provide mass memory storage far exceeding floppy disks in capacity and speed of data transfer—and, of course, in cost.

Hard disks come in several sizes: 5¼-, 8- and 14-inch diameters are the most common, with the 5¼-inch disk the one usually interfaced with microcomputers. The disks, or platters, are made of aluminum, either thin-film plated or coated with ferric oxide or other magnetic media. Both surfaces of a platter are used to record data; hence there is a read/write head for each surface. Also, multiple platters may reside in one drive housing, thus allowing a choice of varying capacities.

To facilitate data transfer, the disk rotates at high speed (usually 3600 rpm, in contrast with a floppy disk drive's 300), so the head would gouge the disk if it touched. It therefore "flies," but (in a fixed drive) only about 18 *millionths* of an inch above the platter surface—a gap about one-tenth the size of a human hair!

Obviously, this is a high-precision machine. Dust, smoke particles or other impurities on a disk would quickly crash the head—hence the sealed housing. This is no guarantee against disaster, however, so a Winchester should always have back-up storage in the form of tape, floppies or even another Winchester.

Assembly listing of 6809 driver for the OS9 operating system.

```
*******************************************************
**        OS9 Level One Disk Driver For The          **
**     Western Digital WD1000 10 Meg Winchester      **
**     Controller within the Gallium 10 System       **
*******************************************************

* Author: Steve Childress of Conejo Computer Products
*         31220 La Baya Dr. Suite 110
*         Westlake Village, CA 91360
* Origin: Adapted from a Micrwoware Systems Corp.
*         floppy disk driver.
* Revision History:
* Rev   Initials/Changes made
* ---   ------------------------------------
*   1   SLC 7/82 Initial design

***** Macro definitions ******

          OPT     LIS          enable macro lib'y listing
          USE     /h0/defs/maclib1 pickup selected macros

***** Macro library "MACLIB1" *****

* Compare and branch if equal
* CBEQ [A | B] [#n | addr],label
CBEQ      macro
          cmp^1   ^2
          beq     ^3
          endm
* Compare and branch if not equal
CBNE      macro
          cmp^1   ^2
          bne     ^3
          endm
* Compare and branch if higher
CBHI      macro
          cmp^1   ^2
          bhi     ^3
          endm
* Compare and branch if lower
CBLO      macro
          cmp^1   ^2
          blo     ^3
          endm
* LSRD n    Logical right shift D
LSRD      macro
          dup     ^1
          LSRA
          RORB
          endd
          endm
* LSLD n    Logical left shift D
LSLD      macro
          dup     ^1
          LSLB
          ROLA
          endd
          endm
          IFP1
          USE     /H0/DEFS/OS9DEFS pickup system EQU's
          USE     /H0/DEFS/RBFDEFS and Random Block Mgr's EQU's
          ENDC
```

More

Listing continued.

```
          0001  DRVCNT    SET     1           NOTE!! this version supports only dr
          0001  REV       SET     1           version number

                ******** RAM organization for each drive *********

 0007                     ORG     DRVBEG      set data counter per System EQU's
 0007                     RMB     DRVMEM*DRVCNT
 001F           CURTBL    RMB     2           Points to current drive table
 0021           CURDRV    RMB     1           current drive no.
 0022           V.TRKR    RMB     2           ADDR OF TRACK REG
 0024           V.FREZ    RMB     1           FREEZE DD.INFO

          0025  DSKSTA    EQU     .           Total RAM required

                ********* OS9 Memory Module Header *****************

 0000                     MOD     DSKEND,DSKNAM,DRIVR+OBJCT,REENT+REV,DSKENT,DSKST
 0000 87CD01F7000EE1812D00150025
 000D FF                  FCB     $FF         Public access permitted

 000E 5744313030 DSKNAM   FCS     "WD1000" Name of driver
 0014 B0
 0014 01                  FCB     1           programmer's edition number

                ****************************************
                * BRANCH TABLE

 0015 160030    DSKENT    LBRA    INIDSK      INITIALIZE
 0018 160095              LBRA    READSK      READ SECTOR
 001B 16006B              LBRA    WRTDSK      WRITE SECTOR
 001E 16001A              LBRA    GETSTA      GET STATUS
 0021 160003              LBRA    PUTSTA      PUT STATUS
 0024 160195              LBRA    TERMNT      TERMINATE DEVICE USE

                ********************** PUT STATUS CALL
                * Put status is used to command special actions

 0027 AE26      PUTSTA    LDX     PD.RGS,Y    POINT TO PARAMS
 0029 E602                LDB     R$B,X       GET STAT CALL CODE
 002B                     CBEQ    B #SS.RST,RESTOR RESTORE?
 002B C103                cmpB    #SS.RST
 002D 2737                beq     RESTOR
 002F                     CBEQ    B #SS.WTK,WRTTRK WRITE TRACK?
 002F C104                cmpB    #SS.WTK
 0031 277B                beq     WRTTRK
 0033                     CBEQ    B #SS.FRZ,SETFRZ FREEZE DD.INFO?
 0033 C10A                cmpB    #SS.FRZ
 0035 2708                beq     SETFRZ
 0037                     CBEQ    B #SS.SPT,SETSPT SET SECTORS/TRK?
 0037 C10B                cmpB    #SS.SPT
 0039 270B                beq     SETSPT

                ********************** GET STATUS CALL
 003B 53        GETSTA    COMB                error: not required for this drive
 003C C6D0                LDB     #E$USVC     ERR CODE
 003E 39                  RTS

                * freeze the volume info
 003F C6FF      SETFRZ    LDB     #$FF        n/a for this driver
 0041 E7C824              STB     V.FREZ,U    SET FLAG
 0044 5F                  CLRB
 0045 39                  RTS

 0046 5F        SETSPT    CLRB                n/a for this driver
 0047 39                  RTS

                ************************************
                * INITIALIZE
                * INPUT: (U) POINTER TO GLOABAL STORAGE

 0048 3410      INIDSK    PSHS    X
 004A 3047                LEAX    DRVBEG,U    POINT TO 1ST DRIVE TABLE
 004C 86FF                LDA     #$FF
 004E C601                LDB     #DRVCNT
 0050 E746                STB     V.NDRV,U    SET MAX DRIVES
 0052 A702                STA     DD.TOT+2,X  INIT TO NON-ZERO
 0054 A78815              STA     V.TRAK,X    INZ TO HI TRACK CNT
 0057 6F8824              CLR     V.FREZ,X
 005A AE41                LDX     V.PORT,U    POINT TO I/O PORT
 005C 8601                LDA     #1          write precomp reg
 005E C62F                LDB     #190/4      precomp at cylinder # >=190
 0060 ED84                STD     ,X
 0062 8D02                BSR     RESTOR      home the head
 0064 3590                PULS    X,PC        return
 0066

                ************************************
                * Restore head to cylinder zero
 0066 3416      RESTOR    PSHS    D,X
 0068 AE41                LDX     V.PORT,U    I/O base address
 006A 8606                LDA     #6          select drive register
 006C 5F                  CLRB
 006D ED84                STD     ,X          select drive 0
 006F CC0716    RES1      LDD     #$0716      restore
 0072 ED84                STD     ,X
 0074 A601      REST1     LDA     1,X         get status
 0076 2BFC                BMI     REST1       loop on busy
 0078 A601                LDA     1,X
 007A 8450                ANDA    #$50        seek complete, ready
 007C                     CBNE    A #$50,RES99
 007C 8150                cmpA    #$50
 007E 2603                bne     RES99
 0080 5F                  CLRB                Success status
 0081 3596                PULS    D,X,PC      restore regs & return
 0083
                * Process error with restore
```

More

the SS50 computer (a Southwest Technical Products 6809 system). The Apple card has many chips, 80 percent of which have nothing to do with the disk drive itself, but rather support EPROM for booting and RAM for supporting Apple's DOS. The software supplied consists of a utility to initially format the disk and a program which patches Apple DOS 3.3 to use the Winchester as well as the Apple floppies.

Unfortunately, the limitations of the fundamental design of Apple DOS preclude treating the Gallium as a single large disk. Instead, the software breaks the drive into 78 "volumes," each one equivalent to a floppy disk. Happily, most newer systems I've seen don't have the constraints of DOS 3.3. Pity the user who buys a Winchester to allow for a large database of business information, only to discover that while he can now have lots of files, none can be larger than the 130K or so bytes of the floppy! In my case, the DOS 3.3 constraints were unimportant, as I intended to use the drive with Microware Systems' OS9, which has no such problems.

The Apple DOS 3.3 tests were successful nonetheless, and the speed improvement was especially impressive. Because the disk revolves at 3600 RPM, the sectors can be read at a rate of 16 milliseconds per sector (60 sectors per second). With clever sector interleaving, this can improve to 120 or more sectors per second. Since we are using a parallel, program-controlled interface, the speed is limited by how fast the driver software can copy the 256 bytes to or from the controller. Very few files exceed 60 or so sectors, however, so usually it takes only a fraction of a second to load a program from disk into memory.

The SS30 Bus Interface Card

The Western Digital controller came with a manual that I used in designing the interface for the SWTP 6809 system. Here's a quick run-down of the design. (Fig. 1.)

The WD 1000 controller requires a tri-state eight-bit bidirectional data bus for exchanging data, three address lines to select one of eight registers, and a couple of control lines. The Winchester chip is basically the same as the FD177x chip, but has more registers and the sophistication described earlier.

The 'LS245 buffers the data bus, since the drive is on the far end of about three feet of ribbon cable. The 'LS174 accepts and holds the desired

ircle 150 on Reader Service card.

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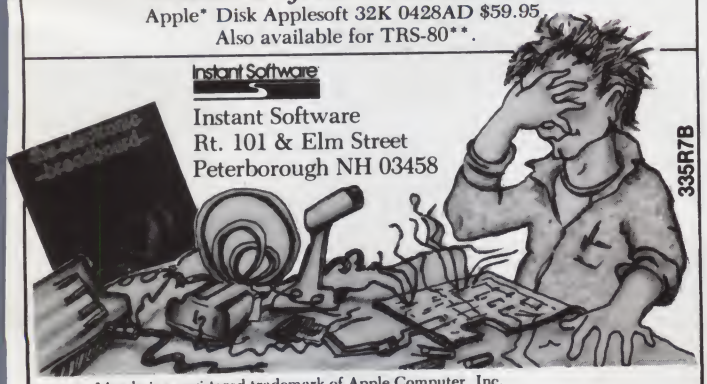

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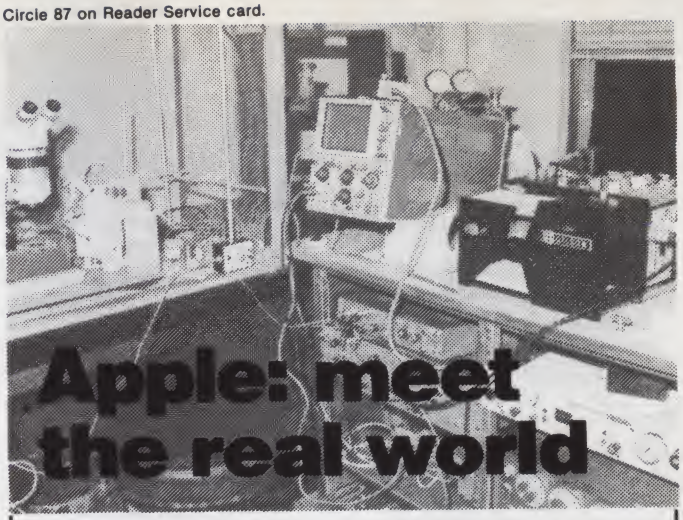
Circle 87 on Reader Service card.



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controller register number (0–7) as sent by the software. (Many systems would use the main memory address lines for the register select, but my technique was aimed at putting the disk interface in one of the SS30C I/O slots, rather than on the main motherboard.)

The 'LS138 chip decodes the RS0 and RS1 signals which provide a one-of-four select for memory-mapped I/O within the registers on the SS30 card itself. The R/W bus signal (read/write) is used as the least significant bit for the 'LS138 to allow for four read and four write registers.

The resulting map is:

Address	Function
PORT+0	read: input miscellaneous status bits
PORT+0	write: sets address bits sent to the controller and sets utility bits for on-board use
PORT+1	read: input data from controller
PORT+1	write: output data to controller

where PORT is $E000 plus four times the slot number (0–7) per the SS30C standard. (The newer SS30 machines provide 16 addresses per slot rather than four.)

The bit layout of PORT+0 is:

Read: bit 0 is "data request" from the controller. This bit is available, but not needed for most applications.

bit 7 is "interrupt request" from the controller and is used as a "device done" indicator for interrupt-driven systems.

bits 1,2,3,4,5 and 6 are unused and undefined.

Write: bits 0,1,2 are the controller's address lines—A0, A1 and A2, respectively. The software must write to this register to select which of the controller's eight registers are to be accessed.

bit 3 is the "interrupt enable." If set to one, the controller's interrupt request will pass through to the SS50 bus IRQ. If zero, interrupts are blocked. This bit is zeroed by system reset for the default.

bits 4,5,6 and 7 are unused.

The layout of the PORT+1 Read/Write bits is governed by the controller registers as described in the data sheet for the chip/controller and the WD *1000 OEM* manual.

With this organization, we access the chip with 6809 code such as:

```
Slot    EQU 3
PORT    EQU Slot*4+
        $E000
CMDST   EQU 7          WD command/
                       status register #
Rdcmd   EQU $20        WD read com-
                       mand
```

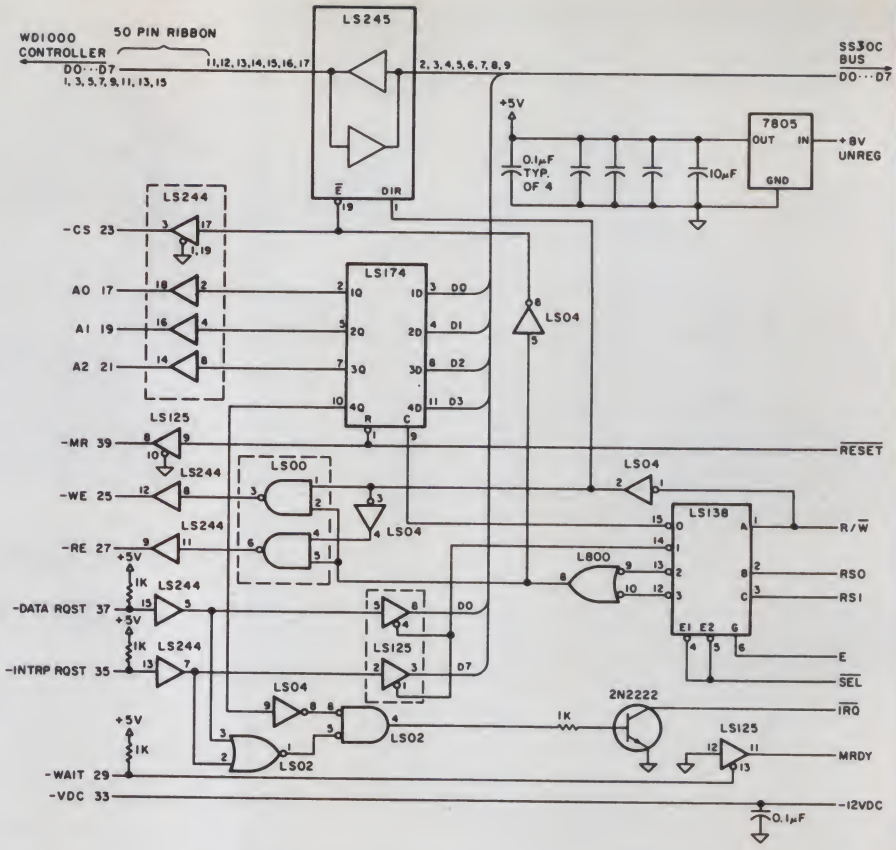

Fig. 1. Schematic of SS30 Bus Winchester Interface Card.

Listing continued.

```
0083 43        RES99    COMA                 set carry
0084 3516               PULS   D,X
0086 C6F6               LDB    #E$NRDY       not ready error code
0088 39        RETRN1   RTS

                        **** WRITE SECTOR ***************
                        *INPUT: B = MSB OF LOGICAL SECTOR
                        *       X = LSB OF     "      "
                        *       Y = PTR TO PATH DESCR.
                        *       U = PTR TO GLOBAL STORAGE

0089 17006D    WRTDSK   LBSR   SELECT        select drive
008C 25FA               BCS    RETRN1        if error
008E 17008F             LBSR   PHYSIC        send disk addr
0091 25F5               BCS    RETRN1        if error
0093 3430               PSHS   X,Y           save regs
0095 AE41               LDX    V.PORT,U      get I/O reg addr
0097 CC0730             LDD    #$0730        WRITE CMD
009A ED84               STD    ,X            issue cmd
009C 10AE28             LDY    PD.BUF,Y      BUFFER ADDR
009F 5F                 CLRB
00A0 E784               STB    ,X            select reg 0=data

00A2 A6A0      WRITE4   LDA    ,Y+           get next byte
00A4 A701               STA    1,X           send it
00A6 5A                 DECB
00A7 26F9               BNE    WRITE4        loop for 256
00A9 3530               PULS   X,Y           restore regs
00AB 1600C7             LBRA   STCK              RETURN VIA STATUS CHECK

00AE
                        ************************************************
                        * WRITE TRACK (format disk)
                        * IN: (A) TRACK NO.
                        * (Y) PATH DESCRIPTOR
                        * (U) GLOBAL STORAGE
                        * [ UNIMPLEMENTED FOR NOW ]
00AE 5F        WRTTRK   CLRB                 no error status
00AF 39                 RTS
00B0
                        ************************************************
                        * READ SECTOR
                        * IN- B=MSB OF LOGICAL SECTOR NO.
                        * X=LSB'S     "     "
                        * Y= PATH DESCRIPTOR
                        * U= GLOBAL STORAGE

00B0 170046    READSK   LBSR   SELECT        select drive
00B3 250E               BCS    READNG        if error
00B5 170068             LBSR   PHYSIC        send head/sector/cyl no
00B8 2509               BCS    READNG
```

More

Listing continued.

```
00BA 3084              LEAX   ,X          IS THIS SECTOR 0?
00BC 2725              BEQ    READ0       special processing

00BE 8D04    RDDSK3    BSR    READSC      READ SECTOR
00C0 2501              BCS    READNG      IF NO ERROR
00C2 5F                CLRB               return success code of 0
00C3 39      READNG    RTS

                       **************
                       * Subroutine READSC reads the selected sector
00C4 3430    READSC    PSHS   X,Y
00C6 AE41              LDX    V.PORT,U
00C8 10AE28            LDY    PD.BUF,Y
00CB CC0720            LDD    #$0720      READ CMD
00CE ED84              STD    ,X          SEND COMMAND
00D0 A601    READSX    LDA    1,X         get wd status
00D2 2BFC              BMI    READSX
00D4 5F                CLRB               byte count
00D5 E784              STB    ,X          select data reg
                       * READ SECTOR LOOP
00D7 A601    READS4    LDA    1,X         GET DATA
00D9 A7A0              STA    ,Y+         STORE AWAY
00DB 5A                DECB
00DC 26F9              BNE    READS4

00DE 3530              PULS   X,Y         RESTORE
00E0 160092            LBRA   STCK        GO GET STATUS

                       ************ READ SECTOR 0 ************
                       * Whenever sector 0 ( the volume status block ) is read
                       * the volume's characteristics are copied to the OS9
                       * path descriptor for the Random Block File manager's
                       * use in dealing with any arbitrary device type.
00E3
00E3 8DD9    READ0     BSR    RDDSK3      READ SECTOR 0
00E5 25DC              BCS    READNG      IF ERROR
00E7 3430              PSHS   X,Y         save regs
00E9 AE28              LDX    PD.BUF,Y    get addr of path descriptor
00EB 3147              LEAY   DRVBEG,U    addr of drive table
00ED C614              LDB    #DD.SIZ-1   number of params to copy
00EF A685    READ01    LDA    B,X         copy 1st N params
00F1 A7A5              STA    B,Y
00F3 5A                DECB
00F4 2AF9              BPL    READ01
00F6 5F      READ05    CLRB               OK STATUS
00F7 35B0              PULS   X,Y,PC      RETURN
                       ***************************************
                       * SELECT DRIVE
                       * All regs saved if no error,
                       *  else error code in B and C=1
00F9 3416    SELECT    PSHS   D,X
00FB A6A821            LDA    PD.DRV,Y    drive # from path descriptor
00FE A7C821            STA    CURDRV,U    save in drive table
0101 A146              CMPA   V.NDRV,U    VALID DRIVE #?
0103 2215              BHI    ERUNIT      if no
0105 3047              LEAX   DRVBEG,U    TABLE BEGINNING
0107 AFC81F            STX    CURTBL,U    save current drive
                       *** Note: For multiple drives, this table is used
                       ***   to save and unsave the drive's cylinder number.
010A AE41              LDX    V.PORT,U    controller address
010C 5F                CLRB               drive no.
010D 8606              LDA    #6          drive regis
010F ED84              STD    ,X
0111 5F                CLRB               CARRY=0
0112 3596              PULS   D,X,PC      RETURN

                       * Handle drive select error:
0114 3516    SELNG     PULS   D,X
0116 53                COMB               set carry
0117 C6F6              LDB    #E$NRDY     not ready error
0119 39                RTS

                       * Handle drive not ready error
011A 3516    ERUNIT    PULS   D,X
011C 53                COMB               CY=1
011D C6F0              LDB    #E$UNIT     ERROR CODE
011F 39                RTS

                       ***********************************************
                       * CONVERT LOGICAL->PHYSICAL DISK ADDR
                       * B has hi-order of 24 bit disk addr, low in X
0120 3436    PHYSIC    PSHS   D,X,Y
0122 5D                TSTB               MSB MUST BE 0
0123 264A              BNE    PHYERR      IF NO
0125 1F10              TFR    X,D         LOGICAL ADDR
0127 10830005          CMPD   #5          small address?
012B 2318              BLS    PHY0        if yes, no divide needed
012D 3440              PSHS   U           save U
012F 1F43              TFR    S,U         see calling seq to DIV
0131 327C              LEAS   -4,S        param area
0133 3606              PSHU   D           put dividend on stack
0135 CC0006            LDD    #6          divisor
0138 3606              PSHU   D
013A 170081            LBSR   DIV         divide by 6, remain in X
013D 3510              PULS   X           get remainder
013F 3506              PULS   D           get quotient
0141 3540              PULS   U
0143 2002              BRA    PHY1
0145 4F      PHY0      CLRA               quotient=0
0146 5F                CLRB               remainder in X is 0..5
0147 10AE41  PHY1      LDY    V.PORT,U    get disk port addr

014A 1E10              EXG    X,D         diskaddr mod 6 in D
014C 8606              LDA    #6          head # register
014E EDA4              STD    ,Y          send head # 0-5 to to controller
```

More →

```
LDX    #PORT          I/O base address
LDA    #CMDST         WD status reg #
STA    ,X             select status
LDA    1,X            get status in A
...
LDD    #CMDST*256     A=cmd reg #,
       +Rdcmd         B=command
                      code
STD    ,X             send register
                      select and cmd
...
```

For those of you not familiar with the 6809, a 16-bit instruction such as STD stores the D register, which is actually the A and B register paired end-to-end. The 68xx family of chips stores 16-bit quantities, with the high order eight bits at the lower of the two addresses for the two bytes (unlike the Intel and other chips). Thus, the STD in the example sends the WD register number to PORT + 0, followed immediately by the value of Rdcmd to PORT + 1. This could also have been coded:

```
LDA    #CMDST
LDB    #Rdcmd
STA    ,X
STB    1,X
```

The Controller's Design

Returning now to the design of the interface, one "gotcha" came up in interfacing the controller to the SS30 bus. The data transfer to and from the controller cannot always be completed in a single cycle of the 6809. The WD data says that up to six microseconds are required to accept or emit a data byte. Fortunately, the 6809's designers allowed for such slow memory devices by providing an input to the 6809 chip called Memory Ready (MRDY). This signal, when zero, causes the 6809 to hold the address lines constant and stretch the clocks until MRDY goes to a one. The WD controller outputs a signal called Wait, which is true so long as the controller needs the address and data lines held constant. So the simple solution is to connect Wait to MRDY (with appropriate gating).

This was done rather easily as shown in the schematic, but a little disclaimer is needed here. My design does not consider the possibility of some direct-memory access (DMA) device (like a double-density floppy controller) contending for the MRDY line along with the controller, which is not DMA-based. In theory, the DMA device's bus cycle and the controller's bus cycle are independent and no conflict would arise. However, I've not studied it in depth.

Listing continued.

```
                *       drive 0 assumed!
0150 1F10               TFR     X,D             disk addr/6 in D
0152 C41F               ANDB    #31             sector no.
0154 8603               LDA     #3              register for sector
0156 EDA4               STD     ,Y              send sector no.
0158 1F10               TFR     X,D             disk addr/6
015A                    LSRD    5 shift 5 right
                0005    dup     5
015A 44                 LSRA
015B 56                 RORB
015C 44                 LSRA
015D 56                 RORB
015E 44                 LSRA
015F 56                 RORB
0160 44                 LSRA
0161 56                 RORB
0162 44                 LSRA
0163 56                 RORB
                        endd
0164 8604               LDA     #4              cyl low order select code
0166 EDA4               STD     ,Y              send low order cyl no.
0168 5F                 CLRB
0169 4C                 INCA                    5, cyl hi order
016A EDA4               STD     ,Y

016C 5F                 CLRB                    CARRY=0 == no error
016D 35B6               PULS    D,X,Y,PC        return

                * Handle illegal disk address error
016F 3536       PHYERR  PULS    D,X,Y
0171 53                 COMB
0172 C6F1               LDB     #E$SECT         ERROR CODE
0174 39                 RTS
                ********************************************
                * CHECK STATUS FOR ERRORS

0175 3410       STCK    PSHS    X
                **** Wait on busy to go false
0177 AE41               LDX     V.PORT,U
0179 8607               LDA     #7              register select for status
017B A784               STA     ,X
017D A601       WBUSY1  LDA     1,X             get WD1000's status
017F 2BFC               BMI     WBUSY1          loop if still busy
0181 8501               BITA    #1              any error?
0183 260D               BNE     STERR           if yes
0185 8606               LDA     #6              deselect drive to extinguish light
0187 A784               STA     ,X
0189 A601               LDA     1,X             get head no.
018B 8A18               ORA     #3*8            select drive 3
018D A701               STA     1,X             to deselect
018F 5F                 CLRB                    OK status.
0190 3590               PULS    X,PC            return with success

                * Determine error causation from the error register
0192 8601       STERR   LDA     #1              select the error status
0194 A784               STA     ,X
0196 A601               LDA     1,X             get error flag bits
0198 3510               PULS    X               clean stack
019A
                * Check each bit, convert to OS9 error codes:
019A
019A 48                 LSLA                    B7
019B 2513               BCS     ERRD
019D 48                 LSLA                    Bit 6
019E 2518               BCS     ERCRC
01A0 48                 LSLA                    Bit 5
01A1 2515               BCS     ERCRC
01A3 48                 LSLA                    Bit 4
01A4 250E               BCS     ERSEEK
01A6 48                 LSLA                    Bit 3
01A7 48                 LSLA                    Bit 2
01A8 2506               BCS     ERRD
01AA 48                 LSLA                    Bit 1
01AB 2507               BCS     ERSEEK
01AD 48                 LSLA                    Bit 0
01AE 2504               BCS     ERSEEK

                * Read error
01B0 53         ERRD    COMB
01B1 C6F4               LDB     #E$RD
01B3 39                 RTS
01B4
                * Seek error
01B4 53         ERSEEK  COMB
01B5 C6F7               LDB     #E$SEEK
01B7 39                 RTS
01B8
                * Unrecoverable CRC check error
01B8 53         ERCRC   COMB
01B9 C6F3               LDB     #E$CRC
01BB 39                 RTS
                * TERMINATE USE OF DISK
01BC 5F         TERMNT  CLRB                    no action needed
01BD 39                 RTS


                ******** Unsigned 16 bit divide ***********
                ** Credit to OmegaSoft's 6809 Pascal for
                **   this routine (modified interface)

          0000  MTEMP   EQU     0               STACK STORAGE FOR DIVIDE

                *********************************
                * Input:  0,U is dividend
                *         2,U is divisor
```

More

Another minor constraint is that if the controller is connected to the SS30 card but powered down, pull-down resistors within the controller card will cause the Wait signal to default to zero. This can cause MRDY to go permanently true (0) if the card is accessed while the drive is off. This one I dismiss as does the doctor who says "It hurts when you do that? Well, don't do that!"

The MRDY signal was not routed to the I/O area of the SWTP motherboard, so I ran a discrete wire to the main section to pick it up from "MRESET," the pre-6809 name for that bus line.

With this relatively inexpensive Winchester and an 80-column display, the Apple II can compete head-on with the newer $10,000 systems.

One last gotcha item is that there is a problem with the old SWTP motherboards that have been modified for the 6809 memory map with I/O moved up to $E000. The modification results in glitches on the slot select lines (SEL), due to cascaded decoder chips on the motherboard. If SEL is sent directly to the controller as chip select, the glitches cause spurious and mistimed MRDYs which actually crash the 6809. My design gates out the glitches, using the master clocks to solve the problem. This one took a couple of days to find, so beware!

Lastly, be aware that the very early 6809 chips did not properly handle MRDY as implemented by SWTP. The Motorola data sheets for the 6809 specify which chips are flawed and show how to tell them by the part numbers on the '09 DIP. Just avoid those early chips and you'll be OK.

To conclude the discussion of the SS30 card, I built the thing on a prototyping board (30-pin, or SS30) which is available for $30 or so. The chips were placed in wirewrap sockets. Be sure to use the sockets with short pins (two-level wirewrap), or the pins will bump into a neighboring card.

The ribbon cable from the card to the Gallium has 50 conductors, and I was stumped for a while on how to connect it to the SS30 card. I wound up using a 50-pin right-angle header, which plugs into the hole pattern on the card and accepts the plug on the

ribbon. The wiring to the header is simple, since all the pins on one side of the header are soldered to the ground plane. I cut away the VCC plane to clear the other 25 pins. Perhaps a better choice in prototyping cards would eliminate this hacking.

Onward and Upward To the Software

Since the WD controller is so intelligent, I was able to prove that the SS30 card was working properly by writing a program in Basic which used pokes and peeks to exercise the disk.

The early steps involved writing and reading registers 0-6 of the controller to ensure that no bits were being garbled and that the correct address was sent to A0, A1 and A2 of the WD board. Peeking the status register (7) yielded $50 as the normal, idle status. Now poking a restore command to the register caused a command to begin. Peeking the status register (7) until the high-order bit "busy" goes off shows when the command finishes. Now the status register should indicate "no errors."

When these tests were completed, it was time to begin the Winchester driver for the OS9 operating system.

As shown in the listing, the OS9 driver is not very complex, since the logic for error retry and seeking (head positioning) is done by the controller itself. While I won't go into the philosophy of OS9 I/O drivers, I'll discuss the driver in terms of the Gallium disk requirements.

Listing continued.

```
                        * Output: Ø,U is remainder (dividend MOD divisor)
                        *         2,U is quotient  (INT(dividend / divisor))

Ø1BE 4F          DIV    CLRA                       SET FLAG TO DIVIDE
Ø1BF 327E        HDM    LEAS   -2,S
Ø1C1 A761               STA    MTEMP+1,S           SET FLAG
Ø1C3 8601               LDA    #1
Ø1C5 6DC4               TST    Ø,U                 CHECK FOR ALREADY JUSTIFIED DIVISOR
Ø1C7 2BØ7               BMI    HDIV53
Ø1C9 4C          HDIV51 INCA
Ø1CA 6841               ASL    1,U
Ø1CC 69C4               ROL    Ø,U
Ø1CE 2AF9               BPL    HDIV51              HAVE IT JUSTIFIED NOW
Ø1DØ A7E4        HDIV53 STA    MTEMP,S             SAVE COUNTER
Ø1D2 EC42               LDD    2,U                 GET DIVIDEND
Ø1D4 6F42               CLR    2,U
Ø1D6 6F43               CLR    3,U                 CLEAR OUT QUOTIENT
Ø1D8 A3C4        HDIV63 SUBD   Ø,U                 SEE IF IT WILL GO
Ø1DA 2406               BCC    HDIV65
Ø1DC E3C4               ADDD   Ø,U                 GET BACK
Ø1DE 1CFE               CLC
Ø1EØ 2ØØ2               BRA    HDIV67
Ø1E2 1AØ1        HDIV65 SEC
Ø1E4 6943        HDIV67 ROL    3,U
Ø1E6 6942               ROL    2,U                 PUT BIT IN QUOTIENT
Ø1E8 64C4               LSR    Ø,U
Ø1EA 6641               ROR    1,U                 ADJUST DIVISOR
Ø1EC 6AE4               DEC    MTEMP,S
Ø1EE 26E8               BNE    HDIV63
Ø1FØ EDC4               STD    ,U                  REPLACE divisor WITH REMAINDER
Ø1F2 359Ø               PULS   X,PC                REMOVE 2 BYTE STACK FRAME AND RETURN
Ø1F4 FDBD86             EMOD   OS9                 Module end (generates module CRC check

        Ø1F7 DSKEND     EQU    *

Symbol Table Size:  6230
2940 Unused Bytes of Macro Storage
   Ø Statement Error(s), Last PC: $Ø1F6
```


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11303	16	.64	.58	.48
11304	18	.73	.66	.55
11305	20	.99	.90	.75
11306	22	1.12	1.02	.85
11307	24	1.25	1.14	.95
11308	28	1.52	1.38	1.15
11309	40	2.05	1.86	1.55

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11202	14	.14	.13	.12
11203	16	.16	.15	.14
11204	18	.18	.17	.15
11205	20	.20	.18	.16
11206	22	.22	.20	.18
11207	24	.24	.22	.20
11208	28	.28	.26	.25
11209	40	.40	.37	.33

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13830	CB3814	3.0-7.0	-28±0.7	0-10	.48x.51x3.05	7.95
1.5 W TYPE:						
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Microware's OS9 is an interrupt-driven, Unix-like operating system with multiple "tree-structured" file directories. This is ideal for a large Winchester, since a separate directory can be set up for each category of software by project, data type, user or whatever. Unlike Apple DOS, there's no limit to the size of a file or the number of files or directories.

The OS9 driver software is pure code, with no data storage areas, and is intended to provide the program code to interface to a particular type of controller. Due to hardware differences, a controller for floppies requires a different driver than the Winchester. All drives connected to a single controller—and all like controllers—share the same driver software. OS9 contains for each drive a "device descriptor", which is a table of constants telling the driver the characteristics of that particular drive. These include: the PORT address of the controller, the number of tracks, whether single- or double-sided, the density, and so on.

One driver can handle many like controllers with multiple drives on each. The device descriptor table also assigns a name to each drive; i.e., D0, D1, H0 or whatever. The user talks to the drive via its name. Also in the device descriptor is the ASCII name of the driver for that particular drive. This is the way OS9 makes the logical connections of drivers and drives transparent to the user.

I think Microware did a splendid job. In my system, with 5-inch, 8-inch and Winchester disks, I boot from the 5-inch and switch everything to the Winchester, using the floppies only for backup and archival storage of data and programs. The driver for the 8-inch is loaded into memory only when I'm actually using that drive. Then it's released to conserve memory.

Returning to the driver listing, OS9 requires a "Jump" table containing LBRA instructions to transfer to the standard subroutines within any OS9 driver. As seen in the listing, these include Initialize, Read sector, Write sector, Seek, Write track and Get/Put status. Microware supplies fairly good documentation on the standards for these instructions in the *System Programmer's Manual* for OS9.

Mating a Winchester With a Controller

By Ken Barbier

Getting started with a new technology is always interesting, often exciting, and sometimes frustrating. While the 5¼-inch Winchester disk is not exactly a new technology, deliveries and applications snowballed in 1982, when the industry really cranked up production while quietly establishing some informal standardization.

While working recently with Action Computer Enterprise of Pasadena, CA, on its project to develop a desktop multiuser multiprocessor, I became closely acquainted with a number of Winchesters currently on the market. What I learned may be of interest to everyone from systems integrators to serious hobbyists, as the prices of hard disk drives and controllers continue to drop.

In integrating its new Discovery 500 system, Action Computer had many Winchesters to choose from, but few controllers. It finally settled on Data Technology's DTC-520A, the only one at that time available in quantity and suitable for the project. The 520A can handle up to four disk drives, two of which can be Winchesters. It is a "smart" controller, with its own onboard microprocessor, providing increased throughput while simplifying the software required in the host computer.

A dozen or so different Winchester drive evaluation units had arrived while the controller decision was being made, and these now had to be tested for compatibility with the DTC controller and evaluated for performance.

All but one of the 5¼-inch Winchester hard disk drives with fixed media received were compatible with the Seagate Technology ST506 drive interface, and operated properly (eventually!) on the DTC controller. This compatibility was limited to the pin designations and signal levels found on the 34-conductor control connector and the 20-conductor signal connector. Incompatibilities did exist in disk formats, signal timing, performance and power requirements. More of these differences were discovered in testing than were apparent from studying the specifications.

The very first hard disk drive to be plugged into the Discovery 500 prototype was from one of the biggest names among disk drive manufacturers. It would not respond to any commands issued by the host computer. Consultation with the factory and the delivery of another evaluation drive produced no better results.

Much later it was discovered that the drive specifications indicated that it had more platters (and therefore more read/write heads) than actually existed. Before the drive could be accessed for reading or writing, it had to be formatted. The controller tried to format nonexisting platters, couldn't find them, and simply reported "drive not ready" back to the host computer. This typifies the problems that arose during the development phase of the project.

Drive manufacturers specify "unformatted capacity 12.25 MB" or "12.76 MB" or "13.3 MB," to quote actual examples, in an effort to claim as much capacity as possible. However, it is the formatted capacity that is available to the user, and the format is dependent on the characteristics of the controller, not the drive. It is possible for a drive manufacturer to format a hard disk with special data compression techniques in order to win the specified capacity race, but these funny formats do the user no good whatever if his controller is not compatible with that particular format.

The DTC-520A controller provides the user with a selection between two standard track formats: 33 256-byte sectors or 18 512-byte sectors per track. Since our evaluation drives were received with all kinds of prerecorded formats, we had to make use of the controller's Format Drive command to re-re-

(Continued on p. 36)

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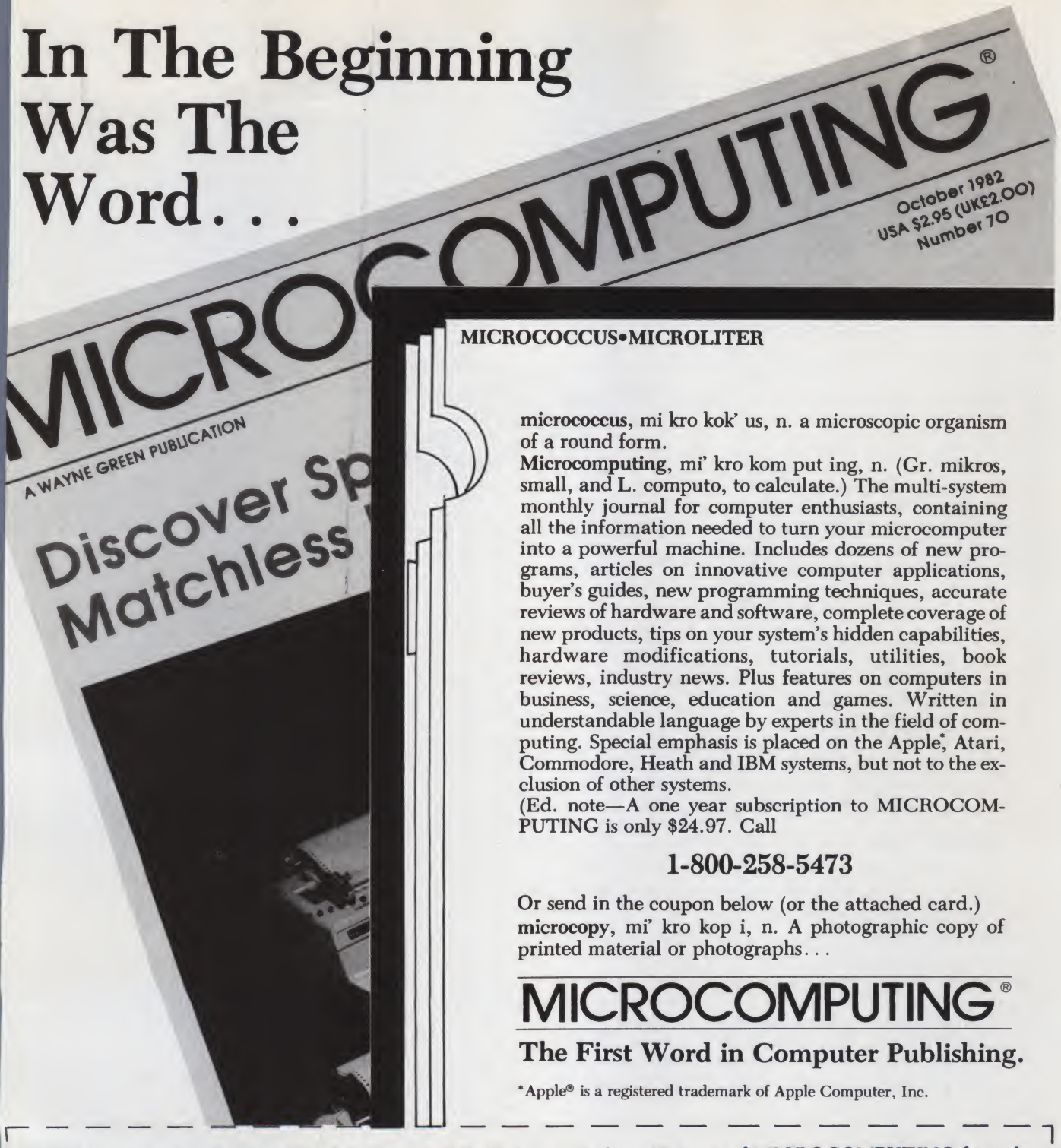

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The Initialize routine does little for the Winchester. Read and Write must convert the OS9-supplied logical sector number (a 24-bit binary integer) to the appropriate numbers for addressing a specific sector on one of the six surfaces.

Address Arithmetic

Here I deviated somewhat from a long-standing IBM standard for hard disks. Convention says to go through all sectors on a track before changing heads (surfaces). In my translation of the logical sector number to the disk address, the driver scans through all six surfaces (numbered 0–5) before switching to the next sector of the cylinder. That is, the driver scans vertically through cylinder-sector 0 , then through sector 1 and so on. After scanning through all 32 sectors of a cylinder, the driver advances to the next cylinder. (There is no speed penalty in this procedure, since head-select time is only about six microseconds.)

The Gallium 10.

(From p. 34)

cord the surfaces of all the platters with one of the two available formats. Obviously, the choice was the most dense format, 18 512-byte sectors. The 12.25, 12.76 and 13.3 MB capacity drives all ended up providing 11,016K of usable storage.

Cylinders × Heads = Tracks

To calculate the usable storage on a hard disk, the user must know how many platters exist within the sealed disk enclosure—no peeking allowed. The number of read/write heads is twice the number of platters. The number of cylinders specified by the drive manufacturer is the number of tracks available on each disk surface. These tracks are created during the formatting process; they are not physical entities.

Some early 5¼-inch drives used more platters and fewer cylinders to achieve comparable disk capacity. This allowed less accurate head positioning (the tracks were farther apart) and less precise head manufacturing. A typical early drive had two platters, four heads and 159 cylinders, for an unformatted capacity of 6 MB.

As the capacity race heated up, manufacturers began supplying drives with more tightly spaced cylinders. An informal standard evolved, and virtually all the drives readily available today have 306 cylinders. A single platter drive therefore has 612 tracks: two heads times 306 cylinders. With 18 sectors of 512 bytes each, those 612 tracks provide 5508K bytes of formatted storage.

The drive that wouldn't play was actually of that configuration. It arrived with the specifications of the earlier model: four heads and half the number of cylinders. The model number reflected the total capacity, and gave us no hint of the actual internal configuration of the drive. A needless panic arose, due to improper documentation.

Since the drives were being selected for installation in a small multiuser computer, the two-platter 306-cylinder drive was standardized as the smallest practical size. While this provides slightly over 11 MB of storage, this model of the Discovery 500 is called a 10 MB system for simplicity.

Upgrading Hard Disk Capacity

Five-and-one-quarter inch Winchester disk drives are currently being delivered with up to four platters. With the 306-cylinder density and the DTC-520A controller track format, this provides a maximum of 22,032K of formatted storage. As of this writing, only one supplier has delivered a production-model drive in this capacity. It has proved to be compatible with the smaller drives, following the necessary disk driver software changes.

Other disk drive manufacturers have "announced" drives storing up to 140 MB on eight platters with 16 heads. While this is exciting, it is not here today, and in any case will not be compatible with the DTC controller, which can address a maximum of eight read/write heads.

Obviously, then, to upgrade to these exotic storage capacities will require more than the presence of the drive. A new controller, and extensive software rewriting, will be necessary.

Software Considerations

Since the DTC-520A is a "smart" controller, the necessary disk driver software is simplified and easy to reconfigure for different disk characteristics and capacities. When the computer system is initialized at power up, the disk drive characteristics are written to the DTC controller by the host computer, and from then on data is accessed according to an absolute sector number, beginning with zero.

The host computer software does

(Continued on p. 37)

(From p. 36)

not need to keep track of the number of disk platters, heads, tracks or cylinders, as the disk sectors are addressed sequentially from the first to the last. The microprocessor on the controller converts an absolute sector address to the proper head, cylinder and sector number.

Also transparent to the host computer software is the disk error detection and correction, and automatic retries following seek errors and soft read errors. For drive testing and diagnostics, these features can be turned off under software control. In the event of errors, the controller provides extensive reporting in the form of error codes, and can be interrogated to provide the address of the sector where the error was discovered.

The ultimate error condition is one in which communication fails between the host computer and the disk controller, or between the controller and the disk drive. To facilitate troubleshooting at this level, the DTC controller provides error codes displayed on a row of light emitting diodes (LEDs) on the controller printed-circuit board. These human-readable codes parallel those readable by the diagnostic software, providing error indications just in case the host computer can't read the controller properly.■

Now to the addressing arithmetic. If N stands for the logical sector number, N modulo 6 determines the surface number (head number) in the WD register set. That is, the *remainder* (0–5) of N/6 = the surface number. Next we need the sector number. Since there are 32 sectors per track, we get the sector number by finding modulo 32 of the *integral* portion of N/6 (already calculated above in finding N MOD 6). Finally, the track (or cylinder) number (0–229) is the *integral* portion of the division of N/6 by 32, which we did to get the sector number.

Put in terms of formulas, if N stands for logical sector number (translated into a decimal), H for head (or surface) number, S for sector number and T for track number:

H = N MOD 6
S = (INT N/6) MOD 32
T = INT [(INT N/6)/32]

For example, if N = 10011000010100 = 9748 decimal,

H = 9748 MOD 6 = 4 (9748/6 = 1624, R4)
S = 1624 MOD 32 = 24 (1624/32 = 50, R24)
T = 50 (the integral value of 1624 divided by 32)

So the required address is sector 24 of track 50 on surface 4 (or, since the numbering begins with 0, the 25th sector of the 51st track on the 5th surface).

Note that the range of OS9's N cannot exceeed 16 bits with the 10-megabyte Winchester (44,000+ sectors), so we can ignore OS9's highest eight bits of the 24-bit number (or maybe ensure that they are zero for safety). Since this math is common to Read and Write, it is a subroutine in the driver, called by both procedures.

Speed becomes a consideration when one tries to optimize the disk Read/Write of sequential sectors so as to "catch" two or more sectors in one revolution of the disk. This is called sector interleaving and is done during formatting by ordering the actual sectors on a track other than 0 to 31. The optimal ordering depends on the operating system's overhead (which affects the rate at which reads are done), and also on the speed at which the data is sourced or consumed by the program doing the disk I/O.

For the simple case of program loading, which involves no computational work for each read, today's microprocessor operating systems can handle about four to eight sectors per revolution at the floppy disk speed of about 300 RPM. The 3600 RPM Winchester is another story! OS9 in particular is hard-pressed to catch two sectors per revolution for program loading with a 1 MHz CPU. For my system, the optimal interleaving would place the even-numbered sectors first on the track, followed by the odd-numbered ones.

I did experiments by reformatting cylinder 229 and doing 16K-byte Reads to see the improvement. Indeed, the speed doubled to one sector every 1/120 of a second after reformatting. I could not get OS9 (level 1) at 1MHz to get four sectors per revolution. Obviously, a DMA-based interface could do much better, but I'm quite happy with a program load time which is faster than I can type. Data file accessing is, in general, not much improved by sector interleaving, especially at 3600 RPM, because of computational delays.

Reading and Writing

For the Read sector routine, the conversion of N to disk address is done; then the WD controller is commanded to read. When this is done (as indicated by the busy bit in the status register), the data in its sector buffer is copied to the OS9 buffer.

You may notice that the copy does not use any handshaking bits to transfer the data from the controller to memory. The manual stresses not to

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use Data Request in the controller, as the transfer can be done at CPU speed without worrying about handshaking. This is a great simplification. On my old 1MHz system, this 256-byte transfer takes only a few milliseconds.

For Write sector, we pretty much do the reverse of the Read sector processing. First, send the disk address; next, send the WD "Write" command; then send 256 bytes to the controller to write. Now we merely wait for busy to go false.

After completing a Read or Write, we must check the resultant status for errors, such as CRC error, sector not found, etc. If one of these happens, it's doomsday, since the controller has tried diligently to recover, even doing home to track 0 and repositioning the head. In several months' operation, I've yet to have a hard error and have had very few soft (recoverable read) errors. If an error is detected, the code in the driver translates the error register (1) bits into the corresponding OS9 error code numbers, which are standard for all drive types.

You may note that the driver does not use the interrupt capability of the hardware. This is a feature I intend to add when time permits, but the drive is so fast that I can live with interrupts blocked for the time being.

As for the Write track routine, Microware implements this for floppy disk formatting, wherein the OS9 Format utility formats each track to simplify the driver. For a Winchester with non-removable media, one essentially never reformats the disk. I chose to NO OP the Write track routine. The Format utility is still run to bring up the disk for the first time; however, it merely establishes the logical organization of the disk by creating the volume index, directories, free-sector bit map, etc., all of which use the driver's sector Read/Write routines. So how did I format the disk? Secret: I used the Apple format utility.

If implemented, the Write track routine would be very simple, consisting of something like:

```
SUBROUTINE Write track

IF OS9-specified track number is not 0
  THEN RETURN {write track 0 does the
    whole disk}

FOR CYLINDER=0 to 229
  {send CYLINDER to WD controller register}
    FOR HEAD=0 to 5
      {send HEAD to WD controller register}
        FOR SECTOR=0 to 31
          {send 0 then SECTOR to WD data
            register}
        NEXT SECTOR
        FOR I=64 to 255
          {send 0 to WD data register (pad out
            buffer to 256)}
        NEXT I
        {send the "format track" command to
          WD cmd register}
          {wait for busy to go false}
    NEXT HEAD
  NEXT CYLINDER
END
```

The details of formatting the disk are in the WD manual.

Epilogue

With the OS9 driver up and running, I'm quite pleased with the Gallium. The more than 44,000 sectors available have improved my efficiency as a software developer tremendously, perhaps by a factor of 4. When editing or word-processing a big file, the exit-with-backup time is now a couple of seconds rather than several minutes, as was the case with eight-inch floppies. You must, however, be disciplined with backup procedures.

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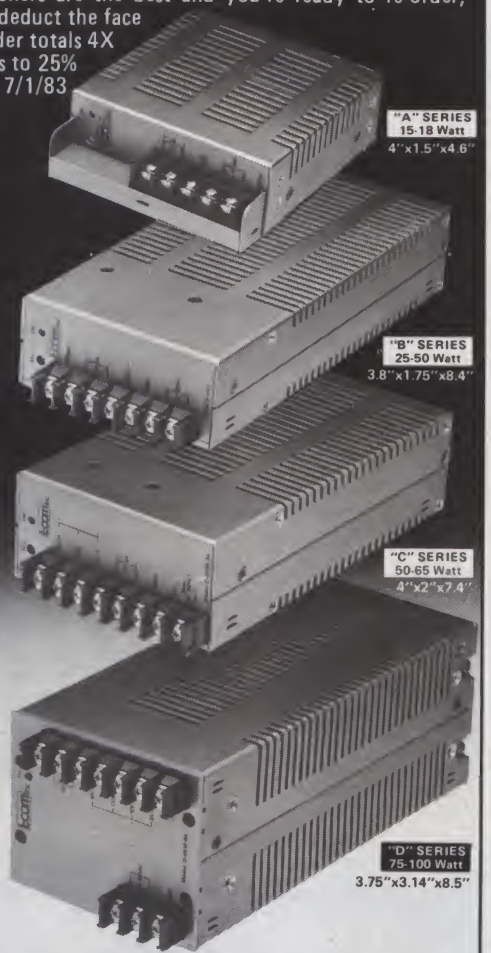

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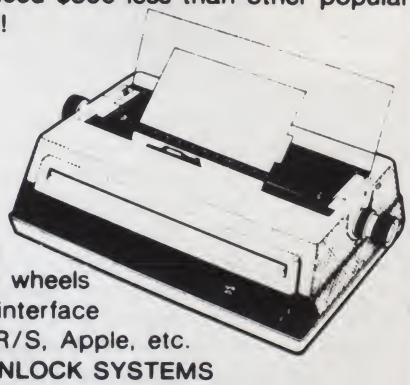

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Fortunately, the OS9 tree-structured file system simplifies this, since I merely copy a directory's files to a floppy to back up a given project's work. As to finding a file within the Winchester's vast capacity, I use SDIR, a utility which quickly gives alpha-sorted listings of all or some directories.

In addition to adding interrupts to the driver, I also intend to migrate the driver over to the Apple II version of OS9, which uses Stellation Two's "The Mill," a 6809 board for the Apple II. Apple OS9 is identical to the SS50 version of OS9 from the user's perspective, including the great interrrupt-driven multiprogramming features. With this relatively inexpensive Winchester and an 80-column display, the Apple II can compete head-on with the newer $10,000 systems, especially if one agrees that in most applications the speed of the disk (not the CPU) determines the overall system throughput.

My bevy of floppies is still there, though. The good ones have been copied to Winchester, but maybe I'd better keep all of them—just in case.■

Virtual Memory

Now you see it—now you don't

By Russell King

If you are looking for an inexpensive way to expand the memory of your computer, virtual memory may be your answer. Virtual memory is an ingenious technique that can, for example, make a 16K memory appear to be 64K (for most eight-bit microcomputers), or make 2M (1M = 1024K) appear to be 8M for 68000 or Z8000 16-bit microcomputers.

It differs considerably from overlay programming (see October *Microcomputing*, 1980) in that it is totally transparent to the user; the effect is achieved through hardware modifications, not programming techniques. Several microprocessor manufacturers have announced that virtual memory will soon be available for their 16-bit microprocessors. In this article I will describe the fundamental principles behind virtual memory techniques to help you understand this new breed of 16-bit microcomputer.

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Saving Space and Money

The rationale behind virtual memory is that a computer really accesses only a small portion of memory at any given time. Also, a portion of any program exists only to handle special conditions such as initialization and termination routines. This means that a significant part of memory is accessed once or seldom—very inefficient.

It would be much better to store infrequently used parts of the program on disk, and move them into memory only when needed. We could then get by with a smaller real memory and use what we have more effectively. The resulting financial savings are also significant when you consider the difference in cost between, say, two and eight megabytes of memory.

Virtual memory works in this way. The entire memory is on a fast, direct-access device—such as a hard disk. The computer RAM is your "window" that looks at some portion of the memory area on the disk. To make this technique most useful, the RAM is divided into several equal-sized windows (called real pages), allowing you to follow many things at once.

Some intelligence and record-keeping abilities are added to keep track of things, and to ensure the most efficient use of all pages. The memory stored on disk—the virtual memory—is also divided into windows the same size as the RAM windows, allowing exact alignment between the real (RAM) and the virtual (disk) memory.

The essential components in a virtual memory system are a CPU (or MPU) and its support circuitry, some RAM (less than the maximum that the CPU can handle), a mass storage device (disk, drum, bubble, etc.) and a Virtual Memory Controller. The configuration in Fig. 1 shows these components. To simplify the discussion, think of the system as using an eight-bit microprocessor, accessing up to 64K bytes of memory and equipped with 16K RAM and 64K virtual memory. Before proceeding to the detailed discussion of the components, look at Table 1, which explains several terms used in conjunction with virtual memory.

The Controller

The Virtual Memory Controller (VMC) performs the necessary memory-management functions. It moves information from memory to disk (and vice versa) and generally keeps track of what is where. Memory access is somewhat different in a system that uses virtual memory. The CPU does not query memory directly, but instead sends all memory requests to the VMC. The address that the CPU requests is called a virtual address in virtual memory. The VMC converts this address into a real address in real memory (in our example, an address within the 16K RAM).

The VMC deals with blocks of memory. When it checks to see if a request is in memory, it is really checking to see whether the block containing that request is in memory. These blocks are called pages. In our sample system we'll define our page size to be 4K (4096 bytes), although a page size of 256, 512 or 1024 bytes would be more practical for this system. Since

Mass storage: a large capacity storage medium with direct access capabilities (disk storage, bubble memory, etc.).
Page: the smallest block of data that is transferred between memory and mass storage.
Paging: the act of transferring a page of data from memory to mass storage or vice versa.
Paging in: paging from disk to memory.
Paging out: paging from memory to disk.
Page size: the size of a block of data. This is 4K in the text, i.e., 4K bytes of data are transferred between disk and memory in one operation.
Page location table, page relocation table: table that keeps track of memory available for paging operations.
Real address: the actual location (in RAM memory) that is addressed.
Swap, swapping: block paging operations.
Translation table: a table that converts the virtual address into a real address.
Virtual address: the apparent address that is being accessed.
Virtual memory controller: one or more devices that control the mechanics of virtual memory.

Table 1. Glossary of terms.

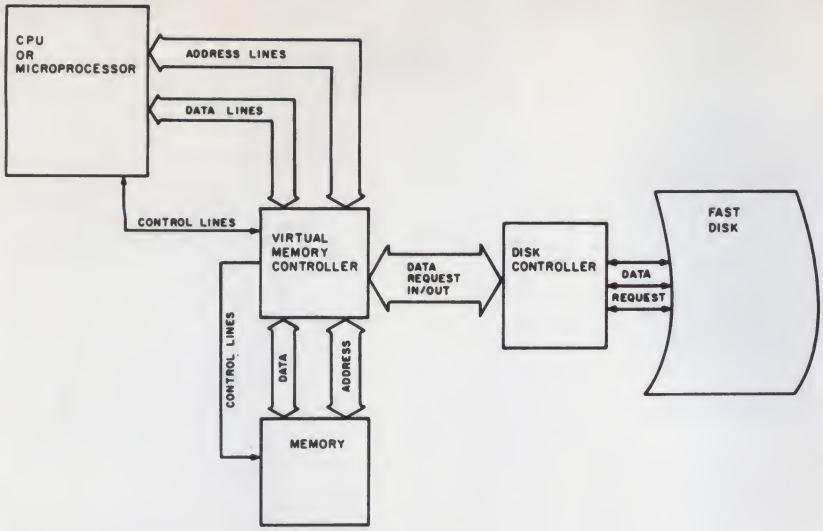


Fig. 1. Components of a virtual memory system.

our sample has 16K bytes of real memory, we have four pages (pages 0–3) of real memory. And, with 64K bytes of virtual memory, we have 16 virtual pages (pages 0–F).

The virtual address that the CPU requests can be divided into two parts. The high-order four bits designate the page address (from 0 to F); the remainder is the displacement, or location within the page. The VMC only changes the page address portion of the virtual address, never the remainder.

For example, if the CPU sends a request to the VMC for address F321 (page F, displacement 321), stored in real page 1, the VMC will find where page F is currently stored and change the page address to 1321. This address, the real address, is where the requested information now lies. The real memory will be accessed at location 1321.

At some later time, virtual page F *may be moved onto* disk, freeing up real page 1 for some other virtual page. Later still, if virtual page F is again moved into real memory, it could be placed in any real page, say page 0, in which case the virtual address F321 would be changed to the real address 0321 by the VMC. Thus real memory is shared dynamically by the virtual memory.

Virtual Technique Offshoots

If disk storage can be used to replace memory, a logical extension would be to use tape storage to replace disks. Thus you could have virtual disk drives, which would allow you to substitute less expensive tape drives for some disk storage. IBM has done this with its mass storage subsystem.

Virtual memory can be used very effectively on systems that have multiple-user capabilities. If our sample computer had an operating system (software) that allowed four people to use the machine simultaneously, each user could have several pages of real and 64 pages of virtual memory assigned to him. This is a simple extension of the concept of virtual memory, involving paging on a larger scale.

In such a system, each user shares the real memory available, but has his or her own virtual memory space. The real memory is shared dynamically, in that one person may have his entire memory space paged out to disk at one point, and later may be using all the available real memory. Moving a user's memory space between disk and memory is called swapping.

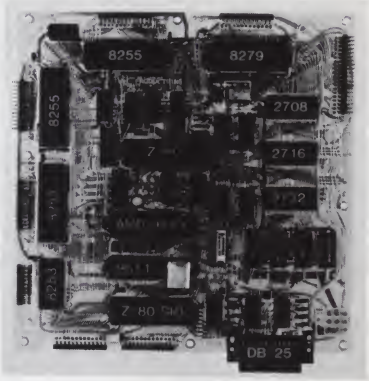
Finally, if a machine can have virtual memory, virtual disks and multiple users, why not virtual everything—even a virtual machine? IBM has an operating system that does just that.

The New Machines

The new 16-bit processors that are capable of directly addressing more than a megabyte of memory will have some form of mass storage (bubble memory or hard disk) for virtual memory. They will probably have up to 256K of real memory initially, with a virtual memory size three or four times as large, with the capability to increase both real and virtual memory up to the maximum for the machine. Desktop computers may use bubble memory for virtual storage, while larger machines will probably use built-in Winchester disk drives.■

Circle 390 on Reader Service card.

Z-80 SINGLE BOARD COMPUTER $49.95



The MASTER CONTROLLER BOARD contains:
-Z-80 Microprocessor
72-Parallel I/O lines; three 8255s
-Keyboard controller: 8279
12K-EPROM: three sockets for 2708, 2716, 2732
2K-RAM: 2114s
8-Sixteen bit counter timer channels: one 8253 and one AMD 9513
2-Serial I/O ports; one Z-80 SIO chip. One port is RS-232 W/DB-25
1-High speed arithmetic processor: AMD 9511
A bus expansion connector is provided.

All this on one board less than nine inches on a side

BARE BOARD. With documentation. **$49.95**

MASTER CONTROLLER BOARD. Assembled w/all parts (no IC's) **$139.95**

MINIMUM KIT. Includes bare board with documentation, one each Z-80, 8255, 2716, four 2114's, 4Mhz crystal, and support gates and buffers, all socketed. **$119.95 A&T 199.95**

MONITOR PROGRAM allows a CRT or TTY to control the MASTER CONTROLLER. This program requires the minimum kit and the serial parts kit. A programmed 2716 and listing is supplied with the monitor. **$29.95** Listing Only **$19.95**

SERIAL PARTS. Includes 8253, Z-80 SIO, 1488, 1489, sockets, and DB-25 connector **$39.95**

MINIMUM KIT, serial parts, w/TINY CONTROLLER BASIC **A&T $239.95**

MAXIMUM KIT w/2-2716's (monitor program and tiny basic) less 9511 **239.95 A&T $319.95**

POWER SUPPLY. 5V2A, -5V¼A, +12V¼A, -12V¼A. Kit **$44.95**

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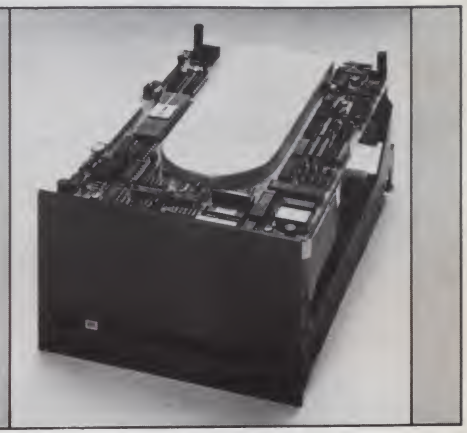
Buyer's Guide to Hard Disk Drives

Microcomputing is printing this buyer's guide to Winchester hard disks as a service to our many readers who want to know more about the characteristics of these mass memory devices and generally what is available on the market. We have limited this survey to systems with less than 40 megabytes of storage, since few microcomputer users will want or need more. The systems vary considerably in the amount and type of interfacing hardware and software included, so buyers should check carefully with dealers or manufacturers' representatives before ordering.

Apple II with Corona 5¼-inch Winchester hard disk.

IBM Personal Computer with Corona Personal Hard Disk.



Atasi Corporation's Model 3033 Winchester.

Manufacturer Name/Address	Model Name/Number	Price	Capacity (unformatted Mbytes)	Disk Drive Type	Platter Diameter (inches)	Number of Platters	Data Transfer Rate (Mbits per second)	Average Access Time (milliseconds)	Track-to-Track Access Time (msecs)	Disk Speed (rpm)	Media Type	Head Type	Drive Shock Mounted?
Ampex Corporation 200 N. Nash St. El Segundo, CA 90245	Pyxis P-7	$1065	7	Fixed	5¼	1	5	90	18	3600	Ferric Oxide	IBM 3350	Yes
	Pyxis P-13	$1280	13	Fixed	5¼	2	5	90	18	3600	Ferric Oxide	IBM 3350	Yes
	Pyxis P-20	$1555	20	Fixed	5¼	3	5	90	18	3600	Ferric Oxide	IBM 3350	Yes
	Pyxis P-27	$1905	27	Fixed	5¼	4	5	90	18	3600	Ferric Oxide	IBM 3350	Yes
	Scorpio S-48	$5085	49.7	Fixed	8	2	9.7	32	6	3600	Ferric Oxide	IBM 3350	Yes
Apple Computer, Inc. 20525 Mariani Ave. Cupertino, CA 95014	ProFile	$2195	5	Fixed	5¼	2	5	95	25	3600	Oxide	Magnesia Zinc	Yes

Atasi Corporation 2075 Zanker Road San Jose, CA 95131	Atasi 3020	$2600	19.8	Fixed	5¼	2	5	30	6	3600	Ferric Oxide	IBM 3350	Yes
	Atasi 3033	$3200	33.1	Fixed	5¼	3	5	30	6	3600	Ferric Oxide	IBM 3350	Yes
	Atasi 3046	$3800	46.3	Fixed	5¼	4	5	30	6	3600	Ferric Oxide	IBM 3370	Yes
Computer Dynamics 105 S. Main St. Greer, SC 29651	CDI WIN-5	$1695[1]	5.3	Fixed	8	1	4.3	70	19	3125	Plated Thin-Film		Yes
Computer Memories, Inc. 9216 Eaton Ave. Chatsworth, CA 91311	5206	$610[2]	6.4	Fixed	5¼	1	5	80	15	3600	Ferric Oxide	IBM 3350	Yes
	5412	$725[2]	12.8	Fixed	5¼	2	5	80	15	3600	Ferric Oxide	IBM 3350	Yes
	6213	$835[2]	13.3	Fixed	5¼	1	5	40	10	3600	Ferric Oxide	IBM 3350	Yes
	5619	$840[2]	19.1	Fixed	5¼	3	5	80	15	3600	Ferric Oxide	IBM 3350	Yes
	6426	$970[2]	26.7	Fixed	5¼	2	5	40	10	3600	Ferric Oxide	IBM 3350	Yes
	6640	$1095[2]	40	Fixed	5¼	3	5	40	10	3600	Ferric Oxide	IBM 3350	Yes
Corona Data Systems, Inc. 31324 Via Colinas Westlake Village, CA 91361	ST 05	$2195	6.4	Fixed	5¼	1	5	85	3	3600	Oxide	Winchester	Yes
	ST 10	$2695	12.8	Fixed	5¼	2	5	85	3	3600	Oxide	Winchester	Yes
	EXPHD 05	$2195	6.4	Fixed	5¼	1	5	85	3	3600	Oxide	Winchester	Yes
	EXPHD 10	$2695	12.8	Fixed	5¼	2	5	85	3	3600	Oxide	Winchester	Yes
	PHD 05	$1795	6.4	Fixed	5¼	1	5	85	3	3600	Oxide	Winchester	Yes
	PHD 10	$2295	12.8	Fixed	5¼	2	5	85	3	3600	Oxide	Winchester	Yes

1. Complete with software and adapter.
2. In quantity to OEM's.
3. Includes controller, interface card, etc. System ready to attach to host computer.
4. Includes back-up floppy.

Circle 311 on Reader Service card.

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Storage Caddy @ $2.95 ea	Quantity _____ FREE Quantity _____		
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		SUB TOTAL	
Calif. residents add 6% sales tax			
Shipping/handling 1 doz. $2, 2 doz. $3.50 3 doz. $4.50, each additional doz. $.50			
For Parcel Post instead of UPS ADD $1			
Outside Continental USA, ADD $2			
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City _____ State/Zip _____

Signature _____

Computer make & model _____ Disk?(y/n)____

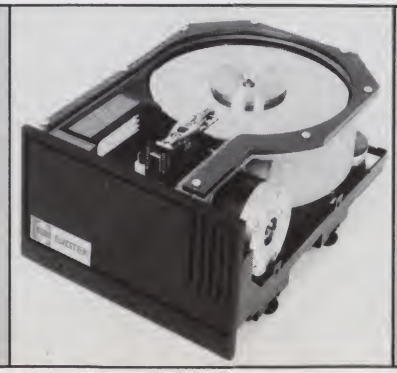
Manufacturer Name/Address	Model Name/Number	Price	Capacity (unformatted Mbytes)	Disk Drive Type	Platter Diameter (inches)	Number of Platters	Data Transfer Rate (Mbits per second)	Average Access Time (milliseconds)	Track-to-Track Access Time (msecs)	Disk Speed (rpm)	Media Type	Head Type	Drive Shock Mounted?
Data Technology Industries 701-A Whitney St. San Leandro, CA 94577	Datavault	$1995	7	Fixed	5¼	1	—	—	—	3600	—	—	Yes
Davong Systems, Inc. 610 Palomar Ave. Sunnyvale, CA 94086	Universal Hard Disk System	$1995	6.4	Fixed	5¼	1	5	110	17	3600	Ferric Oxide	—	Yes
		$2595	12.8	Fixed	5¼	2	5	110	17	3600	Ferric Oxide	—	Yes
		$3095	19.1	Fixed	5¼	3	5	110	17	3600	Ferric Oxide	—	Yes
Disctron, Inc. 1701 McCarthy Blvd. Milpitas, CA 95035	D 507	$555[2]	6.4	Fixed	5¼	1	5	80	17	3600	Ferric Oxide	Mini Winchester	Yes
	D 514	$655[2]	12.8	Fixed	5¼	2	5	80	17	3600	Ferric Oxide	Mini Winchester	Yes
	D 519	$775[2]	19.1	Fixed	5¼	3	5	80	17	3600	Ferric Oxide	Mini Winchester	Yes
	D 526	$895[2]	25.5	Fixed	5¼	4	5	80	17	3600	Ferric Oxide	Mini Winchester	Yes
	DP 100 Lynx	$1390[2]	11.6	Removable	8	1	7	60	15	3600	Ferric Oxide	Winchester	No
EVOTEK 1220 Page Ave. Fremont, CA 94538	5510	$750	7.8	Fixed	5¼	1	5	49	7	3600	Plated Thin-Film	IBM 3370	Yes
	5520	$1050	15.6	Fixed	5¼	2	5	49	7	3600	Plated Thin-Film	IBM 3370	Yes
	5530	$1275	23.4	Fixed	5¼	3	5	49	7	3600	Plated Thin-Film	IBM 3370	Yes
	5540	$1650	31.2	Fixed	5¼	4	5	49	7	3600	Plated Thin-Film	IBM 3370	Yes
	5810	$925	12.9	Fixed	5¼	1	8.25	49	7	3600	Plated Thin-Film	IBM 3370	Yes
	5820	$1475	25.8	Fixed	5¼	2	8.25	49	7	3600	Plated Thin-Film	IBM 3370	Yes
	5830	$1675	38.8	Fixed	5¼	3	8.25	49	7	3600	Plated Thin-Film	IBM 3370	Yes
	5840	$2125	51.7	Fixed	5¼	4	8.25	49	7	3600	Plated Thin-Film	IBM 3370	Yes
Genie Computer Corp. 31125 Via Colinas Westlake Village, CA 91362	5 + 5	$3995	12.8	Removable and Fixed	5¼	2	5	40	18	3443	Oxide	DMA	Yes
IDE Associates 44 Mall Road Burlington, MA 01803	DPR-5-FE	$1650	6.4	Fixed	3.9	1	5	70	3	3547	Metallic Alloy	—	Yes
	DPR-5-RE	$1700	6.4	Removable	3.9	1	5	70	3	3547	Metallic Alloy	—	Yes
	DPR-5-FI	$1450	6.4	Fixed	3.9	1	5	70	3	3547	Metallic Alloy	—	Yes
	DPR-5-RI	$1500	6.4	Removable	3.9	1	5	70	3	3547	Metallic Alloy	—	Yes
International Memories, Inc. 10381 Bandley Drive Cupertino, CA 95014	5006 H	$535[2]	6.4	Fixed	5¼	1	5	68	18.5	3600	Plated	IBM 3350	Yes
	5012 H	$615[2]	12.8	Fixed	5¼	2	5	68	18.5	3600	Plated	IBM 3350	Yes
	5018 H	$715[2]	19.1	Fixed	5¼	3	5	68	18.5	3600	Plated	IBM 3350	Yes
	5040 H	—	41.3	Fixed	5¼	3	5	68	19	3600	Plated	IBM 3350	Yes
IQ Systems 2931 La Jolla St. Anaheim, CA 92806	Graymatter 5	$1995	6.3	Fixed	5¼	1	5	85	15	3600	Ferric Oxide	IBM 3350	No
	Graymatter 10	$2495	12.6	Fixed	5¼	2	5	85	15	3600	Ferric Oxide	IBM 3350	No
	Graymatter 20	$3695	25.5	Fixed	5¼	4	5	85	15	3600	Ferric Oxide	IBM 3350	No

Megavault (SLI) 6431 Independence Ave. Woodland Hills, CA 91367	MV 16S	$2200[2]	16	Fixed	8	1	9.7	45	7	3600	Oxide	IBM 3350	Yes
Microscience International Corp. 575 E. Middlefield Road Mountain View, CA 94043	HH 612	$700[2]	12.8	Fixed	5¼	1	5	85	18	3550	Plated Thin-Film	IBM 3350	Yes
Percom Data Corp. 11220 Pagemill Road Dallas, TX 75243	PHD	$1995	6.4	Fixed	5¼	1	5	85	3	3600	Ferric Oxide	IBM 3350	Yes
	PHD	$2495	12.8	Fixed	5¼	2	5	85	3	3600	Ferric Oxide	IBM 3350	Yes
	PHD	$2995	19.1	Fixed	5¼	3	5	85	3	3600	Ferric Oxide	IBM 3350	Yes
	PHD	$3495	25.8	Fixed	5¼	4	5	85	3	3600	Ferric Oxide	IBM 3350	Yes
Pertec 9601 Lurline Chatsworth, CA 91311	D 3400	$5275	12	1 Fixed 1 Removable	14	2	2.5	40	10	2400	Ferric Oxide	2314 Ferrite	No
	D 3400 EXT	$6280	24	3 Fixed 1 Removable	14	4	2.5	40	10	2400	Ferric Oxide	2314 Ferrite	No
Prizm Computer Products 702 Landwehr Road Northbrook, IL 60062	Model I	$4195[3]	12.8	Fixed	5¼	2	3.2	68	3	3600	Plated Thin-Film	—	Yes
	Model II	$4695[3]	25.8	Fixed	5¼	4	3.2	49	3	3600	Ferric Oxide	—	Yes
Quentin Research 9207 Eton Ave. Chatsworth, CA 91311	QA-505	$2195	6.4	Fixed	5¼	1	5	40	15	3600	Ferric Oxide	Magnesium Oxide	No
	QA-510	$2395	12.8	Fixed	5¼	2	5	40	15	3600	Ferric Oxide	Magnesium Oxide	No
	QA-515	$2695	19.1	Fixed	5¼	3	5	40	15	3600	Ferric Oxide	Magnesium Oxide	No
	QA-520	$2995	26	Fixed	5¼	3	5	40	15	3600	Ferric Oxide	Magnesium Oxide	No
	QA-531	$3195	40	Fixed	5¼	4	5	40	15	3600	Ferric Oxide	Magnesium Oxide	No
Rodime 25801 Obrero Mission Viejo, CA	RO 201	$720[2]	6.7	Fixed	5¼	1	5	90	18	3600	Ferric Oxide	IBM 3350	Yes
	RO 202	$890[2]	13.3	Fixed	5¼	2	5	90	18	3600	Ferric Oxide	IBM 3350	Yes
	RO 203	$1060[2]	20	Fixed	5¼	3	5	90	18	3600	Ferric Oxide	IBM 3350	Yes
	RO 204	$1285[2]	26.7	Fixed	5¼	4	5	90	18	3600	Ferric Oxide	IBM 3350	Yes
	RO 206	$1720[2]	42	Fixed	5¼	3	5	50	5	3600	Plated	IBM 3350	Yes
	RO 208	$2150[2]	53	Fixed	5¼	4	5	50	5	3600	Plated	IBM 3350	Yes
Santa Clara Systems,Inc. 560 Division St. Campbell, CA 95008	SCS-5	$2340	6.2	Fixed	5¼	1	5	70	8.3	3600	Plated Thin-Film	Winchester	Yes
	SCS-10/F	$5995	12	Fixed	8	1	5	70	8.3	3600	Ferric Oxide	Winchester	Yes

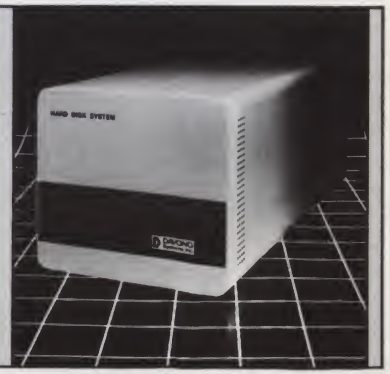
1. Complete with software and adapter.
2. In quantity to OEM's.
3. Includes controller, interface card, etc. System ready to attach to host computer.
4. Includes back-up floppy.

IMI's 5000H series 5¼-inch Winchester.

Disctron's 5¼-inch half-high Winchester disk drive.



EVOTEK's disk drives use thin-film media.

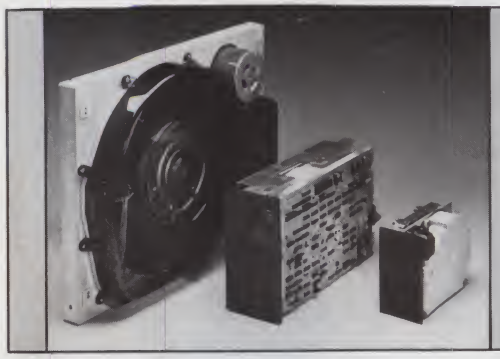


Davong Systems' Universal disk drive.

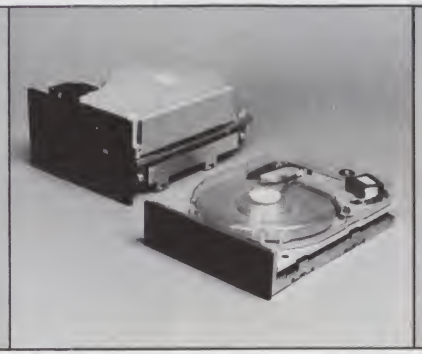
Manufacturer Name/Address	Model Name/Number	Price	Capacity (unformatted Mbytes)	Disk Drive Type	Platter Diameter (inches)	Number of Platters	Data Transfer Rate (Mbits per second)	Average Access Time (milliseconds)	Track-to-Track Access Time (msecs)	Disk Speed (rpm)	Media Type	Head Type	Drive Shock Mounted?
Seagate Technology 360 El Pueblo Road Scotts Valley, CA 95066	ST206	$745[2]	6.4	Fixed	5¼	1	5	85	16	3600	Plated Thin-Film	N/A	Yes
Shugart 475 Oakmead Parkway Sunnyvale, CA 94086	SA 604	$675[2]	6.7	Fixed	5¼	2	5	99	16.2	3600	Ferric Oxide	IBM 3350	Yes
	SA 606	$760[2]	10	Fixed	5¼	3	5	99	16.2	3600	Ferric Oxide	IBM 3350	Yes
	SA 612	$800[2]	12.8	Fixed	5¼	2	5	99	16.2	3600	Ferric Oxide	IBM 3350	Yes
	SA 706	$550[2]	6.7	Fixed	5¼	1	5	99	16.2	3600	Ferric Oxide	IBM 3370	Yes
	SA 712	$650[2]	13.3	Fixed	5¼	2	5	99	16.2	3600	Ferric Oxide	IBM 3370	Yes
	SA 1002	$995[2]	5.3	Fixed	8	1	4.34	70	19	3125	Ferric Oxide	IBM 3340	Yes
	SA 1004	$1205[2]	10.7	Fixed	8	2	5	70	19	3125	Ferric Oxide	IBM 3340	Yes
	SA 4004	$1300[2]	14.5	Fixed	14	1	7.1	63.6	20	2964	Ferric Oxide	IBM 3340	Yes
Smoke Signal 31336 Via Colinas Westlake Village, CA 91362	SP-W15	$3850	18	Fixed	5¼	4	5	70	2	3600	Thin Magnetic Oxide	IBM 3350	Yes
Syquest Technology 47923 Warm Springs Blvd. Fremont, CA 94539	SQ 306	$850[2]	6.4	Fixed or Removable	3.9	1	5	70	18	3547	Plated Thin-Film	IBM 3350	Yes
Tandon Corp. 20320 Prairie St. Chatsworth, CA 91311	TM 501	$450[2]	6.4	Fixed	5¼	1	5	85	17	3600	Plated	IBM 3350	Yes
	TM 502	$550[2]	12.8	Fixed	5¼	2	5	85	17	3600	Plated	IBM 3350	Yes
	TM 503	$650[2]	19.2	Fixed	5¼	3	5	85	17	3600	Plated	IBM 3350	Yes
Tecmar, Inc. 23600 Mercantile Road Cleveland, OH 44122	Share/5 Expansion 40100[5]	$2995	6.4	Fixed	5¼	2	5	85	18	3600	Oxide	IBM 3350	Yes
	Share/10 Expansion 40200[5]	$3995	12.8	Fixed	5¼	2	5	85	18	3600	Oxide	IBM 3350	Yes
	Share/15 Expansion 40300[5]	$4995,	19.1	Fixed	5¼	3	5	74	13	3600	Oxide	IBM 3350	Yes
	Cartridge PC 40011[5]	$1795	6.4	Removable	3.9	1	5	90	18	3600	Chromium Dioxide	IBM 3350	Yes
3M 3M Center St. Paul, MN 55144	8432	$1735[2]	20	Fixed	8	1	.93	65	18.6	3125	Ferric Oxide	IBM 3350	Yes
World Wide Data Systems, Inc. 17321 El Camino Real Houston, TX 77058	Prometheus 5	$1495	6.7	Fixed	5¼	1	5	90	18	3600	Ferric Oxide	Thin Film	Yes
	Prometheus 10	$1695	13.3	Fixed	5¼	2	5	90	18	3600	Ferric Oxide	Thin Film	Yes

	Prometheus 20	$2095	26.7	Fixed	5¼	4	5	90	18	3600	Ferric Oxide	Thin Film	Yes
X Comp 7566 Trade St. San Diego, CA 92121	8 MB PHD	$2195	10	Fixed	5¼	1	5	120	18	3600	Ferric Oxide	—	Yes
	8×8 PHD	$2595	20	Fixed	5¼	2	5	120	18	3600	Ferric Oxide	—	Yes
	Toaster	$2795	12.8	Removable	3.9	2	5	70	18	3600	Chromaflux	N/A	Yes
Zenith Data Systems 1000 Milwaukee Ave. Glenview, IL 60023	Z67[4]	$5995	11	Fixed	8	2	.6	70	19	2983	Ferric Oxide	—	Yes

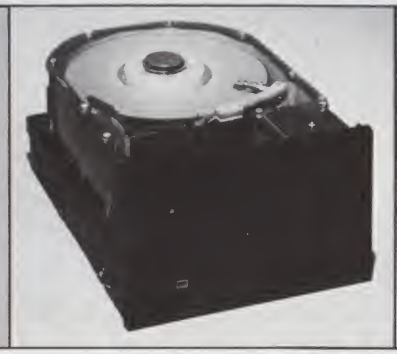
1. Complete with software and adapter.
2. In quantity to OEM's.
3. Includes controller, interface card, etc. System ready to attach to host computer.
4. Includes back-up floppy.
5.IBM PC-compatible only.



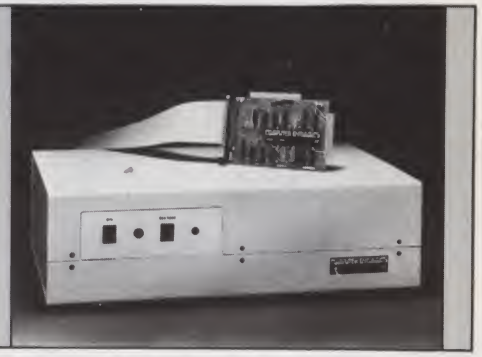
Fourteen-, eight- and 5¼-inch disk drives by Shugart.



Shugart's SA706/712 series are half-height.



Tandon's 6.4 Mbyte TM501 Winchester.



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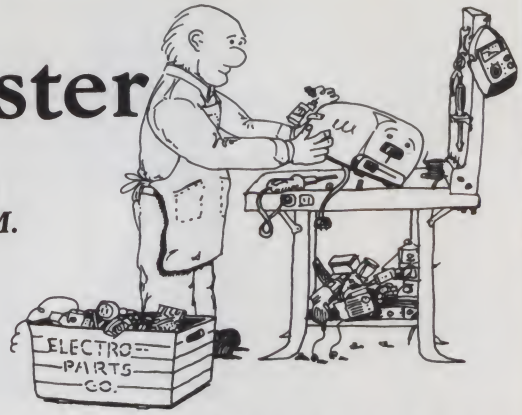


This series on single-chip intelligence continues with details on how to program the 8748 EPROM.

By Mark J. Robillard

Last month, we checked into the programming of the erasable EPROM and tried a chip pin-out. In this installment, I'll detail the program operation.

Programming and Verification

The 8748 is programmed by following these steps, outlined in exact order.

1. Place VDD at +5 volts. Make sure oscillator is running. $\overline{\text{RESET}}$ = 0, T0 = 1, EA = 1, PROG input is open.
2. T0 = 0 (select program mode).
3. EA = +23 V.
4. Apply the lower eight address inputs of the location on the Bus lines, the upper two to P20 and P21.
5. Pull Reset high (this will latch address).
6. Apply the data to be written on the BUS.
7. Place VDD at +25 V.
8. PROG pin is set to 0 V, then to +23 V for 50 ms, then back to 0 V and, finally, floating.
9. Bring VDD back to +5 V.
10. Select verify by pulling T0 to +5 V.
11. Read the data programmed on BUS outputs.
12. If it's okay, reset T0 to zero.
13. Bring $\overline{\text{RESET}}$ back to zero.
14. Return to step 4 for successive addresses.

Simple, yet complicated. Most of the digital stuff sounds fairly easy to accomplish, but that voltage switching . . . Considering the range of switching, some analog transistor switches must be designed. Lucky for you I'm providing working schematics of this part of the design, so all you have to do is build it.

Fig. 1 shows the voltage switch. This circuit was not designed by me; it was included in an article in the July 1982 *Digital Design Magazine* ("A Simple Programmer for the 8748," by Terry Hinshaw). I have used only the voltage switch from this article and improved on the programmer design.

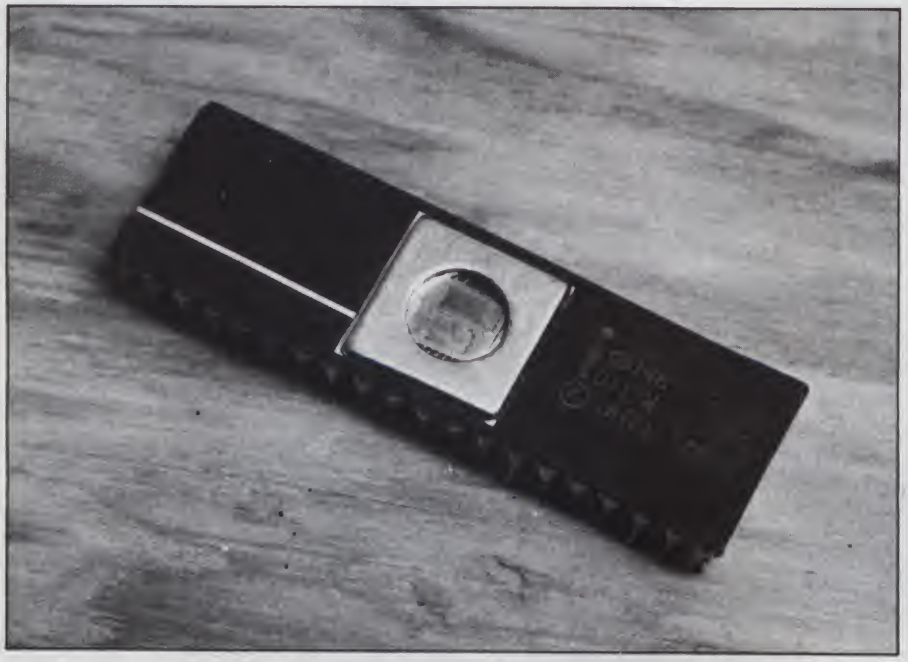
So much for credits. The circuit is simple, as you can see. The 7406 inverters have open-collector outputs that are suitable for driving the transistors shown. As you can see, the VDD circuit selects between +5 V (PC4 = 1) and +25 V. Similarly, the EA circuit will switch from +5 V (PC5 = 1) to +23 V (approximately after the diode and transistor).

If the part you're programming is an 8748H, this voltage must be +18. This is also true of the VDD input. This may be accomplished by allowing the +25 V to flow through a +7.0 V zener diode or to provide a +18.7 V input.

The PROG pin, as you might have guessed, is somewhat more complex. Here we must provide 0 V (PC6 = 1, PC7 = 0), then a swing to +23 V (+18 V for 8748H), which is PC6 = 0, PC7 = 1 for 50 ms, back to zero, then ultimately to a float (PC6 = 1, PC7 = 1). With the circuit already designed for us, let's proceed. (Thank you, Mr. Hinshaw.)

You have undoubtedly noticed by now that there is a strange device looming in the left half of Fig. 2. It's the key to super-simple programmer design. The 8255, for the uninitiated, is a programmable I/O chip. We hook this up to a home computer and let software twiddle the outputs in the sequence necessary for correct programming.

To be more specific, there are three eight-bit I/O ports on the 8255. Port A will be used as a data/address bus,



Here it is! An overfed EPROM (actually, an 8748).

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Port B will function as a kind of control register and Port C will get all the high-voltage action.

Looking back at the sequence of operations, we can deduce that the state of the 8255 outputs should be the following at initialization:

Port A (BUS): To effect a high impedence, set this port to the input mode while keeping the others as outputs.

Port B7 (WR): 1 (write strobe to RAM); more later.

Port B6 (AS): 0 (address strobe to RAM); more later.

Port B5 (RAM): 1 (select for emulator RAM); more later.

Port B4 (RD): 1 (read strobe for RAM); more later.

Port B3 (SS): 0 (single-step control); more later.

Port C7 (VP2): 1 PROG voltage selector.

Port C6 (VP1): 1 C5 (EA) = 1 EA control +5 V.

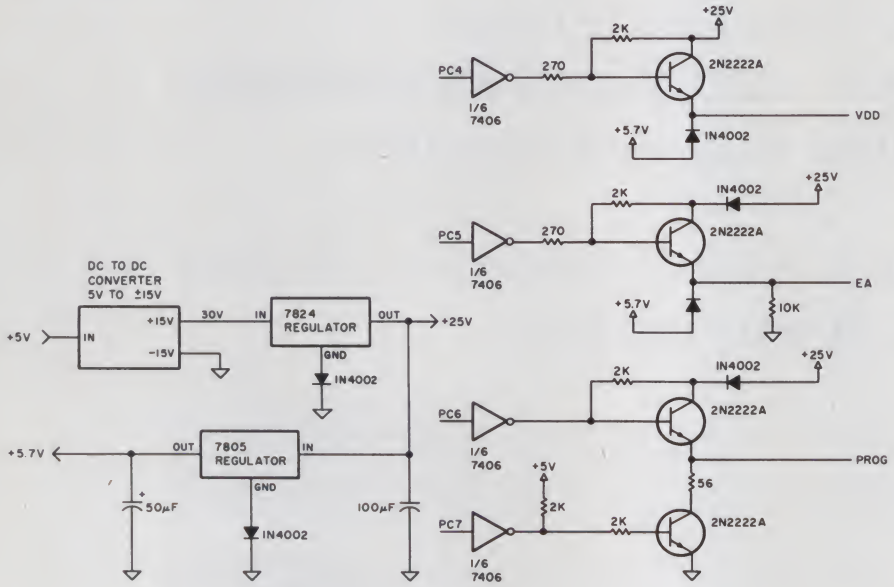

Fig. 1. Analog voltage switches taken from circuit described by Terry Hinshaw for Digital Design Magazine, *July 1982.*

Port C4 (VDD): 1 VDD control +5 V.

Port C3 ($\overline{\text{RESET}}$): 0 directly controls 8748 reset.

Port C2 (T0): 1 directly controls 8748 T0.

Port C1 (A9): X (don't care) upper-address bit A9.

Port C0 (A8): X (don't care) upper-address bit A8.

After seeing this, Fig. 2 will dispel any confusion you may have about how the 8255 fits into the circuit. For the time being, ignore the middle RAM-related circuitry. This is used for emulation and will be thoroughly explained later on.

In fact, we have to quit on this programmer for a while. Why? Because the Basic program I wrote to control it allows for emulation as well, so before you emulate, you should know what you're doing. We'll have to get into the actual operation of this thing we call an 8748.

Memory Utilization

I suppose it's time I let you see what this 8748 looks like. If you haven't come across it before (see photo), it bears a strange resemblance to an overfed EPROM. A window in the center of the part allows the ultraviolet light to enter and flood the chip for erasure. Moving in a little closer, we see the data memory (if you can't see

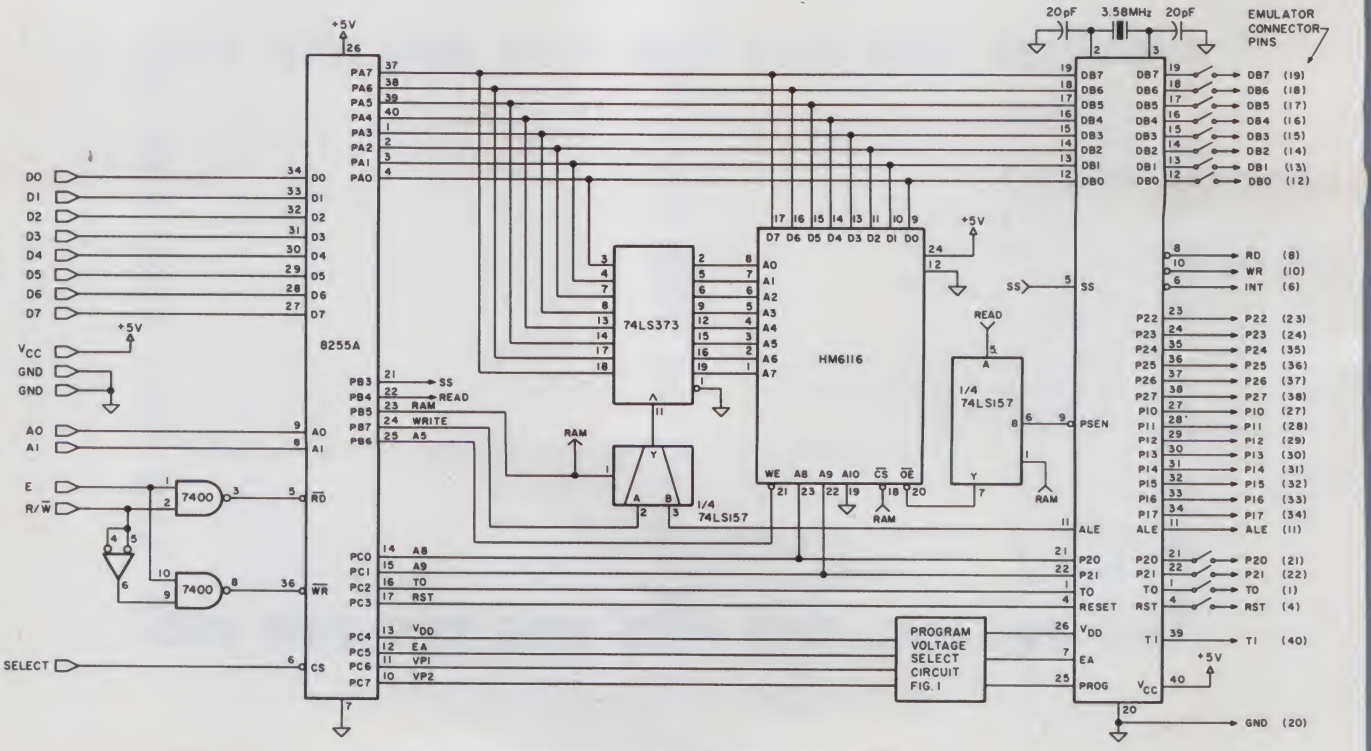

Fig. 2. Complete schematic of 8748 programmer-emulator.

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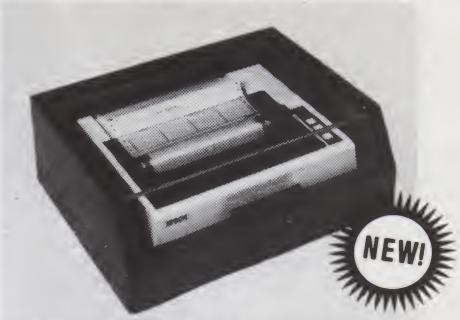

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it, just take my word for it. . . it's there).

Fig. 3 shows the breakdown of what those 64 data memory locations are used for. Starting from zero, there are eight general-purpose registers (Bank 0)—R0 through R7. These may be written to, read from, incremented, decremented or used for just about anything your heart desires.

After these registers, there is an area set aside as a subroutine stack. There are enough locations here for eight subroutines to be nested simultaneously. Each time you initiate a Call instruction, the current program address is pushed onto this stack, much like the larger microprocessors.

Well, we've eaten up 24 locations so far. The next eight support an optional second-register bank (Bank 1). At any time in the program, a SEL RB1 instruction will do an immediate switcheroo. You can use all the instructions pertaining to the first bank with the second, as the R numbers are identical. Just make sure you remember which bank you're in.

Finally, there are 32 eight-bit memory locations that are not used by any specific instruction. These may be used as you wish. In fact, let's examine the instructions available for moving in and out of this internal memory. All data moves pass through the accumulator. The following instructions work on this data memory:

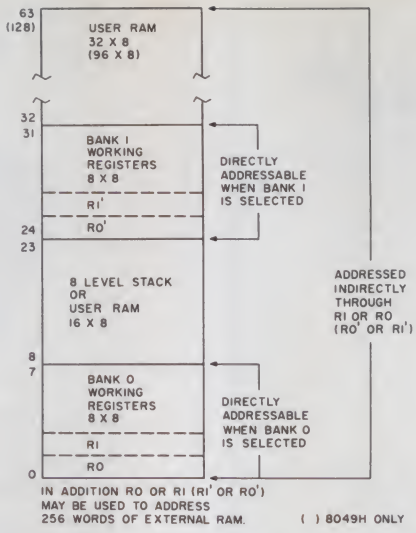

Fig. 3. Map of internal Data Memory.

MOV A, @R0	ADD A, @R0
MOV A, @R1	ADD A, @R1
MOV @R0, A	ADDC A, @R0
MOV @R1, A	ADDC A, @R1
MOV @R0, #data	ANL A, @R0
MOV @R1, #data	ANL A, @R1
XCH A, @R0	ORL A, @R0
XCH A, @R1	ORL A, @R1
XCHD A, @R0	XRL A, @R0
XCHD A, @R1	XRL A, @R1

Quite a list, isn't it? Now let's see what this foreign language really means. The column on the left involves straight moves to and from. You'll notice that every instruction is repeated once for each of R0 and R1. Some explanation here is necessary.

Whenever you address external memory in the 8748, be it data or program memory, you do so using either register 0 or register 1 as a pointer. Therefore, the first instruction in the left column allows the contents of the data memory location pointed to by R0 to be moved into the accumulator. The same is true about the second, except R1 is the pointer.

The second group provides for just the opposite. The contents of the accumulator are stored in a location pointed to by one of these registers.

The third group will allow you to directly set any memory location with the data word of your choice. This

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word is the second part of the instruction. You see, this constitutes our very first two-byte instruction. The others so far are one byte only.

Here, the second byte contains the immediate data. After these comes a useful command. The XCH op code allows the accumulator and the addressed memory location to swap places instantaneously with one byte of instruction. The last, XCHD, will transfer only the lower four bits (nibble) of each. This is useful when working with four-bit BCD data.

That does it for the left. Is it beginning to become clear that the 1024 program locations may be plenty? As you can see, there are many useful instructions which occupy only one byte of program space. Still not convinced? Let's go on.

More Instructions

The right column of instructions provides the ability to perform arithmetic and logic functions on the contents of data memory. The first set will add the contents of the addressed location to the data present in the accumulator.

The result is left in the accumulator and the data memory location contents are unchanged. The next will do the same with the inclusion of the carry-bit information that may have been left from a previous operation.

The logic functions of And, Or and Exclusive Or are accommodated throughout the next three sets. In all cases, the result of the logic operation will be left in the accumulator. All of the instructions in the right column are one byte in length.

Remember that there are three types of memory that the 8748 can handle: Data Memory, Program Memory and External Data Memory. The designers of this micro certainly did not forget them, as illustrated in the instructions arranged just so these may be fully utilized:

MOVX A, @R0	MOVX @R0, A	MOVP A, @A
MOVX A, @R1	MOVX @R1, A	MOVP3 A, @A

This time let's start with the far right column. MOVP will allow the contents of a program memory location to be transferred into the accumulator. Oddly enough, this instruction uses the contents of that same accumulator to address that location. Notice, also, that the program memory internal to the part is more than 1000 locations deep, and the accumulator may address only up to 256!

In this machine, program memory is divided up into pages. Each one is (you guessed it) 256 locations deep. So when you use an instruction like MOVP in a program, only the 256 locations available in the current operation page can be transferred. This sometimes presents a serious limit. After all, why would we use an instruction like this anyway?

Encoding the Keyboard

Have you ever used a microprocessor to encode a keyboard? If you read earlier installments of this series, you will no doubt remember the algorithm shown where, when a key press is detected, the number concocted from a series of wild and wonderful readings pointed to a location in a table of key values. Use this instruction to point to that table, and build the table in program memory.

External fetches outside the chip can get hairy. The BUS pins act as a combination address/data bus. First, the eight bits of address pointer data from either R0 or R1 are placed out on

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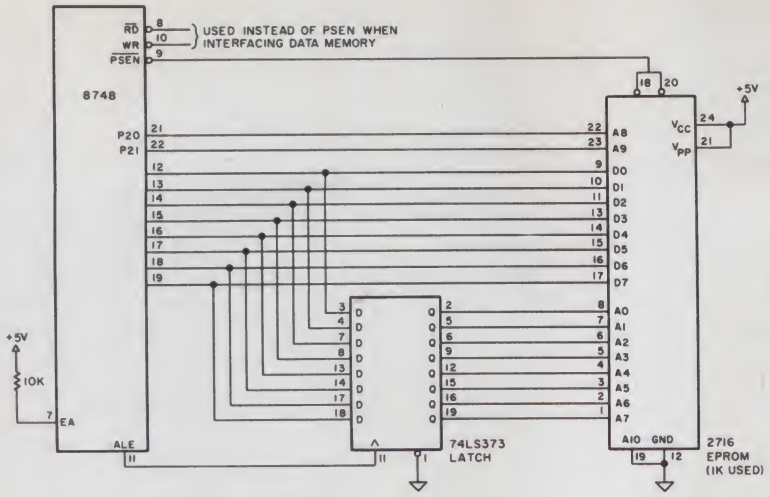

Fig. 4. Connections necessary to interface External Program Memory to the 8748.

the BUS pins. Then the ALE signal rises and falls (much like Rome). On the falling edge of ALE you will want to latch this address.

To do this depends on the memory device you use externally. Some chips allow you to connect to a multiplexed bus and have internal address latches. Others, like the ones commonly used for ROM or RAM storage, don't. In this case, an external latch IC must be used. Fig. 4 shows the particulars of hooking up external memory. Notice in the figure that, if you are connecting external program memory (as we will do for emulation), EA must be pulled high and $\overline{PSEN}$ is used as an output enable. Notice, also, that port lines P20 and P21 will now act as address lines A8 and A9, respectively.

Whenever you try to interface an external memory device to any single-chip microcomputer, you sacrifice I/O lines. In this case, there is also a possibility of expanding the program memory off chip to 4096 bytes. An actual barrier is encountered as you attempt to leave the 2K point. To traverse higher requires that a SEL MB1 instruction be exercised. This will effectively allow another 2K.

Of course, you must remember that only 1K is resident on chip. When accessing these higher locations, port pins P22 and P23 become address lines A10 and A11. So it is a good idea to not utilize these four pins as important I/O lines if you ever decide to emulate or use external memory.

Access Anything

The other instruction dealing with program memory moving is MOVP3. Remember I said getting table data within the same or current page is limiting? Well, this instruction will allow you to access anything in Page 3 (the last 256 locations of internal memory) at any time. This says that you put your data tables high up

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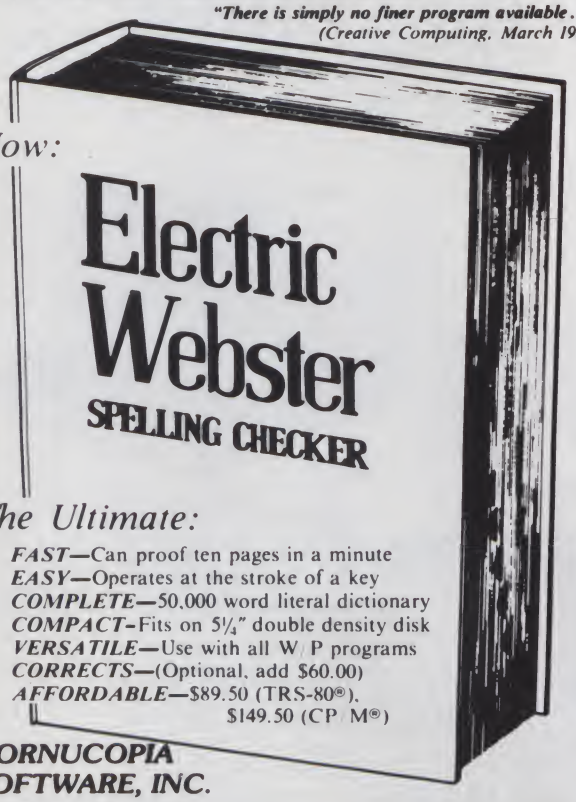

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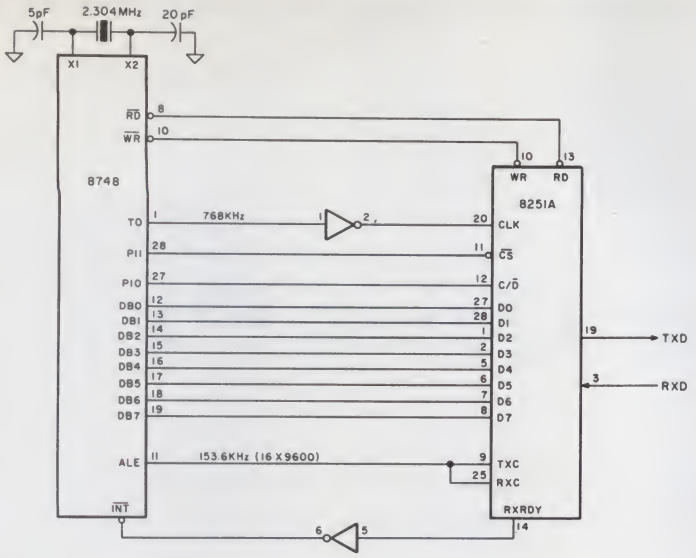

Fig. 5. Hook-up of an external UART device to the 8748.

in memory, where they won't interfere with programs. Well, that's one problem solved.

Now let's turn to our left. The columns of instructions here represent the ability to store and retrieve data from an external memory device. It is assumed that this device is RAM; however, any IC that can be addressed like memory may be substituted. Let me explain. Remember the fact that the Motorola 68701 had an on-board UART? Well, it's a relatively easy task to hook an industry-standard UART (which costs a couple of dollars) onto the 8748. Fig. 5 shows the hookups that allow the use of an 8251A UART. To show the versatility of the 8748, I have included some interesting interfacing.

Have you ever had to add a UART to a system? Sure these devices come in (relatively) small packages now and require little software maintenance to keep them going. But what about the bit rate clocks you've had to provide?

Suddenly the single IC circuit becomes several devices. If you opt for one of those single-chip baud rate generators, you may as well buy another 8748 for the price they demand—and don't forget the extra crystal. That will set you back another $3 or $4. Discouraged? Don't be. Remember, you have a dedicated I/O controller here.

The designers had considered this problem and provided some relief by allowing the crystal frequency clock divided by 15 to output from the ALE line. If you set up your UART to accept a frequency 16 times that needed for a certain bit rate, you can select a crystal to run both the 8748 and the UART. The example in the figure will transmit and receive at 9600 baud, given the frequency of crystal I have chosen.

Another problematic input of the 8251A is the CLK line. This pin demands a clock frequency at least 4.5 times greater than the bit rate. I have enabled the T0 output (ENT0 CLK) clock, which is the crystal frequency divided by three, to provide this. It works fine.

You might notice that there is no address latch present in Fig. 5. No, there is none on board the UART. How, then, are the internal registers addressed? Well, I ignore the address info coming from either R0 or R1. I have control over what goes in or out of the chip by the $\overline{RD}$ and $\overline{WR}$ lines. I use a port line to select the UART, and to address (via C/$\overline{D}$) internal register locations. Because this is the only device present outside the 8748, I really don't care what happens to the pointer data.

So in retrospect, memory manipulations with the 8748 are not only simple, but useful. All of the instructions, except the immediate data move, are contained in one-byte chunks.

We've covered so much, yet there's more to go! Next month, we'll conclude our journey into the land of the 8748 with construction details of a program emulator and complete programmer. In the meantime, try to get a copy of the *Microcontroller Data Manual* from your local Intel representative. This will help you understand what is to come, both in the next article and in your future as an intelligent control designer.■

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A Sinclair Quick Fix

These machine-language programs give your ZX-81 (Timex-Sinclair 1000) the ability to write and read data tapes.

By Alan Sehmer

With its $100 price tag, the Sinclair ZX-81 is truly an amazing machine. The package includes an 8K Basic interpreter, a built-in rf TV modulator and a cassette tape port.

For all its good points, the ZX-81 does have a few faults. One is its inability to make data tapes. Until now, whenever the ZX-81 read from or wrote to the data tape, it would always transfer both the Basic program and whatever variables had been defined. Because of this feature, it's impossible for more than one program to share a common database.

Whenever a program is read from tape, it brings along its own variables, destroying any variables already in memory. I often find it desirable to write data-handling programs in small, single-purpose pieces (for example, one program to enter data, one to sort or number crunch and one to output). This type of approach makes changing or writing new programs fairly easy, but it requires data tapes.

Solving the Problem

To overcome this problem, I wrote two short (90 bytes total) machine-language programs. These programs will read or write only data to the tape, without affecting the Basic program. The programs are "hidden" in the first line of the Basic program as a REM statement and called from the Basic program with the USR command.

These programs will transfer an array of numbers or strings to or from tape. The array can have any name with as many dimensions of any size that the programmer wishes. As with most such programs, there is some setting up to do and there are some restrictions that must be followed.

First, these programs will transfer only arrays. Second, the array to be filled by the read program must be the same size as the array that was written to tape. Third, the REM statement holding the machine-language programs must be the first line in the Basic program. It may have any line number but it must be the first line. Another factor that must be considered is that the programs ex-

Column	
1	Memory address at which the instruction will start.
2	The machine code instruction.
3	Line numbers, same as in Basic. (These are decimal.)
4	Labels (parts of the program are called by these labels).
5	The name of the instruction (OP-CODE).
6	Any argument that the instruction may need.
7	Comments.

Table 1. Code for seven columns in Listing 2.

```
10 REM 12345678901234567890123456789012345678901234567890
   12345678901234567890123456789012345678901234567890
100 LET S$="0123456789ABCDEF"
110 FOR X=16514 TO 16603
120 INPUT H$
130 LET D=0
140 FOR Y=0 TO 1
150 FOR Z=0 TO 15
160 IF H$(Y+1)<>S$(Z+1) THEN GOTO 180
170 LET D=+Z*16**(1-Y)
180 NEXT Z
190 NEXT Y
200 POKE X,D
210 PRINT H$;"  ";
220 NEXT X
```

Listing 1. Puts programs in Listings 2, 3 and 4 into memory.

Address correspondence to Alan Sehmer, 150A Lorretta Drive NW, Corrales, NM 87048.

pect the array to be first on the Basic variable stack.

What this means is that the DIM command for the array must be the first command executed (except for REM commands). Also, because it's impossible for two arrays to *both* be first on the variable stack, only one array may be read or written from a given Basic program. The array may be either numeric or alphanumeric.

If it becomes necessary to store both numeric and alphanumeric arrays, there are two ways around the problem. You may convert the alpha characters to numbers using the code command and store everything as numeric, or you can convert numeric to alpha using the CHR$ command and store everything as alphanumeric.

```
                00100 ; SINCLAIR DATA TAPE PROGRAMS  AL SEHMER      6/6/82
                00110 ;                WRITE DATA
 4082           00120          ORG     4082H           ;4082H  = 16514D
 4082 CDE702    00130          CALL    02E7H           ;SET FAST MODE
 4085 060E      00140          LD      B,0EH
 4087 2100FF    00150 DELAY2   LD      HL,0FF00H       ;DELAY FOR TAPE
 408A 2B        00160 DELAY1   DEC     HL              ;      TO GET TO SPEED
 408B 7C        00170          LD      A,H
 408C B5        00180          OR      L
 408D 20FB      00190          JR      NZ,DELAY1
 408F 10F6      00200          DJNZ    DELAY2
 4091 2A1040    00210          LD      HL,(4010H)      ;LOAD HL WITH START
 4094 23        00220          INC     HL              ;   ADDRESS OF OUTPUT
 4095 4E        00230          LD      C,(HL)          ;   VARIABLE AND LOAD
 4096 23        00240          INC     HL              ;   BC WITH LENGTH OF
 4097 46        00250          LD      B,(HL)          ;   VARIABLE
 4098 23        00260 OUT      INC     HL
 4099 C5        00270          PUSH    BC              ;SAVE BYTE COUNTER
 409A 5E        00280          LD      E,(HL)          ;GET BYTE TO OUTPUT
 409B CD1F03    00290          CALL    031FH           ;OUTPUT BYTE
 409E C1        00300          POP     BC              ;DEC BYTE COUNTER
 409F 0B        00310          DEC     BC
 40A0 78        00320          LD      A,B
 40A1 B1        00330          OR      C
 40A2 20F4      00340          JR      NZ,OUT          ;DONE?
 40A4 C9        00350          RET
                00360 ;
                00370 ;              READ DATA       40A5H = 16549D
                00380 ;
 40A5 CDE702    00390 READ     CALL    02E7H           ;SET FAST MODE
 40A8 2A1040    00400          LD      HL,(4010H)      ;SAME AS ABOVE
 40AB 23        00410          INC     HL
 40AC 4E        00420          LD      C,(HL)
 40AD 23        00430          INC     HL
 40AE 46        00440          LD      B,(HL)
 40AF 23        00450 AGAIN    INC     HL
 40B0 C5        00460          PUSH    BC              ;SAVE BYTE COUNTER
 40B1 1E08      00470          LD      E,08H           ;LOAD BIT COUNTER
 40B3 DBFE      00480 LOOP1    IN      A,(0FEH)        ;WAIT FOR PULSE
 40B5 D3FF      00490          OUT     (0FFH),A
 40B7 17        00500          RLA
 40B8 30F9      00510          JR      NC,LOOP1
 40BA 0E94      00520          LD      C,94H
 40BC 061A      00530 LOOP2    LD      B,1AH
 40BE 0D        00540 LOOP3    DEC     C               ;TIME PULSE
 40BF DBFE      00550          IN      A,(0FEH)
 40C1 17        00560          RLA
 40C2 CB79      00570          BIT     7,C
 40C4 79        00580          LD      A,C
 40C5 38F5      00590          JR      C,LOOP2
 40C7 10F5      00600          DJNZ    LOOP3
 40C9 2004      00610          JR      NZ,LOOP4
 40CB FE56      00620          CP      56H
 40CD 30E4      00630          JR      NC,LOOP1
 40CF 3F        00640 LOOP4    CCF
 40D0 CB16      00650          RL      (HL)            ;COLLECT BITS INTO
 40D2 1D        00660          DEC     E               ;  A BYTE
 40D3 20DE      00670          JR      NZ,LOOP1        ;DONE WITH BYTE?
 40D5 C1        00680          POP     BC              ;DEC BYTE COUNTER
 40D6 0B        00690          DEC     BC
 40D7 78        00700          LD      A,B
 40D8 B1        00710          OR      C
 40D9 C8        00720          RET     Z               ;DONE.
 40DA 18D3      00730          JR      AGAIN
 0000           00740          END
00000 TOTAL ERRORS
LOOP4   40CF
LOOP3   40BE
LOOP2   40BC
LOOP1   40B3
AGAIN   40AF
READ    40A5
OUT     4098
DELAY1  408A
DELAY2  4087
```

Listing 2. Machine-code program.

Using the Programs

To use the programs, they first must be put into memory. To do this, enter Listing 1. Note that line 10 has 90 characters after the REM; this is to reserve room for machine-language programs.

The rest of the program is a hexadecimal-to-decimal converter and a routine in which the machine-language code will be poked into the correct locations. Listing 2 is the machine-code program; most numbers in these programs are in hexadecimal. The seven columns across the page are explained in Table 1.

You need to worry only about column 2, which includes the numbers that must be entered. Now run Listing 1. You'll get a blank screen except for the L cursor and two quotes. Start entering the machine code two digits at a time (for example, CD E7 02 06), pressing Enter after each two-digit figure. The figures will be displayed for checking purposes as you enter them.

You should run out of numbers the same time the program ends. Go back and make sure you have entered everything correctly. (Machine code is very unforgiving about mistakes.)

When you are sure that there are no mistakes, ask for a program listing. Line 10 should now contain all sorts of strange words, graphics characters and symbols. Check that line 100 is intact. If not, start over.

If line 100 is OK, delete lines 100–220, leaving only line 10; save that on cassette. Line 10 is the starting point around which all your data handling programs will start.

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How to use the programs is best shown by examples. In Listing 3, which writes data to tape, line 10 is the machine-language program, line 20 sets up the array A that will be written to tape and lines 30–50 fill array A with numbers. Lines 50–60 prompt and then wait for you to start the tape, and line 80 writes the array on tape.

The variable X in line 80 is a dummy variable. It may be anything you want; however, it will be changed by the USR call, so don't use a variable you wish to save.

Listing 4 reads back the data saved with Listing 3. Line 10 once again should be the machine-program line, and line 20 sets up the array to be filled with data from tape.

Note that the array to be filled does not have the same name as the array that was written to tape. The machine programs do not check the array names; therefore, the array names don't have to match, although they must have the same dimensions.

Lines 30–40 wait for you to start the tape. Line 50 reads the data. Line 60 is needed because anytime either USR is used, the ZX-81 is put into the fast mode. Lines 70–90 display the data read.

One last note: the machine-language programs read and write data the same way the ZX-81 reads and writes Basic programs, so the same volume setting that works with Basic should work with these programs. ■

```
10 REM
20 DIM A(200)
30 FOR X=1 TO 200
40 LET A(X)=X
50 NEXT X
60 PRINT "START TAPE"
70 INPUT D$
80 LET X=USR 16514
```

Listing 3. Program that writes data to tape.

```
10 REM
20 DIM B(200)
30 PRINT "START TAPE"
40 INPUT D$
50 LET X=USR 16549
60 SLOW
70 FOR X=1 TO 200
80 PRINT B(X),
90 NEXT X
```

Listing 4. Program that reads back data saved with Listing 3.

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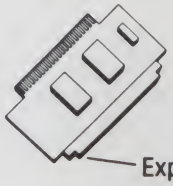

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You Can Count on 1-2-3

Software users have never had it so good. This integrated package from Lotus adds up to value as a spreadsheet, graphics program and DBMS system. It's also capable of word processing.

By Thomas V. Bonoma

Thanks to full-page ads in *Business Week*, *Fortune* and other business publications, and thanks to a flood of peeks and previews in the trade press, Lotus Development Corp.'s 1-2-3 program is taking the IBM PC and Compaq software markets by storm.

Since true software integration so far has proven to be a myth (except, possibly, in the case of Apple's Lisa), managers, hobbyists and other computer users justifiably might be wary about plunking down $500 for another package that might have two months' novelty value, and then will languish on the shelf—to be replaced by the next "major innovation."

1-2-3, an integrated spreadsheet and graphics and database management system with limited text-processing capabilities, is not in this category.

This article is one reviewer's "nickel tour" through 1-2-3. When you leave the bus, ladies and gentlemen, you should have a feel for what 1-2-3 will (and won't) do, just how innovative and integrated it is, how it stacks up with the other major contenders to the integration throne on the PC and whether you should get your own copy or commit your company to an order for 1000 units.

Packaging

1-2-3 is supplied on four disks in an IBM-like box-and-binder system. The package includes a hard plastic overlay for the ten IBM PC function keys, a quick reference guide and 356 pages of documentation laid out in a consistent and coherent format.

Protected from unauthorized copying, 1-2-3 runs under standard PC-DOS, and therefore can work with other applications programs that use this widely available operating system.

Lotus Development Corp.'s 1-2-3 program is taking the IBM PC and Compaq software markets by storm.

Only two disks actually are needed for operating 1-2-3 in everyday use. Thoughtfully, Lotus has supplied a preprepared program disk back-up and an extensive disk-based tutorial that can bring the learner up to speed with the rudiments of 1-2-3 operation.

The fourth disk is taken up by 1-2-3's Graph program, a necessary utility for transferring 1-2-3's graphics from screen to hard copy. (More on the Graph program below.)

The system is not delivered ready-to-use; it must be SYSGENed, or prepared, by transferring certain PC-DOS operating files from the system disk to the program disks.

Setup instructions are clear and easy to follow; you can even configure the Lotus system for operation with a hard disk.

What You Need

The remainder of this article assumes you use a "standard" PC configuration. This includes 128K of memory (up to 544K is supported; I tested the system with 320K) and a monochrome *and* a color board with an RGB monitor (1-2-3 is not recommended for use with a color television, and won't give you any screen graphics at all without a color board, although it still will generate and print them).

Other 1-2-3 standards are two disk drives and an Epson MX-80 or MX-100 printer equipped with Graftrax chips.

I tested 1-2-3 mostly with the aforementioned hardware, which a recent *New York Times* advertisement suggests can be acquired, along with a copy of 1-2-3, for the meager sum of $5700 (at Macy's!) if you're starting from scratch. However, I also put 1-2-3 through its paces with the two optional peripherals supported by the graphics programs—an IDS Color Prism printer and an HP7470A two-pen plotter. Examples of graphics from all three configurations accompany this review.

Programs and the Lotus Access System

Before discussing the specifics of 1-2-3's operation, it is important that you have a feel for the "operating shell" within which 1-2-3 operates. It is one of Lotus' major innovations and goes a long way toward adding credibility to the integration claim made for the software.

Thomas V. Bonoma, 45 Drum Hill Road, Concord, MA 01742, writes a monthly column—"What's New, Big Blue?"—for Microcomputing.

After booting the 1-2-3 disk, a main menu is displayed and you're offered several choices. You can enter:

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4. A set of "translation" routines, which helps you to import VisiCalc or other .DIF format files to 1-2-3 and to export 1-2-3's file format to the .DIF standard interchange format for use in other programs.

5. The Graph program, by which your saved picture files containing graphs can be printed or plotted.

All menus in the Access System itself and inside the applications run by the Access System have the same displays, keystroke requirements, prompts and even "beeps" for errors. This means that the 1-2-3 purchaser has the entire operation of his machine (including "administrative" details like file back-up and the deleting of unnecessary disk files) made marvelously easy. The 1-2-3 owner also has the process rationalized with similar keystrokes and prompts.

It's hard to overstate the importance of the Lotus Access System to professional and other nontechnical users. Lotus has increased the usefulness of its machines many times. This is even more important for the fact that the file management, disk management and other programs are useable apart from 1-2-3 itself, and thus can be employed in everyday use for all of the operator's management needs.

Inside 1-2-3

Within 1-2-3 itself, the user is faced with a constantly available set of menus, submenus, "suggested responses" and the like; this makes the 1-2-3 system a clear rival to spreadsheets like Multiplan for ease of use and clarity of expression.

Submenus are clear, and a constantly available on-line help feature keeps the operator on the right track. Again, this help facility is unique and useful; it allows the user to move both vertically and horizontally through help requests.

Most on-line help systems available today allow increasing specificity of requests for aid. If a user hits "help" (F1 on the IBM PC) at the main menu,

In addition to all the usual financial and statistical spread sheet functions, good cursor movement and excellent on-line help, 1-2-3 has some special abilities for spreadsheet manipulation.

I'll illustrate three examples here. The first refers to Lotus' good date-arithmetic functions, not usually found in spreadsheets. The second refers to keyboard macros, and programming with 1-2-3.

The third refers to some "data" functions, like /Data Table, /Data Fill and /Data Distribution which formally are DBMS functions, but are most useful in spreadsheets too.

1. DATE ARITHMETIC: Not Fancy But Functional

Write Today's Date: @TODAY fx.	A. As Internally Represented	30380
	B. Formatted to a Date	05-Mar
Analyze for @DAY, @MO, & @YR	A. Apply @DAY Function	5.00
	B. And @MONTH Function	3.00
	C. And @YEAR.	83.00
Then, perform manipulations.	A. If TODAY>Feb. 20 show plusses	++++++
	B. How Long to 1/1/84?	302
	C. How Long to 1/1/1999 in hours?	138744

II. PROGRAMMING/MACROs: Fancy, and Requiring Thought

Step 1 — Hate to type in the worksheet frame all the time? Let's define a macro to do it for us, to zero all numerals, to format as currency, and to jump to the beginning of the table!

```
LABELS Jan-Jun{right}Jul-Dec{left}~
NUMBRS {down}0{right}0~
FRMT:C2 /rfc2~{left}~
RETRN {left}{up}
```

Step 2 — Name the Macro with a /Range Name command, using a \ and a letter.

Step 3 — Invoke the macro by putting the cursor at the beginning of where you want the table to be, and hitting [Alt]-Letter. I'll put the cursor on cell C50 and do it now.

Viola!

Jan-Jun	Jul-Dec
$0.00	$0.00

Want your macros to be interactive? They can...replace the zeroes above with {?}, and the macro will stop at each question mark to get user-input before proceeding. Automatic spreadsheet!

Menus/Programming — There's even more. An /X command, which can be used in macros only, gives the user rudimentary, if, goto, and quit commands. In addition, an /XM command allows you to use your own user menu in place of 1-2-3's.

III. /DATA COMMANDS: Quick, and Clean

/DATA TABLE 1 — Substitutes a column of numbers, like interest rates, one at a time into a specified cell, and constructs a senstivity analysis table.

Main Calculation	Inflation	Buying Power
	3%	3.63
Sens. Table		3.63
Calculated	4%	4.84
Automatically w/	5%	6.05
/DATA TABLE 1	6%	7.26

/DATA TABLE 2 — Same as /DATA TABLE 1, except processes two what-if lists simultaneously

Main Table	Flavor	Jan	Feb	Mar	
	Choc.	10.00	20.00	30.00	
	Vanil.	20.00	20.00	20.00	
	Straw.	10.00	5.00	99.00	
	Mocha	3.00	5.00	2.00	
	TOTALS	43.00	50.00	151.00	244.00

DATA TAB				
244.00	5.00	6.00	8.00	
Sens Auto	9.00	245.00	246.00	248.00
Calculate	7.00	243.00	244.00	246.00
w/DT2	4.00	240.00	241.00	243.00

/DATA DISTRIBUTION — Produces a frequency distribution of groups of numbers in "bins."

	BINs	RESULTS	NUMBERS		
Results	1.00	1.00	2.00	9.00	12.00
Produced	3.00	4.00	11.00	0.30	2.00
by /DD	5.00	1.00	4.00	6.00	2.00
	9.00	2.00	13.00	34.00	2.00
		4.00			

DATA FILL — Enters a sequence of numbers into a range of cells, using a start, stop and step value, a la a "do loop."

Nos. from	0.00	0.80	1.60
0 to 2.2	0.20	1.00	1.80
by .2s	0.40	1.20	2.00
	0.60	1.40	2.20

Table 1. An illustration of Lotus' special spreadsheet functions.

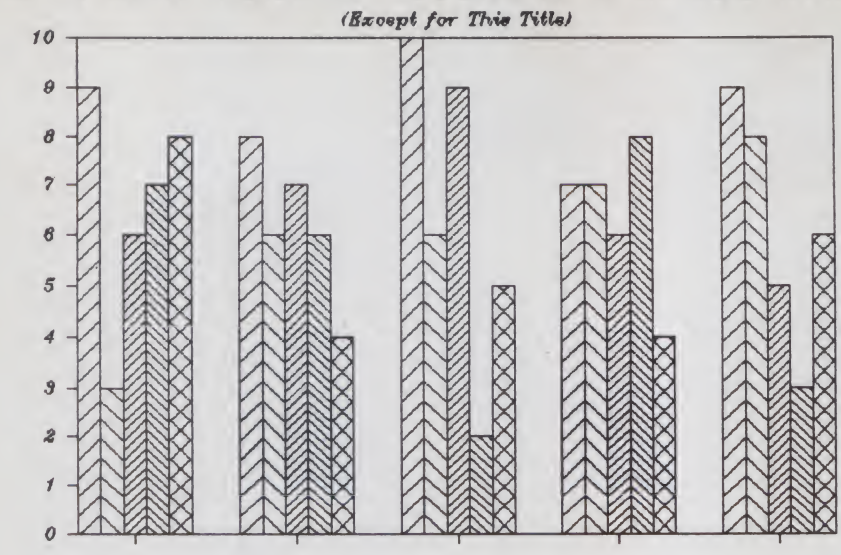

Fig. 1. A "Plain Vanilla" 1-2-3-generated graph, printed on an Epson MX-80 with Graftrax. Note how the necessity of using a separate Graph printing program, even one with a "preview" feature, meant that the missing final "h" on the title was not caught until the graph was printed. To fix it would require reloading 1-2-3, the worksheet, recalling and respecifying the graph and then reprinting the whole thing.

a listing of submenus and what they do is given. If he hits F1 at one of the submenus, a listing of *its* functions and operation is given.

The Lotus system has all of this, but also allows the user to move (with cursor control) horizontally, across related topics of interest. The system retains the most recently referenced 15 help pages in the computer's memory to avoid unnecessary disk waits, and it's indexed for rapid retrieval.

Another example of design excellence is that more than 200 help screens are available for review.

1-2-3 Intricacies

Well, we've seen the outside of the bus and even peeked at the upholstery. Now it's time to look at the engine and to take our tour.

I'm going to assume that you know what a spreadsheet program is and that you either own a popular spreadsheet or have access to one. I'll also

(Continued on p. 64)

1-2-3 vs MBA vs Multiplan

Lotus Development Corp.'s 1-2-3 combines spreadsheet, graphics, database management and text-processing capabilities into one of the most useful software packages on the market. And it compares favorably to other software packages.

To that end, I've prepared Table 1, which matches 1-2-3 on a number of important criteria to two vastly different programs.

The first is Context Management Systems' MBA, which, like 1-2-3, is an integrated spreadsheet, DBMS, graphics and text editing program and which includes (in release 2.0) telecommunications support and forms processing. The second is Multiplan, which is, in my humble opinion, the best pure spreadsheet program on the market.

This comparison might seem unfair to Multiplan, for it doesn't attempt to do nearly as much as 1-2-3 or the MBA. However, the best way to find out how well the "guts" of these two integrated programs work is to compare them to the best dedicated spreadsheet on the market.

The bottom line develops from these comparisons, and is given at the end of the table. But don't skip ahead; there are important details in between.

Functionality Factors

Note that in functionality, the most objective observer would have to say that the MBA is more complete than the 1-2-3, which in turn is more complete than Multiplan. No surprise here—the Context people have had a year in the market to improve their product, and neither 1-2-3 nor Multiplan was ever intended for heavy text editing and telecommunications.

Now look at the environment columns, where it's clear that 1-2-3 outshines the competition and that Multiplan would be rated second. MBA is a distant third, partly because it requires more memory than 1-2-3 to run.

My ranking assumes that you think HP plotter support and hard disk support are necessary. If you own an Anadex printer, you might lean toward the MBA.

A most revealing section is the one labeled "FX'ALITY" (functionality), for it refers to that peculiar mix of learning time, quality of output and breadth of usefulness that we have come to call necessary in top-quality software.

None of the packages are slouches at these items, although it is here where 1-2-3 really shines. The Lotus Access System, for example, requires less learning time than the MBA. The same is true of Lotus' disk tutorials and more extensive help functions. Multiplan has no tutorial, but it holds its own in this section.

Sundry

Let me explain a few of the more obscure entries.

In judging quality of text and graphics display, I rated the ability to highlight, manipulate or otherwise set off portions of text. Multiplan is the best at this, 1-2-3 is acceptable (I'm a tough grader) and the MBA is only adequate, because the color screen text display abilities, including scrolling, are weak on the PC and because you need to use the color screen if you're going to employ MBA graphs.

In graphics, the MBA's graph commands are more flexible than the 1-2-3's, but its displays and prints are in monochrome, which doesn't use the unique capabilities of the PC. 1-2-3 additionally has a better "feel" on graphics display and a better menu-driven way of printing them.

For text printing, by the way, I judged whether the user could have headers, footers, borders, automatic sheet splitting and automatic page-numbering and dating. 1-2-3 really shines here, although Revision 2 of the MBA has all these functions as well, but it's hard to beat Multiplan at anything it was designed for.

In Macros, Range Memory, Cell Protection, Subsidiary Sheet definition and "operations shell," I refer to specialized functions and user-friendliness characteristics that are not necessary in a program, but that make its use easier and faster.

Range Memory refers to whether the program "remembers" the last range you used, and suggests it to you the next time the command is invoked. Cell Protection asks whether you can "lock" cells so that users can't change them. Subsidiary Sheets can contain parts of a spreadsheet, and depend on a "master" sheet, or vice versa.

Again, 1-2-3 wins in these categories, with Multiplan second and MBA third (although MBA's folders and documents storage system has the potential to be closer to what managers do than either of the other systems). Multiplan is the only true subsidiary sheet handler of the group.

(Continued on p.63)

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Finally, on import/export and speed, we come to the heart of any system. What you can use the program with is an important consideration, because most users already have spreadsheets and won't want to rekey their data.

The table is clear on this; because 1-2-3 and Multiplan use PC-DOS, they're more broadly useful than the MBA at this point in time. However, if you use Versaform or one of the other Pascal-driven DBMS programs, MBA probably can read it.

The "SYLK" label under Multiplan refers to Microsoft's attempt to define a file interchange standard, such as .DIF. It didn't work out.

Regarding speed, there is no contest. 1-2-3 is awesome, Multiplan is okay, and the MBA is slow. The MBA is nowhere nearly as slow as it used to be, but compared to 1-2-3, almost anything is slow.

The "Other" section of the table is self-explanatory, so let's turn to the "bottom line."

Table 1. Comparison of Lotus Development Corp.'s 1-2-3 to Context Management Systems' MBA and to Multiplan.

Characteristic	1-2-3	The MBA	Multiplan
VERSION	1.0	2.0	2.0
I. FUNCTIONS			
Spreadsheet	256 x 2,048	Depends	63 x 255
.	Two Windows	Four Windows	8 Windows
.	Good Edit/Cursor	Manual Recalc.	Exc. Edit/Cursor
.	Named Ranges	Box Markers	Named Ranges
.	44 Functions	36 Functions	41 Functions
Database	32 Retrieve Fields	20 Retrieve Fields	None.
.	240 chars./field	Indexed Data	
.	7 DBMS Funcs.	Forms Processing	
.	Table, Fill, Dist.		
Graphics	Pie, Bar, Line	Pie, Bar, Line,	None.
.	6 Ranges Max.	Scatter, Hi-Low	
.	Leg., Symb., Patt.	Area. Many ranges	
.	Named Graphs	Patterns, flex.	
Word Process.	None.		None.
.			
.			
.			
Text Editing	Rudimentary.	Good.	None.
.	Heads,Page Nos.	Pascal text	
.	Suitable for	editor w/	
.	Short Docs.	enhancements.	
Telecomm.	None.	Acceptable.	None.
.		Good protocol	
.		control.	
.		Loses chars. during saves.	
II. ENVIRONMENT			
256K	Uses to 544K	Uses to 544K	Not Required
128K	Required	256K required	Not Required
Color Board	Recommended	Required	Supported
Mono Board	Optional	Optional	Required
Epson	With Graftrax	With Graftrax	Required
IDS Prism	Supported	Supported	Supported
Anadex	Not Supported	Supported	Supported
HP7470A	Supported	Not Supported	Not Supported
Hard Disk	Supported	Not Supported	Supported
Okidata (82A/83A)	Not Supported	Supported	Supported
III. FI'ALITY			
Tutorial	Excellent-Disk	Good-Manual	Good-Manual
Time/Proficient	3-5 days	5 days	2 days
Text Display	Good	Acceptable	Excellent
Graph Display	Excellent	Acceptable	Not Applic.

More →

I defined three typical users and three typical applications for each of the programs, and then subjectively rated them as to how they served each person and need.

The Audiences

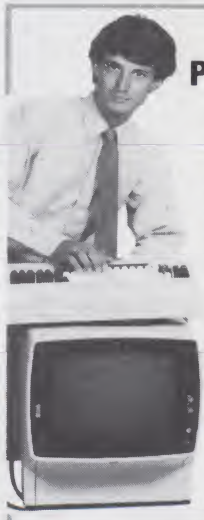
1-2-3, in my opinion, because of its speed and graphics, is excellent for the hobbyist, "knowledge worker," or staff analyst in a corporation. These individuals seldom need to write lengthy documents incorporating spreadsheets, graphs or text, but they need an analysis tool.

For the manager who'd like to have all of 1-2-3's capabilities as well as an integrated professional word processor that can "gather up" graphs and put them into the memoranda, 1-2-3 leaves something to be desired on functions. MBA, which supplies all the functions, is less than satisfactory on speed.

A similar logic was used for the applications. Financial analyses and sensitivity analyses seldom require lengthy explanations, and it is on the analysis portions that 1-2-3 really shines. Strategy analyses, by contrast, require lengthy text explanations in addition to graphics and spreadsheets; 1-2-3 doesn't have extensive text processing capabilities.

The MBA was downrated for both hobbyists and managers because of its slow speed

(Continued on p. 64)



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assume that you need to know what Lotus' 1-2-3 does differently or better than a standard VisiCalc.

I'll take you through three aspects of these differences as illustrations of 1-2-3's power in spreadsheet applications. Then we'll look at 1-2-3's graphics and DBMS capabilities.

Spreadsheet Capabilities

1-2-3 gives the user a 256×2048 (524, 288-cell) electronic worksheet on which to perform calculations, enter tables and record databases (the same sheet is used for everything). The spreadsheet supports two different windows so the user can work with two widely separated parts of the worksheet at the same time.

1-2-3 features 44 built-in functions, from the commonplace (such as @SUM and @AVG) to the esoteric (a full set of NPV functions, for instance, including date arithmetic). Operation is smooth, with easy cursor control, clever use of highlighting and the ability to name ranges on the sheet for inclusion in formulae or further manipulation.

Above all, operation is fast. Usually, you'll look twice or even three times to see that the sheet has been recalculated—the speed of computation is that great.

The standard operations available for spreadsheet control are done especially well in 1-2-3. A variety of

The nicest thing about 1-2-3's graphics commands is that they're fully integrated with the spreadsheet and DBMS functions. That means you don't have to do anything but select the graph menu, specify a data range and any options, and then call a graph menu like you would any other. The graphics routines are also very quick...1 or 2 seconds maximum to completed picture. And, if you have color and mono monitors, you can keep the data on mono and see the graphs on color simultaneously.
The negative about graphics is that to print them, you have to leave 1-2-3 (but not the Access Manager), call a program GRAPH and get your output. There is no convenience printing function for graphs in 1-2-3.

SAMPLE SPREADSHEET

Grades	1	2	3	4	5
Student	9	8	10	7	9
Herbie	3	6	6	7	8
Mary	6	7	9	6	5
Sam	7	6	2	8	3
Phyllis	8	4	5	4	6

And, the accompanying figures show two graphs, one "plain vanilla" on the Epson, and one full blown on the IDS Prism Printer. I have printed them half-size (a legal option from GRAPH) to save space).

Table 2. Some notes on graphing, and a sample plot.

(Table 1 continued)

Characteristic	1-2-3	The MBA	Multiplan
Graph Print	Excellent	Excellent	Not Applic.
Macros	Yes	No	No
Range Memory	Yes	No	Yes
Cell Protect	Yes	No	Yes
Sub. Sheets	Yes	No	Yes
Ops. Shell	Excellent	Folder/Docs-Good	Good
Imports Fr:	DIF/VisiCalc	VisiCalc	DIF/VisiCalc
.	dBase (partial)		ASCII
.	ASCII		SYLK
Exports To:	dBase	None	SYLK
.	DIF		
.			
Speed	Fast	Slow	Medium
IV. OTHER			
Price	495	695	400
Support	Unknown	Good	Good
Availability	Wide	Narrow	Wide
V. OVERALL			
Suitability for...			
Hobbyist	EXCELLENT	GOOD	EXCELLENT
Manager	GOOD	GOOD	EXCELLENT
Knowledge Worker	EXCELLENT	EXCELLENT	EXCELLENT
Suitability To...			
Fin. Analysis	EXCELLENT	GOOD	EXCELLENT
Strategy Analysis	GOOD	EXCELLENT	GOOD
Sensitivity Anal.	EXCELLENT	GOOD	GOOD

(From p. 63)

and because of its word processor, which was significantly improved in revision 2 but still is insufficient for most users.

Counterbalancing this, the MBA was upgraded for both these classes because it includes text formatting abilities, telecommunications features and complete forms functions. That left it with a good rating in both categories.

For knowledge users, who seem to require a little of everything, I rated the MBA excellent in spite of its speed.

And the Applications

Regarding applications, the MBA seems best-suited where 1-2-3 is weakest—for the application where text, graphics, spreadsheet, maybe DBMS and telecommunications may be involved.

Although the MBA's ability to put graphs and spreadsheets into memos is still first-generation, the ability is nonetheless there.

Regarding Multiplan, note that the ratings given implicitly include the aspirations of the program. Multiplan aspires to fewer functions but handles these functions better, and thus will be, in my opinion, more satisfying to more classes of users. When applications are considered, however, Multiplan is less general than the others, and so suffers.

Epilogue

One final note: I started out ambivalent—even somewhat skeptical—of 1-2-3. After all, I've worked with MBA for a year, and I *like* it. But I think I'm coming to love 1-2-3.■ *T. B.*

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formatting operations, for instance, is available, allowing the operator to display a cell's contents using percentages, dollar figures with or without commas, and plus or minus signs.

On all the regular functions, as well as on built-in functions, formula manipulation, range-moving and erasing (including replication), the system is a joy to use. The editor is especially welcome to those of us who are not perfect and who must often go back and make changes in long entries.

So far, so good. But what can this $500 spreadsheet do that a $40 one cannot?

Look at the first page of Table 1, which shows 1-2-3's text editing/justification abilities and some interesting facets about 1-2-3's date arithmetic functions.

Text is entered into any 1-2-3 cell—up to 256 characters—just by typing. A command to "/Right/Justify" the text (the "/" is a 1-2-3 command character) is issued, and the operator can reform the text across any row/column combinations. You wouldn't want to use 1-2-3 to prepare a doctoral dissertation, but to add explanatory text to tables, it'll do.

The date manipulations I've included on the first page of Table 1 might not seem particularly valuable—until you start thinking about potential applications that this facility can open up. For instance, you can write invoices for clients whose bills are overdue, or you can include an automatically updated "Last Revised" cell on your spreadsheets, or you can do hundreds of functions with date arithmetic. And with the ability to split up days, months and years, other applications become possible.

A lot of unique and useful features in 1-2-3 can't be found on other spreadsheets. Look at the second page of Table 1; it explains 1-2-3's keyboard macro and programming capabilities.

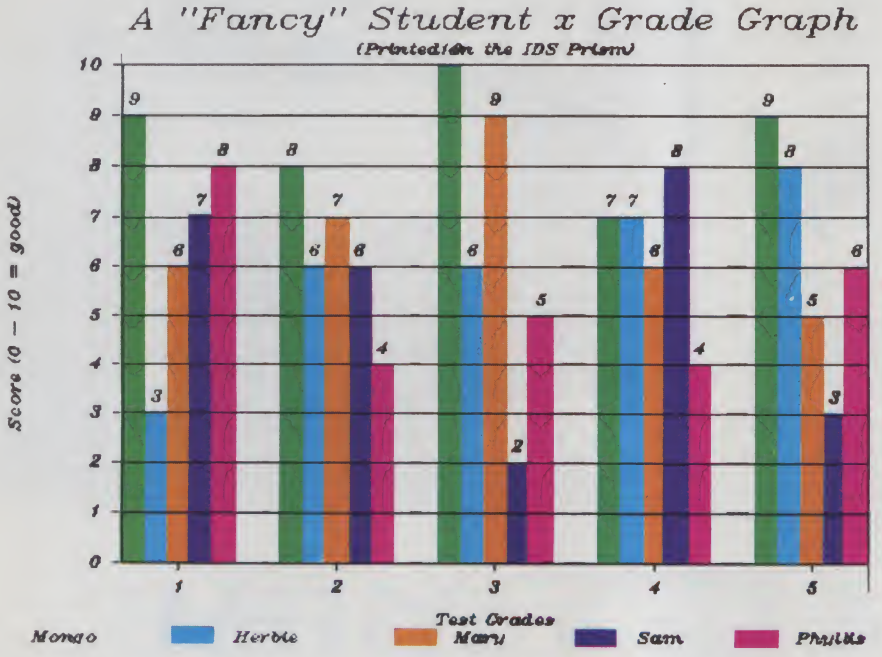


Fig. 2. A fancy grade graph. Note the overprinting of the data label on the third green bar of the second title line.

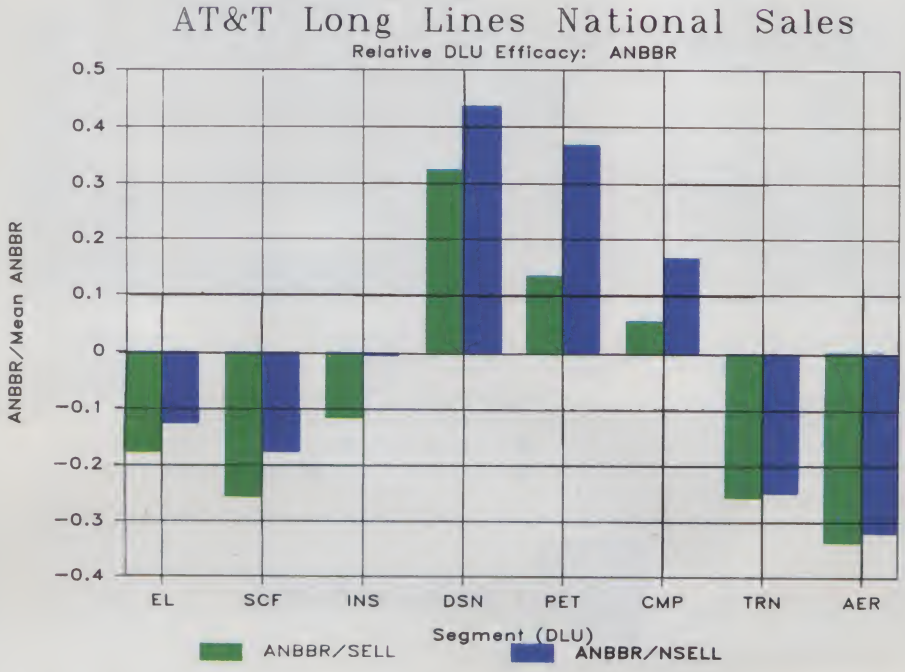


Fig. 3. This 1-2-3 graph was done on the HP-7470A Plotter.

Micro Macros

The word processor I use, PowerText, supports macros. If I'm writing an article on 1-2-3, for example, I certainly don't want to have to type "1-2-3" every time I need that phrase. Rather, I want to define function key number 1 on the PC to stand for 1-2-3, and just hit that key when I want the word or phrase.

Programming capability, which PowerText does not have but 1-2-3 does, refers to the additional capacity to process user inputs and to make different decisions depending on the character of that input.

As Table 1 shows, 1-2-3 lets you automate (Lotus calls it "Automatic Typing") any frequently used commands, phrases or even formulae that you use through a special vocabulary. Once a command is defined, hit the ALT key plus the letter you've designated as the procedure's name, and it is executed. (The small spreadsheet in Table 1 was formed with two keystrokes.)

The user's manual tries too hard to warn users from these advanced commands. If a "hidden" /X command (one that appears on no menus) is employed within the context of a macro, you'll have available some rudimentary, but functional, programming capabilities within your macros.

It's possible, for example, to create a full "turn-key" spreadsheet, which, when loaded, will show a customized

menu of choices that replaces 1-2-3's own menu, executes tasks differently (based on user inputs) and saves the workfile and exits the system—with no possibility of being messed up by the user.

This feature, which will take some time to be understood and even more time to be usefully explored, turns out to be one of 1-2-3's most important benefits. It gives the 1-2-3 the same claim to useful generality that dBase II rightly has.

The last part of Table 1 illustrates some of 1-2-3's special data spreadsheet functions. These functions simplify some of the most commonly needed but misused applications that spreadsheets were intended to satisfy—such as sensitivity analysis and data aggregation.

If you're cooking a roast, for example, you might rotate that roast to brown it. Say you're the scientific type, and rotate the roast two times an hour; you might wonder what the effects of three, four or eight hourly rotations would be (all other factors equal). This is sensitivity analysis.

Or, you may run a restaurant and use up 431 pieces of roast beef a *month*. You might wish to know how many of those roasts were ten pounds and how many were five pounds. This is data aggregation.

As Table 1 shows, 1-2-3 provides two specialized functions to automate the sensitivity analysis task, and another one to help automate data aggregation by constructing frequency tables.

The final function, Data Fill, is useful for those times when you need to complete a table with increasing or decreasing numbers that change by a known interval each time.

These three functions are described in Table 1 and in the 1-2-3 manual.

Graphics

Graphics applications on the IBM PC have started to explode; users who are otherwise sane and serious are now going ga-ga over pictures.

There are two troubles with graphics applications in any automated environment: getting the darned things created in the first place, and then getting them off that electronic medium and onto the hard, cold world of paper. 1-2-3 excels at the first task and does a solid, but nonintegrated, job at the second. Table 2 and Figs. 1, 2 and 3 describe and exhibit 1-2-3's graphics abilities.

Graphs are generated by 1-2-3 on the color monitor. The nicest aspects of the 1-2-3 graphics system are that it is menu driven (in a fashion similar to all other 1-2-3 menus) and that you can revise, change and otherwise play with the graphics until you think they're right.

In some ways, the graphics capabilities of 1-2-3 are limited, but other advantages make up for these limitations.

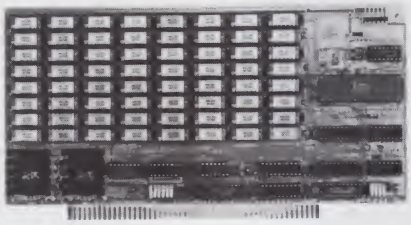
On the limits side, you can graph only six data ranges per picture; furthermore, you cannot adjust the patterns used to "fill in" bars, and you cannot "explode" pie charts to give a clearer picture of one segment. Other dedicated IBM PC graphics packages, such as the outstanding Chartman II, offer these capabilities and more.

On the plus side, though, 1-2-3 graphics are generated *fast*—two seconds, on the average. You can name your graphs and switch between them instantaneously by using those names (which are saved with your workfile) to form the graphics menu.

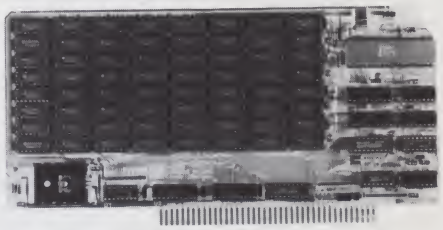
By and large, 1-2-3 makes an intelligent choice for graph parameters—simply because it generates them, although it's not above letting you input titles too broad to print (see Fig. 1). 1-2-3 also isn't above dropping "Mongo's" legend (Fig. 2).

Whether these problems are in graph generation, printing routines or

A FULL LINE OF SEMIDISKS



S-100



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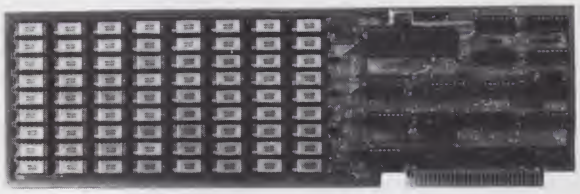

IBM Personal Computer

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user error (I suspect the latter) isn't relevant. Overall, graph generation by 1-2-3 is outstanding.

Graph output to hard copy is outstanding if the operation of the program Graph is referred to. It has a beautiful main menu and prompt screens, and lets you switch among parallel and serial devices at will. It sets the baud rate to your specifications automatically and even lets you preview your graphs before printing.

Yet, to use it, you need to save your 1-2-3 graph in a "picture" file, leave 1-2-3 for the Lotus Access System, call Graph and then do the printing. This puts unnecessary distance between the manager and his output, and is less than satisfactory (although necessary, I suppose, for memory conservation reasons).

When you've messed up a title, as I did on Fig. 1, it's bothersome to end Graph, recall 1-2-3, reload your file, change the graph and cycle through Graph again. This is the only aspect of 1-2-3 that I find less than excellent, and that judgement is only for the degree of integration and ease of use presented.

Clearly, 1-2-3 works well with all the peripherals tested, and when it's teamed with quality equipment, like the HP or IDS, it performs nicely.

Database Operations

1-2-3 boasts an array of fine DBMS functions, which I've summarized in Table 3.

To understand 1-2-3 DBMS operations, you need to understand input range, criterion range and output range. The input range is the database itself; it's made up of the top six lines of Table 3, including the headings.

The criterion range is the piece of your worksheet on which you write the fields you are interested in searching (I have two: Last Name and Amount Owed) and what you want to know.

Although you'd think there is only one criterion on Table 3, there are two. The blank line under Last Name tells 1-2-3 that I'll take any name. The +E2>250 tells 1-2-3 to check the Owed column for deadbeats owing me more than $250.

The output range is used only when you want to Extract records, as I have done. It's also possible just to find them, in which case 1-2-3 highlights the relevant records in the input range.

Note in Table 3 that I did a statistical analysis in the DBMS to show that it's possible to manipulate data as if it was regular spreadsheet data—with the caveat that you must use one of 1-2-3's special DBMS functions to do so.

Putting Out Your Cat

All right, enough! So 1-2-3 does everything but put out the cat, wind your watch and wash the car. . . Is it *good*?

In comparison to Context Management Systems' MBA and to Multiplan, 1-2-3 holds its own (see sidebar). In fact, with all of its features, functions and benefits, 1-2-3 is nothing less than outstanding. It was carefully designed and even more carefully implemented, and it should qualify as a classic (perhaps *the* classic) of microcomputer software for a time to come.

If you do serious work with a microcomputer, or think you might, you'd be wise to acquire this package.■

Last Name	First	Address	City,ST,Zip	Owed
Schmaltz	Klyman	1211 W. 110 Street	Biloxie, MI 02212	$309.24
Androgeny	Getit	348 RR 2	Simpleton, OH 3332	$121.11
Mosby	Moses	99 S. Court St.	Wing, VA 22111	$993.11
Glork	Harold	44 W. Circle Square	North, NY 44993	$22.15
Diamond	Sapphire	811 18th St.	Worth, TX 99222	$1,111.33

OK, there's a little database. It is required that the top row of the worksheet be dedicated to field labels, but other than that, nothing special about it. All the worksheet commands, for instance, are legal.

DATA COMMAND SUMMARY

1. /Data Sort - Sort the DB on a key, primary or secondary, in ascending or descending order.
2. /Data Query - Find, Extract, Unique, or Delete records on certain criteria. In the partial "output range" below, we'll find everyone who owes us more than $250.00 by name and amount owed.

CRITERION RANGE		OUTPUT RANGE		
Last Name	Owed	Last Name	Owed	
	+E2>250	Schmaltz	$309.24	
		Mosby	$993.11	
		Diamond	$1,111.33	

Here's what went on. The /DQ Find command makes the cursor jump to the data above, singling out Schmaltz, Mosby and Diamond. The /DQ Extract command puts a copy of the fields indicated in the Output Range. The criterion range specifies the test (e.g., is E2 greater than $250?). This test is repeated for all subsequent cells in the input range.

There's some other functions, though. The database statistical functions allow computations of sums, averages and the like with specified criteria. So, to find the statistics on these deadbeats owing more than $250, here's what we'd do...

DEADBEATS OWING >$250

Sum	2413.68
Average	804.56
Std. Dev.	353.55378554
Variance	708.86333333
Maximum	1111.33
Minimum	309.24

And, by adjusting the criterion range (what you want to see), any kind of summary is possible.

There's no reason why we can't use other Data commands, either. For example, /Data Distribution, which produces a grouped freqeuncy polygon.

BINS	Frequencies of Customers
50	1
150	1
250	0
350	1
450	0
550	0

-- 4 --

650	0
750	0
850	0
950	0
1050	1
1150	1
	0
Sum	5

Table 3. A sampling of 1-2-3's DBMS functions.

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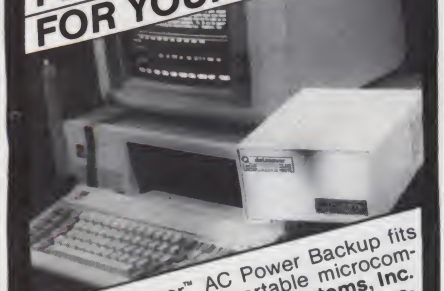

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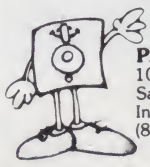

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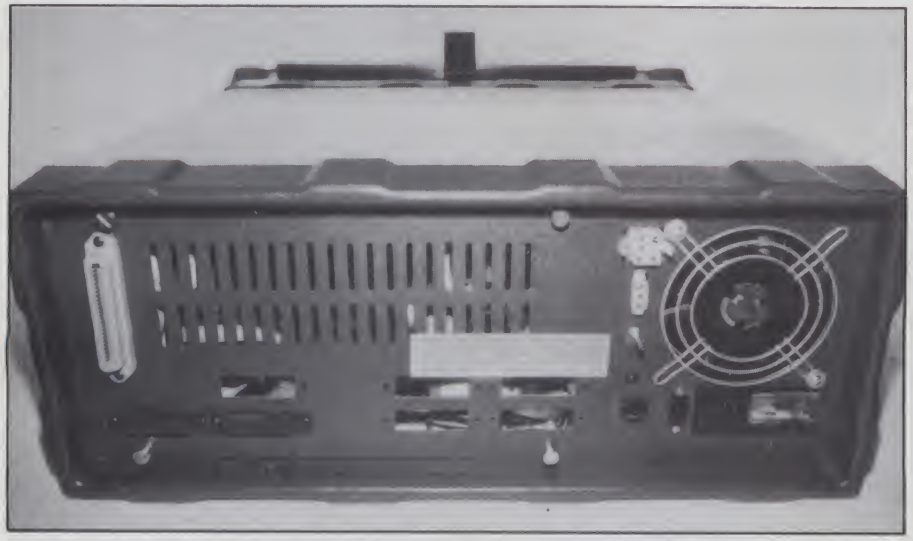
Blue-Collar Portable

The M6000P is a rugged industrial portable that works on the plant floor as well as in the office.

By Timothy Daniel

In its standard configuration, the M6000P has two 376K 5¼-inch disk drives. All units come with a detachable VT100-style keyboard.



The M6000P back panel can be removed by loosening four thumbscrews. This accesses to the ten STD bus slots. The large 50-pin connector is used with eight-inch disk drives and the two db25 connectors are for parallel printer and RS-232 interfaces. Empty slots are provided for the user who wants to customize the computer.

With a barrage of portable computers currently invading the microcomputing marketplace, the decision to buy a portable only leads to more decisions involving compatibility, size and software.

In this review, the portable computer to be examined is the M6000P from Micro Source, Inc. (PO Box 319, New Lebanon, OH 45345). I'll share some insights into that computer—insights that can't always be gained from a showroom demonstration.

To PC or Not to PC?

The M6000P is not compatible with the IBM Personal Computer. About 30 percent of the portables on the market claim to be. The M6000P, like most of the remaining 70 percent, uses the Z-80A microprocessor chip and is compatible with the CP/M operating system. Z-80A machines boast huge software support, thanks to the popularity of CP/M. Consider the question of compatibility carefully. You may decide that you can get more for your money by not jumping on a bandwagon.

Relatively Portable

It was a long way from the parking lot to the second-floor office where I demonstrated the M6000P to a friend. As I trudged up two flights of stairs, I decided that the phrase "portable computer" is a relative one. Weighing in at 35 pounds and taking up 2380 cubic inches (17×20×7), the M6000P is small enough to fit under many airliner seats and big enough to make you think twice about taking it on an extended trip.

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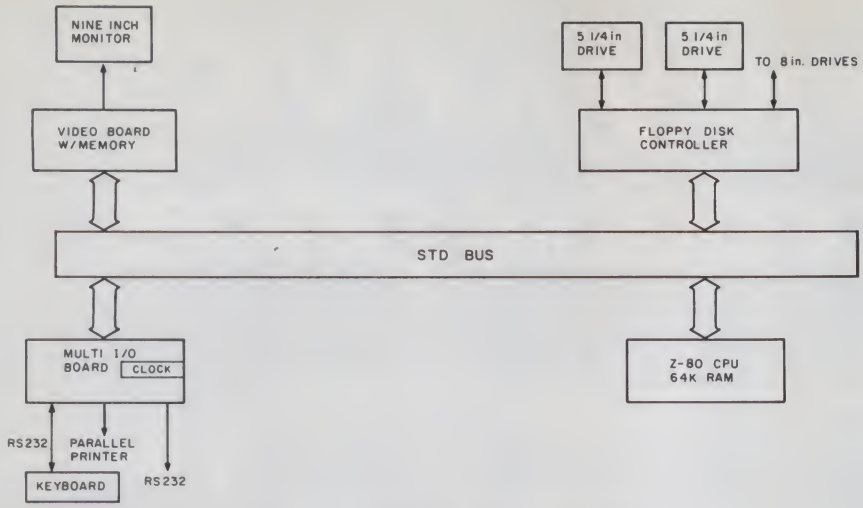

Fig. 1. Block diagram of the M6000P computer.

couldn't care less if it is traveling by car, plane or dug-out canoe, it will have to put up with rough treatment. I didn't drop the M6000P in front of a speeding truck or hand it over to a gorilla, but I did notice that it has an aluminum case with reinforced sides, where some portables use plastic, and that the keyboard acts as a cover, clamping securely over the CRT and disk drives. Even with this rugged construction, I would be reluctant to check it through to Des Moines (or anywhere else) without putting it into a shipping carton first.

Micro Source's packaging of the M6000P leaves two areas for improvement. First, the recessed back panel is vulnerable to protruding objects. Second, the computer lacks a handy way to store the power and keyboard cables. You could end up having your computer in L.A. with the critical cables back home in Boston.

What About Flexibility?

Portable computers, on the whole, are often integrated packages where modifications and upgrades become difficult, if not impossible, to achieve.

Micro Source claims that the M6000P can be configured for almost any application. As shown in Fig. 1, the central element is the STD bus. This standard, designed by industry heavyweights Mostek and Prolog, is geared towards the Z-80A microprocessor. An STD card has 56 pins and is typically 4.5×6 inches.

Although the STD bus is not popular among personal computer manufacturers, it is firmly entrenched in industrial applications, with more than 70 firms supplying hundreds of compatible boards.

A discussion of the M6000P's technical parameters is necessary to highlight one of the M6000P's strongest features—flexibility. If your requirements don't go beyond word processing and spreadsheet calculators, almost any portable will do. On the other hand, if you need a machine that works on the plant floor as well as in the office, the choice is tougher. Hence the need to dig into details.

A Capsule Look At Micro Source's M6000P

Manufacturer
Micro Source, Inc., 595 N. Clayton Road, New Lebanon, OH 45345; 513-687-1395.
Base List Price
$3900.
Standard Features
Z-80A CPU; eight-slot STD card cage; 64K RAM; two 5¼-inch double-sided, double-density floppy disk drives, 386K each (formatted); rear external connection for eight-inch floppy disk; full travel VT100, standard keyboard (83 keys); nine-inch CRT with 80-character by 24-line video interface; CP/M 2.2 operating system; 120 VAC operation.
Proportions
Thirty-five pounds; 17×20×7 inches.
Documentation
Instruction manual and individual software documentation.
Popular Options and Accessories
Parallel peripheral interface; serial peripheral interface; five-inch Winchester disk drive; ten- or 12-slot STD card cage; M68000 upgrade with Unix operating system; special configurations (contact MSI); direct-connect modem 0–12,000 baud; acoustic coupled modem.
Software
WordStar with MailMerge and SpellStar; CalcStar with Superfile; transient CP/M system commands like PIP, SYSGENX and DDT, a demonstration package that includes graphics routines along with two games, and a utility program called A(rchivist).

Tech Talk

The M6000P uses a switching power supply rated at 160 watts, providing +5, +12, −12 and +24 volts. The computer is kept cool by a large and somewhat noisy fan. In its standard configuration the M6000P includes a ten-slot card rack. Four slots are occupied by the CPU/RAM board, floppy-disk controller, video-display driver and multipurpose I/O card, respectively.

The CPU/RAM card features a Z-80A running at 4 MHz, on-board clock and reset circuits, 8K of PROM, and 64K of 200 ns dynamic RAM. The PROM acts as a "shadow" and, like the other memory, is under software control. Besides diagnostic and monitor routines, the PROM takes care of system reset. When the system locked up, I dutifully hit the reset button located on the keyboard and, in most cases, the system came to life immediately.

Occasionally it was necessary to power-down for a few seconds before the system would reset. Later I found out that my unit had a bad delay-line circuit, causing minor reset problems.

I didn't give the M6000P's monitor and diagnostic firmware much thought until I encountered mysterious BDOS errors, a sign that something is seriously wrong with a disk. Using the diagnostics, I was able to load selected sectors of disk data into the computer's memory. From there it was easy to examine the data using the monitor. It took a while, but I was able to verify exactly what was wrong with the disk and make the necessary corrections.

Residing next to the CPU/RAM card is the M6000P's I/O board. Besides providing two serial RS-232 ports and a Centronics-style parallel printer port, it contains a clock and a calendar. This circuit, which is accompanied by battery backup, provides month, date, day of week and 24-hour time, including seconds. The channel A RS-232 port is dedicated to the keyboard interface, leaving the second port available for asynchronous and bisynchronous communications. Rates of 50 to 19,200 baud are software selectable and full-interrupt capability is supported. Both the printer and RS-232 signals are brought out to db25 connectors on the rear panel. The only thing I found missing was a label showing which connector was

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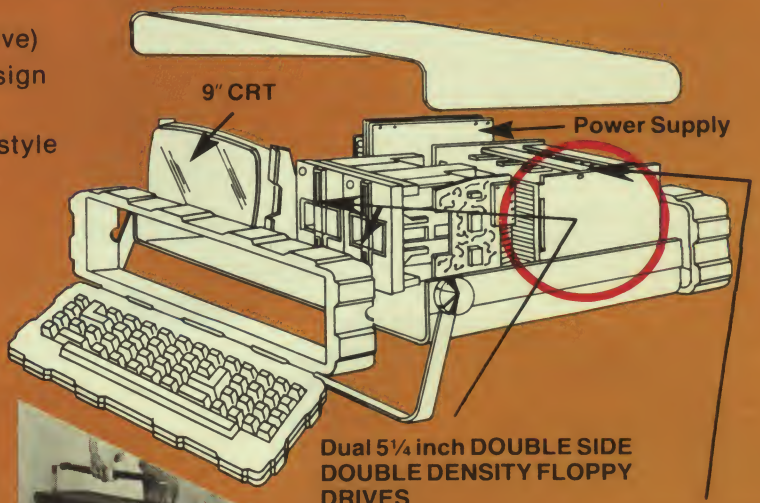

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Now the same kindly dealer who keeps your Apple PC in the pink can do the same competent job for your Apple hard-disk and your Apple daisywheel printer.

So if you're looking to expand the capabilities of your Apple II or III, remember:

Now you can add Apples to Apples.

Gutenberg would be proud.

Old Faithful Silentype® has now been joined by New Faithfuls, the Apple Dot Matrix Printer and the Apple Letter Quality Printer.

So now, whatever your budget and your needs, you can hook your Apple to a printer that's specifically designed to take advantage of all the features built into your Apple. With no compromises.

The 7x9 Apple Dot Matrix Printer is redefining "correspondence quality" with exceptional legibility. With 144x160 dots per square inch, it can also create high resolution graphics.

The Apple Letter Quality Printer, which gets the words out about 33% faster than other daisywheel printers in its price range, also offers graphics capabilities. See your authorized Apple dealer for more information and demonstrations. Because, unfortunately, all the news fit to print simply doesn't fit.

A joy to behold.

The new Apple Joystick II is the ultimate hand control device for the Apple II.

Why is it such a joy to use?

With two firing buttons, it's the first ambidextrous joystick — just as comfortable for lefties as righties.

Of course, it gives you 360° cursor control (not just 8-way like some game-oriented devices) and full X/Y coordinate control.

And the Joystick II contains high-quality components and switches tested to over 1,000,000 life cycles.

Which makes it a thing of beauty. And a joystick forever.

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Up the creek without a paddle?

Or lost in space? Or down in the dungeons?

Whatever your games, you'll be happy to know that someone has finally come out with game paddles built to hold up under blistering fire. Without giving you blisters.

Apple Hand Controller II game paddles were designed with one recent discovery in mind:

People playing games get excited and can squeeze very, very hard.

So we made the cases extra rugged. We used switches tested to 3,000,000 life cycles. We shaped them for holding hands and placed the firing button on the right rear side for maximum comfort.

So you'll never miss a shot.

A storehouse of knowledge.

If you work with so much data or so many programs that you find yourself shuffling diskettes constantly, you should take a look at Apple's ProFile,™ the personal mass storage system for the Apple III Personal Computer.

This Winchester-based 5-megabyte hard disk can handle as much data as 35 floppies. Even more important for some, it can access that data about 10-times faster than a standard floppy drive.

So now your Apple III can handle jobs once reserved for computers costing thousands more.

As for quality and reliability, you need only store one word of wisdom:

Apple.

Launching pad for numeric data.

Good tidings for crunchers of numerous numbers:

Apple now offers a numeric keypad that's electronically and aesthetically compatible with the Apple II Personal Computer. So you can enter numeric data faster than ever before.

The Apple Numeric Keypad II has a standard calculator-style layout. Appropriate, because unlike some other keypads, it can actually function as a calculator.

The four function keys to the left of the numeric pad should be of special interest to people who use VisiCalc.® Because they let you zip around your work sheet more easily than ever, adding and deleting entries.

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How Much Memory Is Enough?

If 376K is good, 10,000K must be better—so goes the reasoning at Micro Source, Inc. After finishing the review of the M6000P, which in its standard configuration has two 376K disk drives, I had a chance to spend a few days tinkering with a unit that had a 10-megabyte Winchester hard disk option.

The two computers looked about the same, the only visual difference being a piece of plastic covering the hole where drive B usually resides. Of course, there are other differences—like price. The hard disk option boosts the price from $3900 to $5895.

The extra two grand gives you storage capacity that is about 30 times greater than the 5¼-inch disk drive that the Winchester replaces and about ten times what can be crammed onto a double-sided double-density eight-inch disk. You also gain speed.

My informal tests showed that the hard disk was two to three times faster for many operations. If those advantages aren't enough to justify the additional outlay, consider the fact that a hard disk is much quieter than a conventional drive and that you won't have to fuss with disks.

My efforts to reach the hard disk's capacity were about as successful as trying to fill a swimming pool with water—one cup at a time. After loading a word processor, dictionary, two database managers and a smattering of utility programs, I still had almost nine megabytes to go! However, it was not a futile exercise. I learned that managing the contents of a hard disk is a lot tougher than tending to the files on 5¼- or eight-inch media.

One problem stemmed from the inability to move large files from the 5¼ to hard format by way of the PIP command. I ended up PIPing the files to eight-inch disk, then onto the hard disk.

Once I had moved a few dozen files, another problem became apparent whenever I typed DIR. By the time I reached the bottom of the directory, I had usually forgotten what was at the top. This aggravation is relieved in part by the hard disk architecture; it is divided into logical five-megabyte units called F and G.

Further division can be obtained by the User command, which is present on version 2.2 of CP/M. User works at the directory level, flagging file names with a number 0 through 15. If you're logged on as user 3, entering DIR will return a listing of only those files designated by a 3. I stored my word processor under one user number, the spreadsheet program with a second, a database under another and so on. Once the confusion subsided I found the user command to be an easy way around some of the file management problems associated with a hard disk. My review period wasn't long enough to try out a utility like A(rchivist), but such programs would seem to be natural for working with extended storage.

Looking back at the original premise—"If 376K is good, 10,000K must be better"—I couldn't help but wonder what the limit for disk storage in portables is. Engineers at Micro Source stated matter-of-factly that they were only days away from releasing versions of the M6000P that had 20 and 27 megabyte hard disks and that a few customers had even gone so far as to request portable computers with 100 megabytes of storage!

In the 20 to 100 megabytes range, an operating system like CP/M is going to face some serious problems. So why not, as one engineer proposed, go to another operating system, maybe one like Unix? I immediately applied the brakes and pointed out that Unix was a 16-bit system and that the M6000P was an 8-bit machine. The reply was quick: "Just replace the Z-80A CPU board with an STD compatible 68000 card. And while you're at it, why not add 256K of virtual memory and some extra I/O?" Suddenly everything fit together. By making the appropriate upgrades, a computer like the M6000P could evolve into a sophisticated multi-user system. It makes me wonder about the definition, "portable computer."■

T.D.

which. This quandary was cured by checking the connectors with a meter and adding a label made from tape.

There is not a lot that can be said about interface capability—either it exists or it doesn't. Despite what some salesmen may claim, a parallel or "Centronics" printer port is essential, if for no other reason than it allows you to get by with a cheaper printer.

One item on my wish list for portable computers is a built-in modem, one with both acoustic and direct coupling. For some reason most portable manufacturers have shied away from offering built-in modems. At least Micro Source offers a modem as an external option.

Before moving on, just a few words about clocks. They are not on my "essential" list, but I do like the kind in the M6000P. Thanks to battery backup, you set the clock once and then forget it. You don't have to enter the date and hour every time you turn the computer on.

The video board employs an 80-character by 24-line controller and uses its own memory and port mapping to minimize the load on the rest of the system. Although high-resolution graphics are not supported, 16 combinations of video attributes are available. These include underlining, half intensity, blinking and inverse video. Screen brightness can be controlled by software as well by a potentiometer on the back panel. The video board drives a nine-inch green P-31 monitor, with 253 characters. Resolution is surprisingly good, with each character using a 6×8 grid superimposed on an 8×10 field.

The fourth board in the standard M6000P is the floppy disk controller. Designed to handle a total of four drives, the controller will support any combination of eight-inch or 5¼-inch units.

Disk drives are a bit like tires on a car. You're bound to get some. The question is are they sport radials with raised lettering or retreads? Two 5¼-inch drives are built in and configured for double-sided, double-density service, each holding up to 376K of data. A rear panel connector provides both power supply and data signals for using eight-inch floppy disk drives.

When compared to the average 5¼-inch drive, the Micro Source floppies are standouts. Imagine being able to combine a sophisticated word processor, spelling checker and form-letter module on one disk, with room

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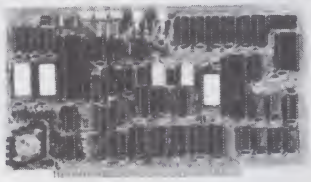

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left over! I learned the hard way that you can't use just any disk to do this. Plagued by inexplicable errors, I finally realized that my generic brand disks that work fine with an Apple disk drive wouldn't hack it in a 376K-per-drive environment. Once the change was made to high-quality disks my problems disappeared.

Look-Alike Keyboard

Rounding out the M6000P's hardware is its VT100-style keyboard. Copied from the layout used on Digital Equipment Corporation (DEC) terminals, the keyboard has 83 keys placed in a fashion similar to electric typewriters. Besides a sculptured shape, the keyboard features separate carriage return and line-feed keys, separate delete and backspace keys, a lighted caps-only key, auto repeat and a numeric keypad.

Also on the keyboard is the system-reset switch, bell-simulating audio tone generator and eight LEDs that act as auxiliary output indicators. The keyboard communicates with the computer serially, via an eight-conductor telephone-style cable. I found the keyboard very easy to use, with the only drawback being the short and rather stiff cord.

> Terminals are a subject for debate rivaled only by the merits of light beer . . .

A combination of the keyboard's specific function keys, the video display board, firmware and software allows the user to dictate the M6000P's terminal characteristics. By using the Set-up mode, the screen intensity, video and cursor attributes, clock/calendar display and key-click feature can be controlled. You can also use Set-up to make a screen dump to your printer or to disable the LED echo of the last character entered on the keyboard.

The M6000P offers further customization by its ability to emulate many of the features of three popular terminals. CP/M's Stat command lets the user change from the Adds Regent 40 mode, which is invoked upon power up, to emulators for the Lear Siegler ADM-31 or Televideo 910.

Terminals, and keyboards in particular, are a subject for debate rivaled only by the merits of light beer or defense spending. For my money I like a standard keyboard. I can take or leave the extra numeric keypad since most of my work is word processing rather than number crunching. One nice thing about the M6000P is that if you don't like the features of the terminal, you can always switch to another.

Operating System

In my opinion, CP/M is not well-oriented for end users, nor is it easy for moderately experienced computerists to master. But I also realize that Micro Source would have been crazy to select any other operating system. CP/M, despite all its faults, is generally acknowledged to be the standard of the industry, and the vast quantity of CP/M software ensures that the system will be around for years to come.

Theoretically, a CP/M program can be transferred from a TRS-80 to an Apple to the M6000P. In practice, however, this scenario of portability can be tarnished by incompatible disk formats and software that is keyed to the features of a particular terminal.

Micro Source alleviates some of the problems associated with terminal configuration by offering you a choice of three popular emulators. The headache associated with disk formats is dulled somewhat by the M6000P's ability to work with both 5¼- and eight-inch drives. Even with this much flexibility there can be disappointments. If you already have an Osborne 1 computer and want to upgrade to an M6000P, you won't be able to use your old disks in the new computer. The Osborne uses a different version of CP/M, one that is not compatible.

What About Software?

The M6000P comes with three software disks that include a word processor with form letter module, spelling checker, data retrieval program, electronic spreadsheet and a system utility.

If you were to buy the Micro Source software bundle at your local dealer you would spend more than $1200. The software that comes with the computer looks and tastes just like the store-bought version. You become a licensed user and receive complete documentation.

As long as I'm being subjective, let

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me put in two cents worth about the concept of bundled software. Deep down I like it. But don't feel obligated to buy a computer just because of the software that is included with it. You can always add software; you're pretty much stuck with the hardware.

Documentation

Given the opportunity, I would write a couple thousand words just about documentation. Luckily, editors intercede and readers are spared my diatribes about the missing index or the unlabeled diagram. The original M6000P documentation is not the best I've seen and certainly not the worst. The second version was infinitely better, but still not in the winner's circle.

My first criterion centers around accuracy. The original instruction manual had its share of bugs, most of which were addressed in an addendum. Under the completeness column I give the updated documentation a well-earned "B."

Realizing that the M6000P is a technical product aimed at hardware applications, Micro Source has thoughtfully included schematics for STD cards. There is still room for improvement, though. I couldn't find any examples or hints about programming the keyboard LEDs, nor is the video board's character set fully documented.

Next on my documentation checklist is the overused, but still valid, idea of "user friendliness." Micro Source documentation does not tell you how to plug the computer in or what way to insert the disk. They assume that the user is familiar with basic microcomputer principles and that step-by-step instructions are not necessary.

Micro Source is aware that the typical M6000P user has a specialized industrial or military application in mind. Customer support represents this fact. Documentation has been upgraded to include details about adding an eight-inch disk drive. Also, the options focus on ways to make the hardware more powerful. For example, software for converting noncompatible disks doesn't have the priority that developing an STD-compatible 68000 CPU card does. The "typical" user has asked for the former, not the latter. As a small and relatively new company, Micro Source is eager to keep its customers happy. The technical staff is accessible. If you need help, it is there.

Parting Thoughts

The standard M6000P is not cheap. It retails for $3900. You can buy two Osborne 1's for that price and have some change left over. In one respect the M6000P is just another portable, good for word processing and spreadsheets. There are, however, a few differences. You get a nine-inch, 80-column display. The disk drives hold almost 400K apiece, and the ability to change terminal characteristics is built in. Are these features worth the price? If all that you need is word processing and games then I don't think so.

On the other hand, the M6000P is an expandable STD industrial computer that just happens to come in a portable package. Admittedly, I don't have first-hand experience using the M6000P for process control in a chemical plant or as automated test equipment in an airplane hanger, but those kinds of applications are feasible. If you need the ability to upgrade or customize, then the M6000P represents a good value.■

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Hello, Noah here. Recently I got a contract to build this fellow a large boat. It seems he wants to collect two of each animal and make a floating zoo of some sort. So, in order to keep track of all the building materials and converting everything to cubits like he said, I got a minicomputer. But, with all this rain we have had lately, the power to my computer has been terrible. Every day for the last 39 days I have lost data every time the light blinked. So I got a **MAYDAY** Uninterruptible Power Supply from SUN RESEARCH up there in New Hampshire. Takes all the surges and spikes out of the line and keeps me running during those blackouts. So now I can keep track of all the animals and how many of each I have (those rabbits will drive you foolish) and keep track of all the different supplies (those elephants will eat you out of house and home). I have also hooked my phone system into the **MAYDAY** so I can keep track of incoming calls during those blackouts. The Boss gets really angry when He can't get through...more lightning. I was building this boat in my cellar, but the wife got tired of moving it around and said, "Get that ark out of here." "Ark". I kind of like that name.

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Osborne Draws Another Line

The Executive is Adam Osborne's attempt to keep up with a field he helped to create. This 28-pound portable is a little heavier than the Osborne 1, but it features a seven-inch screen—an improvement on the single most-criticized aspect of the Osborne 1.

In the May 1981 issue of *Microcomputing*, Adam Osborne drew a line and dared hardware designers to cross it.

Osborne, a microcomputer columnist-turned-designer, had just released the epitome of a portable (at least up to that point): the Osborne 1.

"With the Osborne 1, I have laid down my challenge for the future," Osborne wrote (*Microcomputing*, May 1981, pp. 106–110).

He went on to prod manufacturers to try to outdo his Osborne 1. "The current microcomputer industry leaders—Radio Shack, Apple and Commodore—have lost their way. They've turned their backs on the strategies that made the industry successful," Osborne wrote.

He even predicted that, "By 1983, (the Osborne 1) will have a lot of company" in the portable market.

And it does. The Kaypro II, the Zorba, the Otrona, the M6000P and countless other machines have followed Osborne's lead. Now, with Osborne supposedly feeling the heat of the competition, he's striking back.

Osborne 1 Upgrade

Osborne's answer (for now) to his competitors is the Executive. Two versions of the Executive are available: the Executive I, which sells for $2495, and the Executive II, which sells for $3195. Both releases offer the same free software, including Wordstar, MailMerge and SuperCalc, that comes standard with the Osborne 1.

The Executive's most notable feature is its seven-inch, amber, easy-to-read, 24-line by 80-character screen. The enlarged display size should appease critics of the Osborne 1's five-inch screen.

Slightly larger than the Osborne 1, the Executive weighs 28 pounds and measures 20.5×13×9 inches (when closed). The case, which is weather-resistant, includes a leather handle for easy carrying, and the power cord is stowed inside.

Operating systems used with the Executive include CP/M+ (segmented version) and UCSD p-System. The microprocessor is a Z-80A, and memory capabilities are 128K of RAM, 4K of video refresh RAM, 8K EPROM, 4K character font RAM and 2K scratch pad RAM.

The Executive uses 5¼-inch, single-sided floppy disks; storage provides for a maximum of 15 disks. The keyboard is detachable and includes 69 keys.

The Executive II offers the same features as the Executive I, but with a few extras. With its 8088 microprocessor, it's designed to be an IBM-compatible machine. Along with CP/M+ and UCSD p-System, the Executive II also runs on MS-DOS-2. Additional languages the Executive II offers are CP/M-86 and two versions of Basic.

The arrival of the Executive coincides with rumors of another new Osborne portable—a smaller one—scheduled for a late summer release.

Some of Osborne's competitors will keep pace with the Executive and the rumored follow-up, but they all won't be so fortunate.

"The Compaq will remain competitive," Osborne predicted, "but the Kaypro's gonna die." ■

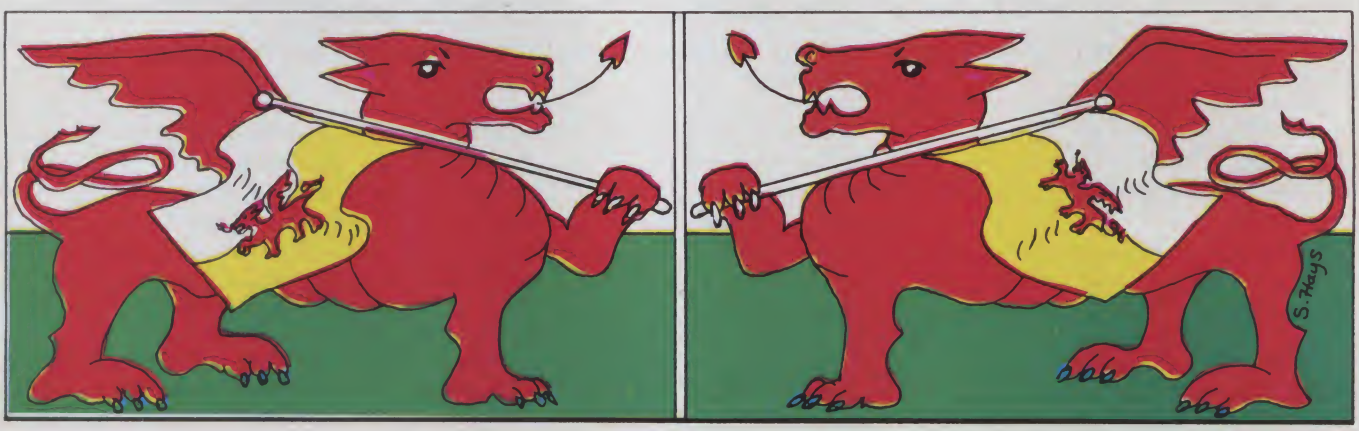
Larry Canale
***Microcomputing* staff**

The Executive is slightly bigger than the Osborne 1, but the screen is larger, too. The seven-inch amber screen presents a clear, sharp display.

The Computer That Roared

The Welsh Dragon is not a mythical figure; it's for real and presents a formidable opponent for the TRS-80 Color Computer on the British market.

By Fernleigh Edmondson



The Dragon uses the same 6809 CPU as the TRS-80 Color Computer, as well as many of the corresponding suite of support chips and Microsoft Basic. However, The Dragon offers twice as much RAM as the TRS-80 Color Computer.

In the past few months, several new microcomputers have been introduced in the U.K. Each has its strengths, but most are variations of standard Basic (usually color Basic) plus one of the well-tried veterans, the Z-80 or the 6502. Two recent exceptions, though, are the Jupiter Ace (which features Z-80 and Forth) and now the Dragon, which combines a 6809 CPU with color Basic.

As Dragon advertisements announce, the 6809 CPU is an up-to-date version of the 6502. The 6502, the ads point out, is still used by the Apple and the BBC Micro, along with a few other systems. But the Dragon is the first popular British-made micro to use the 6809, and it's a good value for the money.

The Dragon's Bytes

For slightly less than £200 (about $400), the Dragon supplies a 16K ROM Basic with color, 32K of RAM, advanced graphics, sound through TV, automatic control of cassette recorder, full editing and the facilities for plugging in ROM-based game cartridges and/or two joysticks. The

Address correspondence to Fernleigh Edmondson, 59 Grange Road, Dorridge, Solihull, West Mid's B93 8QS, England.

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8-bit: 8085

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DIAGNOSTICS:
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Data Base Manager
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*128K bytes standard.
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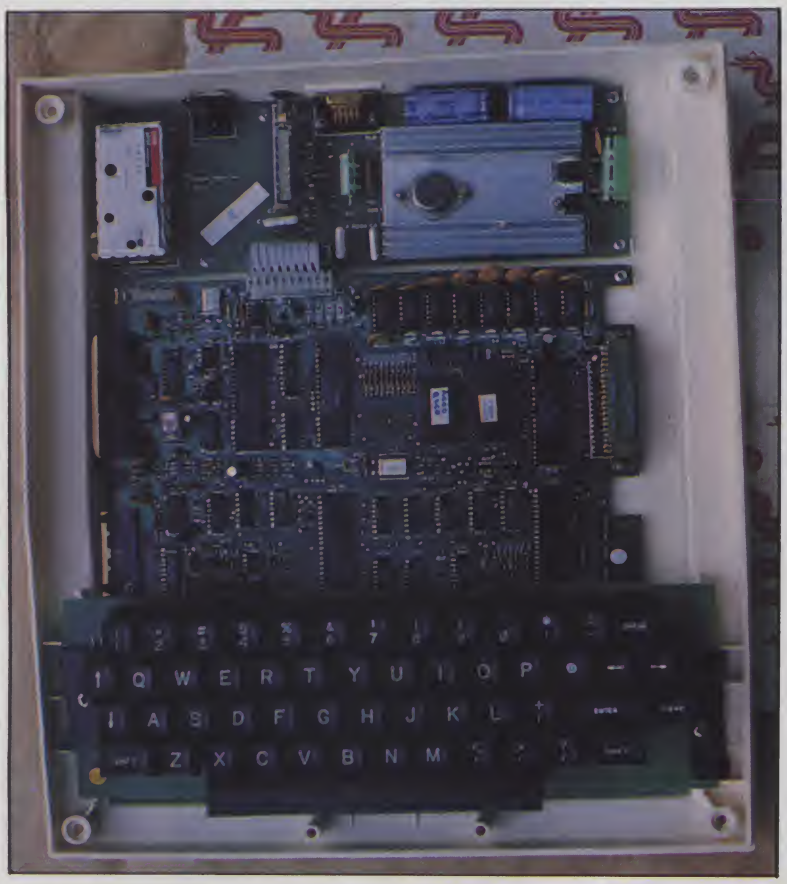
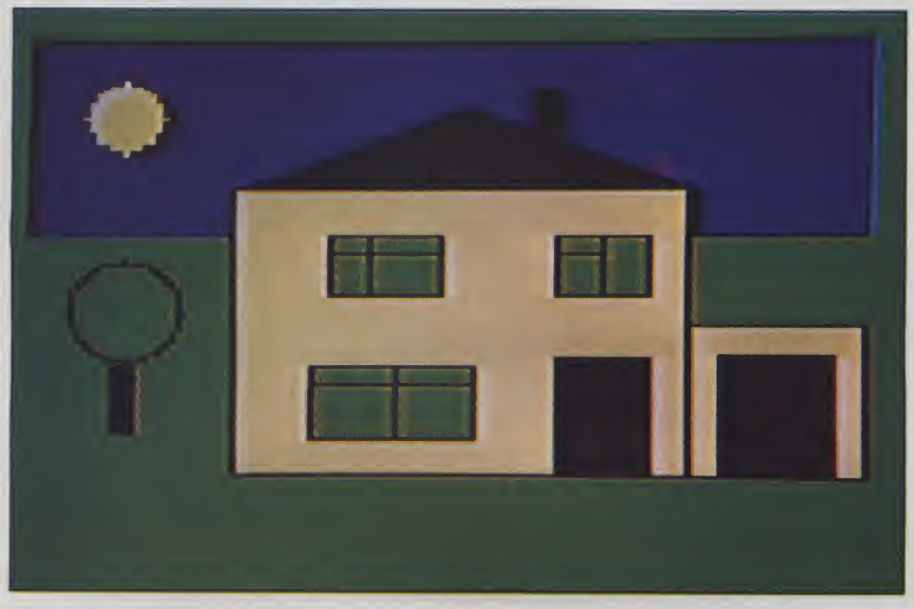
303-014

printer interface is parallel-Centronics-type, and not the RS-232 that is supplied with the Tandy Color Computer.

Although the models for sale in the U.K. are intended for use with the European PAL TV system, the circuitry is probably more suitable for use with the U.S. color system, and this should speed up production of models adapted for sale in North America.



The Dragon's keyboard and components are of high quality—and similar to those of Tandy machines. The only difference immediately apparent is the provision of a parallel printer output port rather than the RS-232 port.



Five levels of resolution and nine colors provide for flashy graphics from the Dragon.

The Basic language used with the Dragon is the Microsoft 16K Color Basic. It appears to be identical with Tandy Color Computer's Extended Basic. The Dragon's Basic presumably is newly produced for the 6809, and has a wide range of useful commands. Among the additions to the expected range are RENUMber, TRON and TROFF (for tracing the line-flow through a problem program). Another addition is SKIPF, a command for reading through a cassette tape and stopping at the end of the program in order to record a new program. Motor On and Motor Off switch the tape recorder (or similar item) on and off as required, and the machine obligingly does so at the end of recordings and readings.

On the other hand, the machine under test would not run the following set of instructions:

```
10 INPUT"C=";C:FOR I=C TO 10:
```

Most Basics will accept the use of a defined variable as a starting point, but for some reason the Dragon will not do so. Nor will the Tandy Color Basic Computer, which I checked in the local Tandy Store (although the black-and-white Level II machine ran the program). This is quite a disadvantage: many programs use variables as starting and ending points in For... Next loops. All three machines would accept a variable as the end-point of a loop. "FOR I=3 TO B" causes no trouble, providing that B had been defined earlier in the program.

I found the character set to be somewhat limited. The first half consists of the usual control characters and punctuation symbols, followed by figures and an all-caps alphabet. The keyboard also features a second capitals alphabet in reverse (white on black), but there is no lowercase alphabet for display on the screen. The second half of the character set is taken up by eight similar sets of graphics, each set differing only in background color.

The screen display consists of 16 lines of 32 characters each, which I find a little cramped—especially when combined with the lack of lowercase letters on the screen. When used with a printer, it is possible to switch into and out of lowercase by typing SHIFT/0:. The lowercase letters are shown on the monitor screen as reverse capitals; the results on the

creen are intelligible, but not leasing.

It would appear that some changes will be necessary before the Dragon can be used as anything other than a home computer designed for lighter activities. Using it as a word processor, for example, would probably not be practical with the present character set.

Slaying the Dragon's Graphics

The Dragon's graphics are comprehensive: five levels of resolution, along with nine colors, are available. The facilities for drawing lines, rectangles, boxes, circles and ellipses are effective and straightforward. The Paint command, however, may cause some difficulty; perhaps the instructions in the manual were at fault, because I've seen other reports of problems in this area.

On the whole, though, I liked the colors and graphics facilities. In particular, it's useful to be able to get hold of a particular rectangle on screen and put it elsewhere. This saves effort—and mental arithmetic—when parts of the screen are repeated. The actual colors on my TV aren't as bright as those I get from my Spectrum, nor are they as true or intense.

The instructions for playing sound (through the TV speaker) are good, and it's easier to use sound on the Dragon than on other systems I have tried. The examples given in the manual are limited, but because the whole system is in line with musical notation and practice, this is no problem to the musically-oriented computer enthusiast. Notes may be indicated by the usual letters (or by figures), with sharps or flats, with note lengths and with octaves. And there are facilities for tempo, pauses, volume changes and for the execution of substrings.

The instructions consist of a book accompanied by a summary sheet. The sheet is useful for those who have some knowledge of computers and Basic while getting a feel for the machine, but it is soon necessary to consult the manual in order to get the best out of the system. The manual is, in general, well-written, and I found only one error; it involved the use of a variable in the starting-point of a For. . . Next loop. Unfortunately, little information about the hardware side of the machine is provided. For example, no details were given about the connections to the tape recorder socket, and it was necessary to work these out (the lead is an "extra").

Plans for Dragon 64

The Dragon was the brainchild of Tony Clarke and Richard Wadman, who laid out the specifications on behalf of the Mettoy Co., which specializes in making toys. For financial reasons, the computer manufacturing has been directed to a new company, Dragon Data Ltd. (Queensway, Swansea Industrial Estate, Swansea, Glamorgan SA5 4EH). Plans are in progress to bring out a 64K machine, the Dragon 64, with enhanced graphics, and to produce a modestly-priced disk system for this machine.

The Dragon is being distributed through large retail chains in the U.K., such as Boots the Chemists, Dixon's camera/electronics shops and Curry's Electrical and Domestic Appliance chain, as well as directly from Dragon Data. Computers actually can be seen in these shops, so the queue situation may not be as desperate as in the case of Sinclair's innovations. ■

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Vive la Difference! Valdocs

While the Epson QX-10 offers impressive features, it's the software—particularly the Valdocs operating system—that puts it a step ahead of its competitors.

By Jim Hansen

The Epson QX-10 and software documentation. The six-volume set of Peachtree software will be Epson's first applications software release. Also shown is the CP+ manual, CP/M Primer *and the Microsoft Basic manual, part of the documentation supplied with the CP/M-based QX-10 system. (Photos by Jim Hansen.)*

The HASCI keyboard used with Valdocs on the QX-10. Notice the Selectric-like keyboard layout in the typing section. The editing cluster and numeric pad are to the right. Above the typing section are the Valdocs function keys. The Valdocs QX-10 can also run TPM (a fast CP/M look-alike) or CP/M 2.2.

Last month we looked at the Epson QX-10 hardware. While the machine itself is impressive, it's the software—especially the Valdocs operating system—that sets the QX-10 apart from other micros.

QX-10 Essentials

The QX-10, a Z-80A-based computer, features two double-sided, double-density disk drives with a formatted capacity of about 380K each, a battery-backed-up calendar clock and 64K of RAM. It comes standard with an RS-232C serial interface and a Centronics-compatible parallel printer port.

The only optional feature offered for the QX-10 at this time is the Valdocs operating system. Valdocs is installed (by Epson) by plugging another 192K of 64K RAM chips into the motherboard, bringing the CRT controller memory up to 128K and changing the standard ASCII keyboard to the HASCI version.

The QX-10 is packaged in three components: a keyboard, the electronics case and the CRT display. The keyboard is attached to the computer with a coiled cable. The 11½-inch CRT display normally sits on top of the electronics enclosure. The display is formatted into 25 lines of 80 characters, and has a graphics resolution of 640×400.

The QX-10 hardware won my enthusiastic endorsement. I found the display and keyboard to be exceptionally well-designed, and although some people may like "heavier" keys, the

Address correspondence to Jim Hansen, PO Box 234, New Boston, NH 03070.

Z80 Software

DEBUG QED LINKER MODEM MACRO TPM BASIC I ZDDT ZTEL QSAL ZEDIT TOP I 6502X TPM II

SOFTWARE DESCRIPTIONS

M (TPM I) - $80 A Z80 only operating system which is able of running CP/M programs. Includes many features not nd in CP/M such as independent disk directory partitioning for o 255 user partitions, space, time and version commands, date time, create FCB, chain program, direct disk I/O, abbreviated mands and more! Available for North Star (either single or ble density), TRS—80 Model I (offset 4200H) or II, Versafloppy Tarbell I.

M-II - $125 An expanded version of TPM which is fully CP/M compatible but still retains the extra features our customers e come to depend on. This version is super FAST. Extended sity capability allows over 600K per side on an 8" disk. Availapreconfigured for Versafloppy II (8" or 5"), Epson QX-10, orne II or TRS-80 Model II.

CONFIGURATOR I

This package provides all the necessary programs for customizing TPM for a floppy controller which we do not support. We suggest ordering this on single density (8SD).
Includes: TPM-II ($125), Sample PIOS (BIOS) SOURCE (SFREE), MACRO II ($100), LINKER ($80), DEBUG I ($80), QED ($150), ZEDIT ($50), TOP I ($80), BASIC I ($50) and BASIC II ($100)
$815 Value **NOW $250**

CONFIGURATOR II

Includes: TPM-II ($125), Sample PIOS (BIOS) SOURCE (SFREE), MACRO II ($100), MACRO III ($150), LINKER ($80), DEBUG I ($80), DEBUG II ($100), QSAL ($200), QED ($150), ZTEL ($80), TOP II ($100), BUSINESS BASIC ($200) and MODEM SOURCE ($40) and DISASSEMBLER ($80)
$1485 Value **NOW $400**

MODEL I PROGRAMMER

This package is only for the TRS-80 Model I. Note: These are the ONLY CDL programs available for the Model I. It includes: TPM I ($80), BUSINESS BASIC ($200), MACRO I ($80), DEBUG I ($80), ZDDT ($40), ZTEL ($80), TOP I ($80) and MODEM ($40)
$680 Value **NOW $175**

MODEL II PROGRAMMER

This package is only for the TRS-80 Model II. It includes: TPM-II ($125), BUSINESS BASIC ($200), MACRO II ($100), MACRO III ($150), LINKER ($80), DEBUG I ($80), DEBUG II ($100), QED ($150), ZTEL ($80), TOP II ($100), ZDDT ($40), ZAPPLE SOURCE ($80), MODEM ($40), MODEM SOURCE ($40) and DISASSEMBLER ($80)
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ASIC I - $50, a 12K+ basic interpreter with 7 digit precision.

ASIC II - $100. A 12 digit precision version of Basic I

USINESS BASIC - $200. A full disk extended basic with ndom or sequential disk file handling and 12 digit precision ven for TRIG functions). Also includes PRIVACY command to otect source code, fixed and variable record lengths, simultaneus access to multiple disk files, global editing, and more!

CCOUNTING PACKAGE - $300. Written in Business asic. Includes General Ledger, Accounts Receivable/Payable, nd Payroll. Set up for Hazeltine 1500 terminal. Minor modifications needed for other terminals. Provided in unprotected source orm

MACRO I - $80. A Z80/8080 assembler which uses CDL/TDL nemonics. Handles MACROs and generates relocateable code. ncludes 14 conditionals, 16 listing controls, 54 pseudo-ops, 11 rithmetic/logical ops, local and global symbols, linkable module eneration, and more!

MACRO II - $100. An improved version of Macro I with xpanded linking capabilities and more listing options. Also internal code has been greatly improved for faster more reliable peration.

MACRO III - $150. An enchanced version of Macro II. Internal uffers have been increased to achieve a significant improvement n speed of assembly. Additional features include line numbers, ross reference, compressed PRN files, form feeds, page parity, dditional pseudo-ops, internal setting of time and date, and xpanded assembly-time data entry.

DEVELOPER I

Includes: MACRO I ($80), DEBUG I ($80), ZEDIT ($50), TOP I ($80), BASIC I ($50) and BASIC II ($100)
$440 Value **NOW $150**

DEVELOPER II

Includes: MACRO II ($100), MACRO III ($150), LINKER ($80), DEBUG I ($80), DEBUG II ($100), BUSINESS BASIC ($200), QED ($150), TOP II ($100), ZDDT ($40), ZAPPLE SOURCE ($80), MODEM SOURCE ($40), ZTEL ($80), and DISASSEMBLER ($80).
$1280 Value **NOW $350**

DEVELOPER III

Includes: QSAL ($200), QED ($150), BUSINESS BASIC ($200), ZTEL ($80) and TOP II ($100)
$730 Value **NOW $300**

COMBO

Includes: DEVELOPER II ($1280), ACCOUNTING PACKAGE ($300), QSAL ($200) and 6502X ($150)
$1930 Value **NOW $500**

LINKER - $80. A linking loader for handling the linkable modules created by the above assemblers.

DEBUG I - $80. A tool for debugging Z80 or 8080 code. Disassembles to CDL/TDL mnemonics compatible with above assemblers. Traces code even through ROM. Commands include Calculate, Display, Examine, Fill, Goto, List, Mode, Open File, Put, Set Wait, Trace, and Search.

DEBUG II - $100. A superset of Debug I. Adds Instruction Interpreter, Radix change, Set Trap/Conditional display, Trace options, and Zap FCB.

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ZAPPLE SOURCE - $80. This is the source to the SMB ROM version of our famous Zapple monitor. It can be used to create your own custom version or as an example of the features of our assemblers. Must be assembled using one of our assemblers.

MODEM - A communication program for file transfer between systems or using a system as a terminal. Based on the user group version but modified to work with our SMB board or TRS-80 Models I or II. You must specify which version you want.

MODEM SOURCE - $40. For making your own custom version. Requires one of our Macro Assemblers.

DISASSEMBLER - $80. Does bulk disassembly of object files creating source files which can be assembled by one of our assemblers.

HARDWARE

S-100 — SMB II Bare Board $50. "System Monitor Board" for S-100 systems. 2 serial ports, 2 parallel ports, cassette interface, 4K memory (ROM, 2708 EPROM, 2114 RAM), and power on jump. When used with Zapple ROM below, it makes putting a S-100 system together a snap.
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5PC	5.25" IBM PC Double Density
5XE	5.25" Xerox 820 Single Density
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5ZA	5.25" Z80 Apple (Softcard compatible)

TPM INFO When ordering TPM I or II, in addition to Disk Format, please specify one of the following codes

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	NSSD/Z	North Star Single Density for Zapple I/O
	NSDD/H	North Star Double Density for Horizon I/O
	NSDD/Z	North Star Double Density for Zapple I/O
	TRS80-I	TRS-80 Model I (4200H Offset)
	TRS80II	TRS-80 Model II
	VI8	Versafloppy I 8"
	VI5	Versafloppy I 5.25"
TPM-II:	VII8	Versafloppy II 8" (XD)
	VII5	Versafloppy II 5.25"
	TRS80II	TRS-80 Model II (XD)

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keyboard is one of the best I have used.

Confessions of a Reviewer

Before continuing with the review of the software for the QX-10, I would like to make a personal statement to both you, the reader, and to Epson America. My general preference in writing reviews is to open the box the buyer will get, and to comment on exactly what I find. My reason for this approach is that I want to let you know what you're in for after plunking down your money.

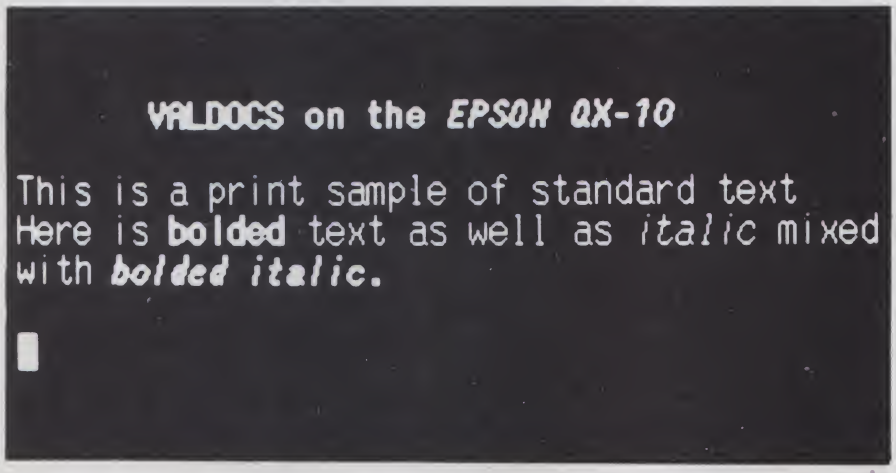
Unfortunately, I am not able to give a direct report on the final documentation or software that you'll find when you open up a new QX-10 computer. The reason is that, as I am writing this review, the manuals (while nearly complete) are still being revised. Even the BIOS for CP/M is under revision.

I'm writing this review, then, without having had a chance to use the final versions of any of the software supplied with the QX-10 computer system.

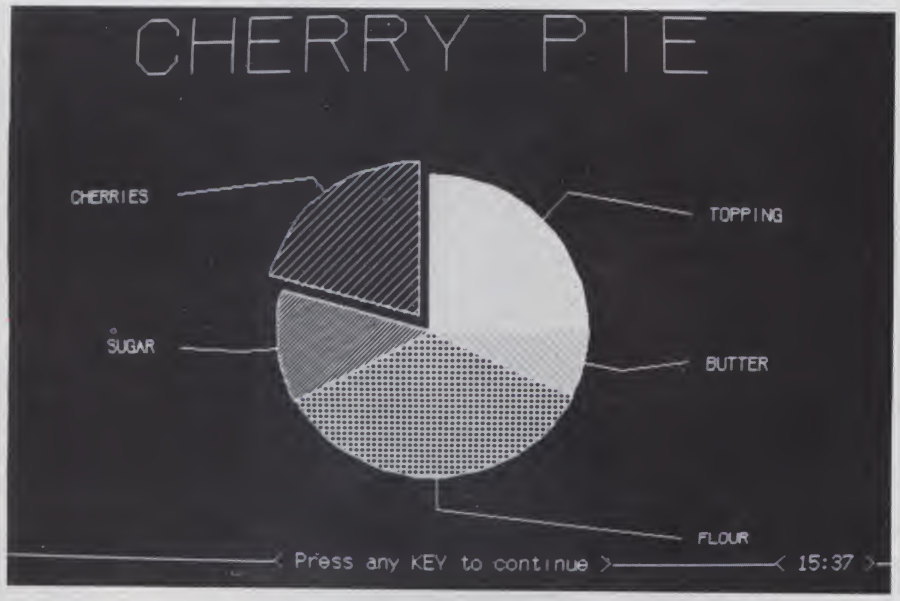
The Epson people have been gracious in getting me the latest they could rip away from their software development department. (All the QX-10 software is American-made.)

The fact that they were willing to let me see their "dirty underwear" while they're still getting the final bugs out of the system is incredible for two reasons. First, when the push is on to put the final touches on a new system, the last thing any engineer needs is a request from his marketing people to get "the latest version, no matter what the condition." Second, I'm writing for a publication that has the ability to influence sales, so it took some visceral fortitude for Epson to let me see, use and report on a product that wasn't ready for the marketplace.

With that in mind, here is what I found.



One of the many Valdocs features is the "soft" character font. This photograph, taken directly from the screen of the QX-10, shows normal and italic characters as well as bold equivalents, selected as desired by the touch of a button in the typestyles cluster. This text can be stored as a normal text file, and can be printed just as you see it here on Epson's new FX-80 printer.



Valdocs allows impressive graphics charts to be made just by answering a few questions. This pie chart took less than a minute to design. Four questions—name, density, value and normal or "pulled-out" position—for each of the five slices must be answered. Pie, bar, line and scientific charts can all be made and stored for inclusion with text to be printed on the FX-80 printer.

The QX-10 with CP/M—Documentation

The QX-10 is delivered with its own version of CP/M 2.2, CP+ (from Taurus Software) and Microsoft Basic, Release 5. The documentation shipped with the QX-10 consists of an operations manual, a copy of *CP/M Primer* (written by Stephen Murtha and Mitchell Waite) and a paperback copy of the Microsoft Basic manual.

The QX-10 operations manual is a 35-page booklet that describes the basic features of the system. The four chapters explain how to hook up the system and describe some of the features of the QX-10 in terms of memory, the operating system and the keyboard.

The manual also tells how to install option cards in the system expansion area (there are no expansion cards available at this time). The final section covers troubleshooting procedures.

The operations manual is nontechnical and well-written, and it should be easy to understand by the first-time user.

The 92-page *CP/M Primer*, published by Howard W. Sams & Co., is a competent introduction to the CP/M system. Eight chapters are used to describe, in elementary terms, operating system basics, memory usage and organization, system initialization, STAT and PIP and the CP/M editor, assembler and dynamic debugging tool (DDT). Three appendixes describe the internal structure of CP/M and compatible software, and a detachable CP/M reference card is provided.

The Microsoft Basic manual (titled *Microsoft Basic for the QX-10)* is actually the Microsoft user's guide and Basic reference manual combined into a single 6×9 paperback.

I presume that this manual is a preliminary offering that will be edited to better reflect the QX-10 computer. Right now, it could be accused of carrying excess baggage and of lacking some pieces.

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Print formatting	No	No	Yes
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Support smart CRT functions	Yes	No	Some
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For example, the manual covers Cload and CSave, but the QX-10 does not support these cassette commands, since it has no cassette interface. (The lack of a cassette interface probably marks a mature computer design these days.)

Another example: one command apparently lacking in this Basic is one that could communicate to the serial port. No mention of it was made anywhere in the Microsoft manual.

The CP+ software documentation is bound in a wine-colored ring binder of a size I have never seen before (ten inches high by 11 inches wide). Whether Epson will distribute the documentation in this form or in something less wieldy is not clear. What is clear is that CP+ makes CP/M more user-friendly, especially to someone new to computers.

CP+ basically makes CP/M into a screen-driven operating system. I counted 18 different screens, each of which controls a specific function, such as copying or erasing files, controlling a printer, setting up a printer queue, examining disk directories, and selecting and running a program from the disk.

I didn't have an opportunity to actually use CP+ on the QX-10, since it is still being configured for the system and was not operational in time for this review. Epson plans to have it installed so that, instead of the system coming up directly into CP/M, the CP+ will be the default-user interface.

Barking Up the Right Peachtree

Epson is distributing Peachtree Software as the main applications software base for the QX-10. This package includes the Electronic Spreadsheet (a VisiCalc-like electronic spreadsheet program capable of driving 253 rows of 63 columns), the Calendar Management System (a menu-driven facility- or time-scheduling system that can also provide audit trails of any given function) and Telecommunications (which allows two CP/M-based computers to send files to each other, as well as to timesharing systems).

The Peachtree Mailing List Manager can prepare labels and lists for bulk mailing, but can also serve as a reference aid to hold parts lists or bibliographies, for example.

Peachtext, which I used to prepare the QX-10 reviews, comes with a thesaurus (which I haven't used yet) on a separate disk. When combined with the Spelling Proofreader, Peachtext makes an excellent text-processing system—especially when the merits of the QX-10 screen and keyboard are considered.

I've been using the QX-10 CP/M-based system for about six weeks. I still find minor bugs here and there, but they're rapidly being cleaned up.

Epson apparently wasn't happy with the BIOS, the computer-independent section of CP/M; the company is busily rewriting a large part of it.

I applaud the use of CP+, but don't like some of the controls it uses. If you want to go to another screen menu, for example, you must type "+" or "–" (depending on the direction). Since the "+" requires that you hit a shift and the key, and the "–" is a rather obscure key on most terminals, I would probably choose a return key for forward and maybe the backspace for reverse—these keys are large and easy to use on most terminals.

Other signs of the software not being totally integrated include the edit keys, which don't work in CP/M (I've fallen into the habit of using the edit

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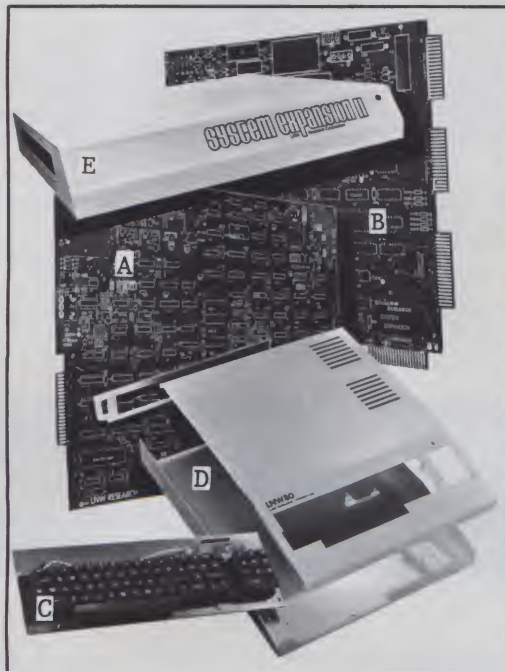

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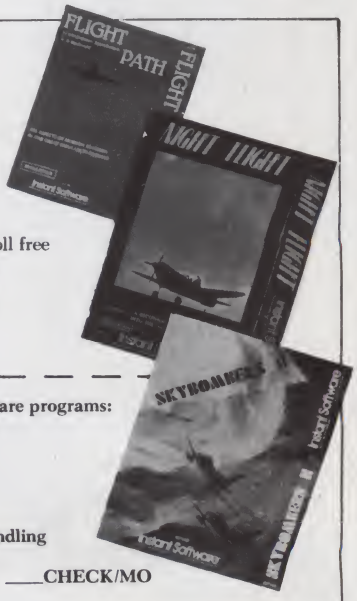

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pad back-arrow key to backspace, and CP/M doesn't like that). In fact, even Peachtext rejects its own editing keys when you input the name of the file to edit.

These details are being worked on and will be taken care of by the time the QX-10 is ready for market.

QX-10 with Valdocs

When you buy a QX-10 with Valdocs, you're buying a totally integrated workstation that is ready to use as soon as it is turned on.

Valdocs, which stands for "Valuable Documents," is an operating system written in a version of Forth. Underneath Valdocs is a CP/M-like operating system called TPM. Written by Technical Design Labs, TPM is much faster than CP/M—yet compatible with CP/M 2.2.

The Valdocs version of the QX-10 is menu-driven and uses a HASCI keyboard (Human Applications Standard Computer Interface), which has a Selectric-like typing area, an editing cluster, a numeric keypad and four clusters of predefined function keys.

The function keys call up operating system features and programs normally typed into CP/M. These are grouped in two functional areas—System Controls and File Controls.

Systems Controls has keys for Stop, Help, Copy Disk and Undo. The help key can be used any time, regardless of what you are doing. Stop and Copy Disk are pretty much self-explanatory. Undo is used right after you make a blooper and want out of it.

The File Controls section has Store, Retrieve and Index for menu-driven save, load and directory commands. Additionally, Print causes text files of your choice to be formatted and sent to the printer.

The print mode uses a printer spooler so printing takes place in the background with the rest of Valdocs available. (In fact, a list of files to be printed is maintained by Valdocs. The list can be edited at any time to either add or cancel files to the printer queue.)

The mail key allows any file stored on disk to be sent (via D.C. Hayes Smartmodems or Epson modems that will be made available later) over telephone lines to other computer systems.

The mail system maintains a telephone directory of your contacts, and saves both voice and data numbers. When you wish to send information, the system automatically dials and establishes contact, transfers the file and hangs up.

Other options let you see the messages that have come in for you, as well as the ones still waiting to be sent. Since the QX-10 has a calendar-clock, it is possible to automatically send mail at night, on weekends or whenever you choose.

The applications section has four functions. MENU allows the user to leave Valdocs and enter the TPM operating system. CALC allows immediate use of a basic four-function calculator (with memory) on the screen. The calculator can be used at any time; it even allows a cursor to be positioned around the screen to check numbers (or enter them) in a document that is being prepared.

SCHED is a scheduler that allows you to make appointments. It's much like an electronic desk calendar; each day has one page for appointments and one for notes. Options allow time to be reserved, an itinerary for any given date to be printed, and time events, such as meetings and phone calls, to be entered.

The draw key allows you to make pie, bar, line and scientific charts. These charts are made by answering a list of questions on a menu. When completed, they can be displayed on the screen, printed, stored as a document or trashed. If you're using an Epson printer, these charts can be inserted into text documents and printed along with the text.

The charts are of high quality. A piece of the pie, for example, can be pulled out from the center of a pie chart for emphasis. Each piece can be independently shaded and assigned its own label.

The final functional cluster of keys (Typestyles) allows the selection of the font or character design. The characters may be printed in bold or italics or both. The remaining keys—size and style—are reserved functions that will be available in later editions of the Valdocs system.

Something New

In this brief overview, I hope you've picked up the impression that Valdocs is something new.

Except for the spreadsheet, thesaurus and spellchecker, Valdocs is an integrated system that is essentially

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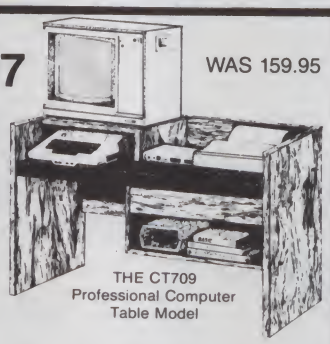

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the equivalent of CP+ and the Peachtree applications software available for the CP/M version of the QX-10. Even so, Valdocs is something more.

When running, the QX-10 is no longer a computer running a text processor. It is an integrated workstation with operating features (normally available only in bits and dabs from a smattering of other software houses) that have been collected together into a cohesive unit and married to a computer system of unusual integrity.

One of the nice aspects of Valdocs is that any of the functions on the keyboard can be invoked at any time. It doesn't matter if you're in the middle of a large editing job or if you're using the mail system; you can still use the on-screen calculator or check your schedule. Another automatic feature of Valdocs is that files being edited are periodically backed up, protecting your work if power should fail.

But there is a price to pay for all this complexity and convenience. Since the screen is "soft" (meaning it is actually being used as a graphics tablet on which characters are graphed), and the editor and whole Valdocs system are written in a high-level language, there is a perceptible delay in keyboard-to-screen operation. The delay isn't terribly objectionable, but it is there. However, with the 32-byte buffer built into the keyboard, it is unlikely that you'll ever "out-type" the QX-10 and drop characters.

Disk operation sometimes takes a little longer than you might like (this will probably change in the operational software), but at least Valdocs tells you what's going on. And the time is always printed at the bottom of the screen. The editor digitally displays the name of the file, page and line number, and the cursor position at the bottom of every page. This system talks to you, keeping you advised in a polite and friendly way about what is happening.

I haven't seen an entire operating Valdocs system run at one time, but I have seen most of the pieces working in various states of repair. The system is coming together fast, and will be on the market, I would guess, by early summer.

The Valdocs manual is written so simply that nearly anyone can use it. Perhaps the best thing that can be said for Valdocs is that the manual is not necessary; the operating system is totally self-documenting.

Beating Up Shorelines

I'm in a real quandary. I have found the combination of the Peachtext text-processing system (even though not fully installed on my QX-10) and the QX-10 to be such a joy to use that I'm almost afraid to switch over to the Valdocs system. (I did just enough to get Peachtext operational; production systems sold by Epson will be completely adapted and installed, ready to use out of the box.) Yet, because of the price (about $500) and the system integrity, I plan to change as soon as I can.

Valdocs and the QX-10 together make a tool for people who want to use an integrated workstation, rather than a computer that is adapted for one or more applications. Valdocs may well be the prototype of user-friendly and truly "user-useable" software of the next decade.

If Valdocs isn't the wave of the future, at least it's going to beat up a lot of shoreline.■

Next month, Jim Hansen takes a look at how the QX-10 is used with the latest in Epson's line of printers, the FX-80.

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Micro Software Digest

Compiled by Swain Pratt

Micro Software Digest presents capsulized software reviews from various computer-related publications.

Energy Czar

System Requirements: Atari 400 or 800 with a minimum of 16K RAM
Manufacturer: Atari, Inc., 1265 Borregas Ave., Sunnyvale, CA 94086
Price: $15
Comments: "Anyone who plays Energy Czar," says the review, "will quickly realize that even the most honorable energy decisions can have disastrous consequences." In this game, you, as America's energy czar, must make legislative decisions based on various data, and your decisions must confront public-opinion polls.

"Once you learn the ropes of Energy Czar," concludes the review, "you'll find it's no longer a game about energy but a game about economics, using energy as a backdrop." Reader Service Number 419

(Reviewed in Popular Computing, *February 1983)*

LogOn

System Requirements: IBM PC, Apple II or TRS-80 Model II; UCSD p-System; 64K RAM; one disk drive
Manufacturer: Ferox Microsystems, 1701 N. Fort Myer Drive, Arlington, VA 22209
Price: $150
Comments: "LogOn," says the review, is "a smart-terminal package written in UCSD Pascal. . . LogOn is easy to use and has some valuable features, but its price is at the high end of the smart-terminal scale."

"If you are a Pascal person," concludes the review, "you may enjoy some of the benefits of LogOn and the ability it provides to keep an all-Pascal system." Reader Service Number 420

(Reviewed in InfoWorld, *February 14, 1983)*

The Word Processor

System Requirements: Apple II with 48K RAM or IBM PC; dual disk drives
Manufacturer: Bible Research Systems, 8804 Wildridge Drive, Austin, TX 78759
Price: $160
Comments: The Word Processor, according to the review, "works as a Bible-study tool. . . it lets you connect any single phrase or string of characters within the Bible to all its precise reference points." The program has both Old and New Testaments in their entirety on eight double-sided floppy disks.

"The package is very user-friendly," states the review, and "stands as a monument that programmers planning to condense other massive literary works onto disk form will want to emulate." Reader Service Number 417

(Reviewed in Popular Computing, *February 1983)*

Word-Index II

System Requirements: 8080 or Z80-based computer; CP/M 2.2; 48K RAM; 5¼-inch or eight-inch floppy or hard disk drive
Manufacturer: Borland, Ltd., 69 Upper Georges St., Dun Laohaire, Dublin, Republic of Ireland
Price: $195
Comments: The review states that this is "an exceptional program. . . which operates in conjunction with WordStar to produce an outstanding table of contents and index for reports." You must possess WordStar to use it.

The review gives the program excellent ratings in all respects, and concludes: "This product is well written and a valuable addition to your software library." Reader Service Number 421

(Reviewed in InfoWorld, *February 14, 1983)*

Microsoft Flight Simulator

System Requirements: IBM PC; PC-DOS; 64K RAM; one disk drive; color/graphics adapter, or, better, composite color monitor
Manufacturer: Microsoft, 10700 Northup Way, Bellevue, WA 98004
Price: $49.95
Comments: This program, says the review, is "the most sophisticated flight simulator program ever implemented for a microcomputer. 'Sophisticated' means realistic, big and challenging." There are different levels of flight difficulty, varying weather conditions and emergencies that pop up as you fly cross-country.

"In some ways," states the review, "using Flight Simulator is harder than flying a real plane. The graphics are very smooth. . . this is a helluva program. The Personal Computer is finally attracting people who can use it to its full potential." Reader Service Number 416

(Reviewed in Softalk for the IBM Personal Computer, *February 1983)*

Tricky Tutorials

System Requirements: Atari 400 or 800; disk drive or cassette player
Manufacturer: Educational Software, Inc., 4565 Cherry Vale Ave., Soquel, CA 95073
Price: $99.95 for all six tutorials; $19.95 to $29.95 singly
Comments: Tricky Tutorials, according to the review, provides the beginner with "an easy entry into Atari's wonderful worlds of color, design and music."

"The six installments," concludes the review, "are written in an energetic, easy-to-understand style. . . It's a first-rate package that uses luxurious living color to entice you to learn more about your Atari home computer. No tricks, just treats." Reader Service Number 418

(Reviewed in Popular Computing, *February 1983)*

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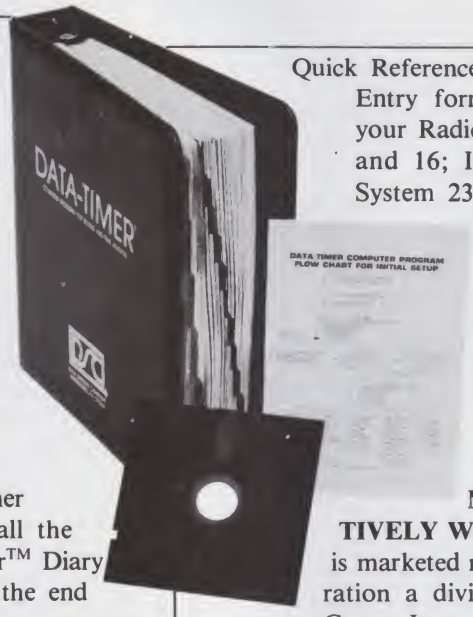

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Home Clock Family Bulletins

System Requirements: Timex/Sinclair 1000 or Sinclair ZX-81; 16K RAM; cassette-tape player; TV
Manufacturer: King Software, 85 Myrtle St., Lowell, MA 08150
Price: $20
Comments: "This program," says the review, "makes of the Timex/Sinclair 1000 a combination alarm clock and bulletin board . . . if you spend too much time looking at [TV], Home Clock Family Bulletins will let you communicate with each other via the tube."

The program, concludes the review, "does what its title proclaims. To that extent, this is a good program." Reader Service Number 413

(Reviewed in InfoWorld, *February 21, 1983)*

valFORTH

System Requirements: Atari 400/800; 24K RAM; disk drive
Manufacturer: Valpar Corp., 3801 East 34 St., Suite 105, Tucson, AZ 85713
Price: $45
Comments: valFORTH is a program which can bring the FORTH computer language to your Atari. "valFORTH," says the review, "is based on the standard model of the FORTH Interest Group (fig), with most of the core words coded in Machine Language for extra speed. It is a straightforward implementation, with very thorough documentation."

valFORTH succeeds, according to the review, "to the degree that anybody who feels confident programming in BASIC and wants to develop higher-performance type programs should certainly investigate this alternative." Reader Service Number 414

(Reviewed in Softside, *issue #36)*

Type Right

System Requirements: Commodore PET, 64 or 8032 machines; 8K RAM; 4040 disk drive
Manufacturer: Barron Enterprises, 714 Willow Glen Road, Santa Barbara, CA 93105
Price: $29.95
Comments: Type Right, according to the review, "is a complete typing tutorial in 22 lesson-programs" which "provide a self-paced course of study." There are drills that are scored and games that are fun.

"The program," concludes the review, "apparently was written for tape and was merely dubbed onto disk without considering the peculiar conditions of a disk environment. These problems could be remedied by improved documentation." Reader Service Number 415

(Reviewed in InfoWorld, *January 3, 1983)*

Micro Barmate

System Requirements: Apple II or II Plus; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Virtual Combinatics, Box 755, Rockport, MA 01966
Price: $30
Comments: "This unique program," says the review, "steps through the entire preparation of more than 220 popular and diverse drinks." You can also give Micro Barmate a list of the ingredients you have on hand, and the program will search out and tell you what drinks you can make.

Other features are information on alcohol-related subjects and helpful hints on planning a party. There are also, according to the review, "hints on bartending, suggestions for stocking your home bar, recipes for making your own liquors and even a calorie chart." Reader Service Number 407

(Reviewed in Softalk, *March 1983)*

Bug Byter

System Requirements: Apple II or II Plus; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Computer Advanced Ideas, 1442A Walnut St., Suite 341, Berkeley, CA 94709
Price: $39.95
Comments: Bug Byter is a program to monitor your machine-language programs, states the review, by acting as an interpreter. "At the same time," says the review, "it updates the screen display of the lines being executed, the status of the stack, the values of all the registers, each flag in the status register, and user-selected memory locations."

Because of all it does, it slows up the program, but "the reduced speed is important for debugging," states the review, "because normally, when a machine-language program does something unexpected, it's moving so fast that it's in the next state before you can stop it." Reader Service Number 408

(Reviewed in Softalk, *March 1983)*

Cdex Training for VisiCalc

System Requirements: Apple II or II Plus; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Cdex Corp., 5050 El Camino Real, Suite 200, Los Altos, CA 94022
Price: $49.95
Comments: This program is a quick way of training people to use the basics of VisiCalc, according to the review. "Just put the first disk into the drive . . . What unfolds is a graphic, interactive explanation of VisiCalc's most basic commands."

"It doesn't give in-depth coverage," concludes the review, but "for a time-short individual who wishes to learn or teach VisiCalc's basics in a hurry, quickly and painlessly, this is a good approach, well executed." Reader Service Number 411

(Reviewed in Softalk, *March 1983)*

Edix

System Requirements: IBM PC; PC-DOS; 96K RAM; at least one disk drive
Manufacturer: Emerging Technology Consultants, Inc., 2031 Broadway, Boulder, CO 80302
Price: $195
Comments: Edix, according to the review, is a very useful word processor and text editor for editing programs on the IBM PC. It is not, however, suitable if you're going to write a novel.

"This editor," says the review, "includes one particularly innovative feature: the ability to edit and view more than one file at a time. If you use Edix with Wordix (also by ETC), you get text editing capabilities previously available only on large computers." Reader Service Number 402

(Reviewed in InfoWorld, *March 7, 1983)*

Helpware

System Requirements: IBM PC; DOS 1.1; 64K RAM; one or two disk drives
Manufacturer: Softwrights, 12606 Greenville Ave., Suite 100, Dallas, TX 75243
Price: Unavailable
Comments: "Helpware," says the review, "does for data files what a word processor does for text. It allows you to move, manipulate, save and rename pieces of data." A prime aim of Helpware, however, is to simplify the use of PC-DOS.

Aside from documentation which may give novices trouble, the review concludes that "Helpware is a fine program for people who want an easier-to-use DOS." Reader Service Number 404

(Reviewed in InfoWorld, *February 21, 1983)*

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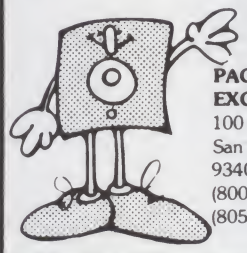

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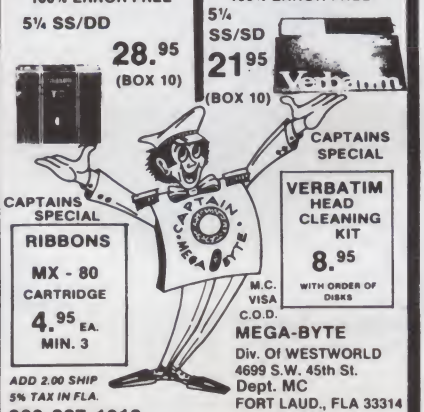

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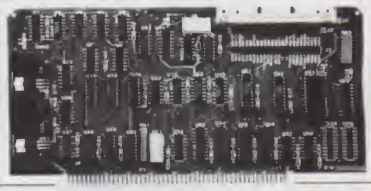

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Wordix

System Requirements: IBM PC; PC-DOS; 128K RAM; two disk drives; printer
Manufacturer: Emerging Technology Consultants, Inc., 2031 Broadway, Boulder, CO 80302
Price: $195
Comments: "Wordix is an advanced text formatter," states the review, "intended to be a companion product to the editor Edix. In fact, the two programs work well independently." Edix is more appropriate for program development, while Wordix is better for manuscript writing.

The review says that you can "easily customize Wordix to perform complicated or unusual tasks." Besides long text formatting, it is good for creating manuals, reports, form letters and for address labels. Reader Service Number 403

(Reviewed in InfoWorld, *March 7, 1983)*

Know Your Apple

System Requirements: Apple II or II Plus; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Muse Software, 347 North Charles St., Baltimore, MD 21201
Price: $29.95
Comments: "This program," says the review, "takes much of the mystique from the workings of the Apple." It presumes the user knows nothing about a computer, and it details the Apple's workings using hi-res pictures of the parts.

"For new users of the Apple," the review concludes, "Know Your Apple is an outstandingly worthwhile program. People learn much more easily with visual instruction than by trudging through weighty manuals." Reader Service Number 405

(Reviewed in Softalk, *March 1983)*

Metatrak II

System Requirements: Apple II or II Plus; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Syntauri, 3506 Waverly St., Palo Alto, CA 94306
Price: $275
Comments: "The Syntauri people," says the review, "have created the Metatrak software to bring the basic concepts of multitrack recording to their famous AlphaSyntauri digital synthesizer." Metatrak produces tone colors through using the AlphaPlus operating system.

According to the review, "A musician may build a piece of music one track at a time, assigning any of the tone colors to any of 16 tracks . . . [Metatrak's] range of tone colors and accuracy of recording make it useful for serious production of recorded electronic music." Reader Service Number 409

(Reviewed in Softalk, *March 1983)*

Pandemonium

System Requirements: Apple II or II Plus; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Soft Images, 200 Route 17, Mahwah, NJ 07430
Price: $39.95
Comments: Pandemonium, according to the review, is a game depending on solid thinking rather than flashy graphics and quick reflexes. "Pandemonium," says the review, "challenges you to form words horizontally, vertically and from top to bottom on the two diagonals of a five-box-by-five-box grid."

"The program runs quickly and smoothly," concludes the review. "Very few details have been overlooked. But watch out: this game is hard. It really makes you think." Reader Service Number 406

(Reviewed in Softalk, *March 1983)*

Versa-File

System Requirements: Z80-based microcomputer; CP/M and MP/M; 48K RAM; 5¼-inch or eight-inch disk; a CRT terminal with cursor positioning
Manufacturer: Analytic Management Systems, 247 High St., Palo Alto, CA 94301
Price: $69
Comments: "Versa-File," says the review, "is a low-cost, indexed, file-management system . . . it has selection and sorting features as well as a convenient interface with WordStar." To use this program, however, you must know how to use a text editor to create files.

"Initially this package is frustrating," concludes the review, "due to the mandatory text editor and screen documentation that is not thorough. However, after you have designed the screens and formatted the reports, Versa-File is easy to use . . . At $69, this program is well worth the price!" Reader Service Number 412

(Reviewed in InfoWorld, *February 21, 1983)*

Time Accountant

System Requirements: Commodore CBM 8032; 32K RAM; 8050 disk preferred; wide-carriage printer
Manufacturer: Image Software, 3678 Nicole, Las Vegas, NV 89120
Price: $425
Comments: The Time Accountant, the review states, "provides lawyers, accountants and other professionals with a convenient and accurate hourly-rate billing system . . . with the one-megabyte floppy-disk drive, it can accommodate 800 clients and 13,060 billable transactions."

"The complex chain of menu selections," says the review, "is well-documented and self-evident to users familiar with law-office practice." The review concludes that "this is a smooth-running and fast time-accounting system." Reader Service Number 401

(Reviewed in InfoWorld, *March 7, 1983)*

Sherwood Forest

System Requirements: Apple II or II Plus; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Phoenix Software, 64 Lake Zurich Drive, Lake Zurich, IL 60047
Price: $34.95
Comments: In Sherwood Forest, an adventure with excellent graphics, according to the review, "the player gets to be Robin Hood—only he's been away and none of his friends recognize him." Robin has to get back with his friends, win Maid Marian and outwit the sheriff.

"The puzzles are fun and mostly logical," concludes the review. "The story hasn't great depth, but it's light, humorous and enjoyable to play." Reader Service Number 410

(Reviewed in Softalk, *March 1983)*

InfoWorld, published by Popular Computing, Inc., 375 Cochituate Road, Box 880, Framingham, MA 01701.

Popular Computing, published by BYTE Publications, Inc., 70 Main St., Peterborough, NH 03458.

Softalk, 11160 McCormick St., North Hollywood, CA 91601.

Softalk for the IBM Personal Computer, published by Softalk Publishing Company, 11160 McCormick St., North Hollywood, CA 91601.

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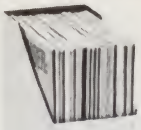

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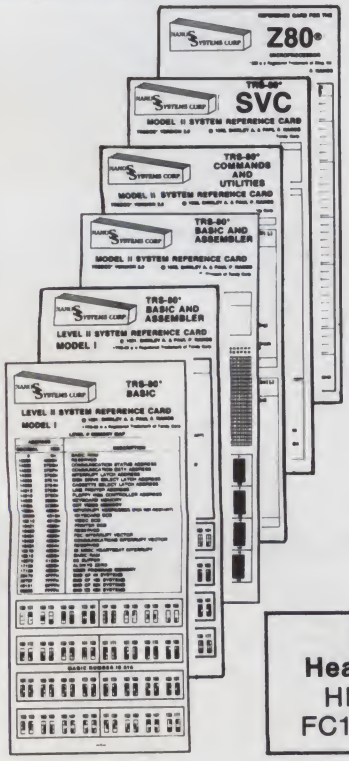

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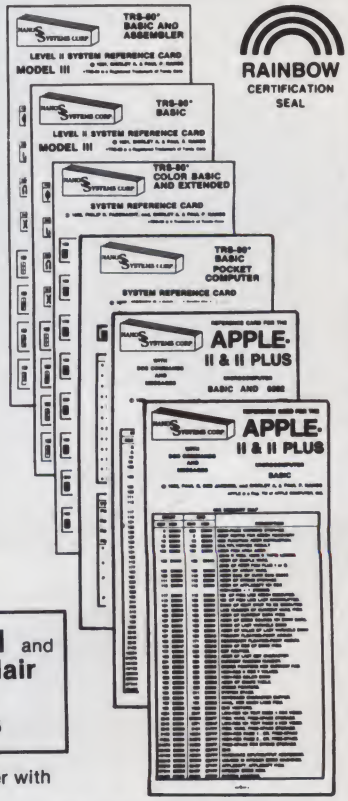

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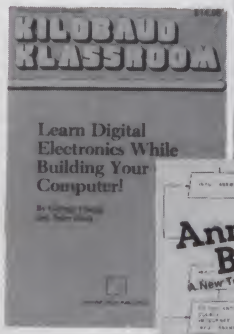

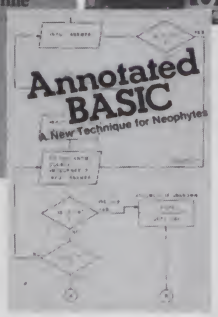

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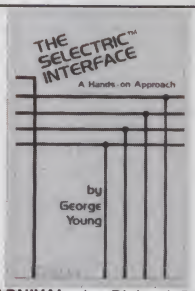

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Programming/Languages

6502/Apple/Vic

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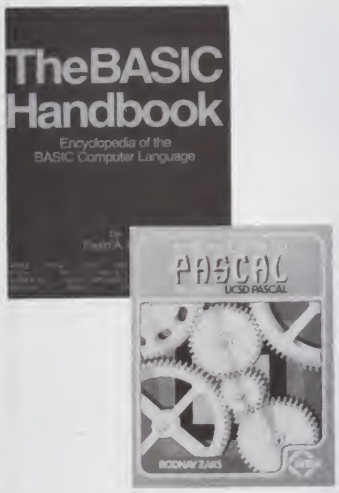

LEARNING IBM BASIC FOR THE PERSONAL COMPUTER—by David A. Lien This is a comprehensive how-to book that will help you get the most for your IBM-PC. A completer BASIC tutorial, it puts your PC to work *while* you learn BASIC. This has been written with the beginner in mind and encourages learning in a relaxed and enjoyable manner with its easy step-by-step instructions. It's also a excellent text for the classroom. BK1273 $19.95

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Z-80

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68000/6809

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6502B	14.95

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COM8116	10.95
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LM566	1.49
XR2206	3.75
8038	3.95

74LS00

74LS00	.24	74LS173	
74LS01	.25	74LS174	
74LS02	.25	74LS175	
74LS03	.25	74LS181	2.
74LS04	.24	74LS189	8.
74LS05	.25	74LS190	
74LS08	.28	74LS191	
74LS09	.29	74LS192	
74LS10	.25	74LS193	
74LS11	.35	74LS194	
74LS12	.35	74LS195	
74LS13	.45	74LS196	
74LS14	.59	74LS197	
74LS15	.35	74LS221	
74LS20	.25	74LS240	
74LS21	.29	74LS241	
74LS22	.25	74LS242	
74LS26	.29	74LS243	
74LS27	.29	74LS244	
74LS28	.35	74LS245	1.
74LS30	.25	74LS247	
74LS32	.29	74LS248	
74LS33	.55	74LS249	
74LS37	.35	74LS251	
74LS38	.35	74LS253	
74LS40	.25	74LS257	
74LS42	.49	74LS258	
74LS47	.75	74LS259	2.
74LS48	.75	74LS260	
74LS49	.75	74LS266	
74LS51	.25	74LS273	1.
74LS54	.29	74LS275	3.
74LS55	.29	74LS279	.4
74LS63	1.25	74LS280	1.
74LS73	.39	74LS283	.6
74LS74	.35	74LS290	.8
74LS75	.39	74LS293	.8
74LS76	.39	74LS295	.9
74LS78	.49	74LS298	.8
74LS83	.60	74LS299	1.
74LS85	.69	74LS323	3.
74LS86	.39	74LS324	1.
74LS90	.55	74LS352	1.
74LS91	.89	74LS353	1.
74LS92	.55	74LS363	1.
74LS93	.55	74LS364	1.
74LS95	.75	74LS365	.4
74LS96	.89	74LS366	.4
74LS107	.39	74LS367	.4
74LS109	.39	74LS368	.4
74LS112	.39	74LS373	.9
74LS113	.39	74LS374	.9
74LS114	.39	74LS377	1.
74LS122	.45	74LS378	1.
74LS123	.79	74LS379	1.
74LS124	2.90	74LS385	1.
74LS125	.49	74LS386	.4
74LS126	.49	74LS390	1.
74LS132	.59	74LS393	1.
74LS133	.59	74LS395	1.
74LS136	.39	74LS399	1.
74LS137	.99	74LS424	2.
74LS138	.55	74LS447	.3
74LS139	.55	74LS490	1.
74LS145	1.20	74LS624	3.
74LS147	2.49	74LS640	2.
74LS148	1.35	74LS645	2.
74LS151	.55	74LS668	1.
74LS153	.55	74LS669	1.
74LS154	1.90	74LS670	1.
74LS155	.69	74LS674	9.
74LS156	.69	74LS682	3.
74LS157	.65	74LS683	3.
74LS158	.59	74LS684	3.
74LS160	.69	74LS685	3.
74LS161	.65	74LS688	2.
74LS162	.69	74LS689	3.
74LS163	.65	74LS783	24.
74LS164	.69	81LS95	1.
74LS165	.95	81LS96	1.
74LS166	1.95	81LS97	1.
74LS168	1.75	81LS98	1.
74LS169	1.75	25LS2521	2.
74LS170	1.49	25LS2569	4.

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7400

00	.19	74132	.45
01	.19	74136	.50
02	.19	74141	.65
03	.19	74142	2.95
04	.19	74143	2.95
05	.25	74145	.60
06	.29	74147	1.75
07	.29	74148	1.20
08	.24	74150	1.35
09	.19	74151	.55
10	.19	74152	.65
11	.25	74153	.55
12	.30	74154	1.25
13	.35	74155	.75
14	.49	74156	.65
16	.25	74157	.55
17	.25	74159	1.65
20	.19	74160	.85
21	.35	74161	.69
22	.35	74162	.85
23	.29	74163	.69
25	.29	74164	.85
26	.29	74165	.85
27	.29	74166	1.00
28	.45	74167	2.95
30	.19	74170	1.65
32	.29	74172	5.95
33	.45	74173	.75
37	.29	74174	.89
38	.29	74175	.89
40	.19	74176	.89
42	.49	74177	.75
43	.65	74178	1.15
44	.69	74179	1.75
45	.69	74180	.75
46	.69	74181	2.25
47	.69	74182	.75
48	.69	74184	2.00
50	.19	74185	2.00
51	.23	74190	1.15
53	.23	74191	1.15
54	.23	74192	.79
60	.23	74193	.79
70	.35	74194	.85
72	.29	74195	.85
73	.34	74196	.79
74	.33	74197	.75
75	.45	74198	1.35
76	.35	74199	1.35
80	.59	74221	1.35
81	1.10	74246	1.35
82	.95	74247	1.25
83	.50	74248	1.85
85	.59	74249	1.95
86	.35	74251	.75
89	2.15	74259	2.25
90	.35	74265	1.35
91	.40	74273	1.95
92	.50	74276	1.25
93	.35	74279	.75
94	.65	74283	2.00
95	.55	74284	3.75
96	.70	74285	3.75
97	2.75	74290	.95
100	1.75	74293	.75
107	.30	74298	.85
109	.45	74351	2.25
110	.45	74365	.65
111	.55	74366	.65
116	1.55	74367	.65
120	1.20	74368	.65
121	.29	74376	2.20
122	.45	74390	1.75
123	.49	74393	1.35
125	.45	74425	3.15
126	.45	74426	.85
128	.55	74490	2.55

LINEAR

LM301	.34	LM340 (see 7800)		LM566	1.49	LM1800	2.37
LM301H	.79	LM348	.99	LM567	.89	LM1812	8.25
LM307	.45	LM350K	4.95	NE570	3.95	LM1830	3.50
LM308	.69	LM350T	4.60	NE571	2.95	LM1871	5.49
LM308H	1.15	LM358	.69	NE592	2.75	LM1872	5.49
LM309H	1.95	LM359	1.79	LM709	.59	LM1877	3.25
LM309K	1.25	LM376	3.75	LM710	.75	LM1889	1.95
LM310	1.75	LM377	1.95	LM711	.79	LM1896	1.75
LM311	.64	LM378	2.50	LM723	.49	ULN2003	2.49
LM311H	.89	LM379	4.50	LM723H	.55	LM2877	2.05
LM312H	1.75	LM380	.89	LM733	.98	LM2878	2.25
LM317K	3.95	LM380N-8	1.10	LM741	.35	LM2900	.85
LM317T	1.19	LM381	1.60	LM741N-14	.35	LM2901	1.00
LM318	1.49	LM382	1.60	LM741H	.40	LM3900	.59
LM318H	1.59	LM383	1.95	LM747	.69	LM3905	1.25
LM319H	1.90	LM384	1.95	LM748	.59	LM3909	.98
LM319	1.25	LM386	.89	LM1014	1.19	LM3911	2.25
LM320 (see 7900)		LM387	1.40	LM1303	1.95	LM3914	3.95
LM322	1.65	LM389	1.35	LM1310	1.49	LM3915	3.95
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LM331	3.95	LM399H	5.00	MC1358	1.69	RC4136	1.25
LM334	1.19	NE531	2.95	MC1372	6.95	RC4151	3.95
LM335	1.40	NE555	.34	LM1414	1.59	LM4250	1.75
LM336	1.75	NE556	.65	LM1458	.59	LM4500	3.25
LM337K	3.95	NE558	1.50	LM1488	.69	RC4558	.69
LM337T	1.95	NE561	24.95	LM1489	.69	LM13080	1.29
LM338K	6.95	NE564	2.95	LM1496	.85	LM13600	1.49
LM339	.99	LM565	.99	LM1558H	3.10	LM13700	1.49

H = TO-5 CAN T = TO-220 K = TO-3

RCA

CA 3023	2.75	CA 3082	1.65
CA 3039	1.29	CA 3083	1.55
CA 3046	1.25	CA 3086	.80
CA 3059	2.90	CA 3089	2.99
CA 3060	2.90	CA 3096	3.49
CA 3065	1.75	CA 3130	1.30
CA 3080	1.10	CA 3140	1.15
CA 3081	1.65	CA 3146	1.85
		CA 3160	1.19

TI

TL494	4.20	75365	1.95
TL496	1.65	75450	.59
TL497	3.25	75451	.39
75107	1.49	75452	.39
75110	1.95	75453	.39
75150	1.95	75454	.39
75154	1.95	75491	.79
75188	1.25	75492	.79
75189	1.25	75493	.89
	75494	.89	

BI FET

TL071	.79	TL084	2.19
TL072	1.19	LF347	2.19
TL074	2.19	LF351	.60
TL081	.79	LF353	1.00
TL082	1.19	LF355	1.10
TL083	1.19	LF356	1.10
	LF357	1.40	

CMOS

4000	.29	4527	1.95
4001	.25	4528	1.19
4002	.25	4531	.95
4006	.89	4532	1.95
4007	.29	4538	1.95
4008	.95	4539	1.95
4009	.39	4541	2.64
4010	.45	4543	1.19
4011	.25	4553	5.79
4012	.25	4555	.95
4013	.38	4556	.95
4014	.79	4581	1.95
4015	.39	4582	1.95
4016	.39	4584	.75
4017	.69	4585	.75
4018	.79	4702	12.95
4019	.39	74C00	.35
4020	.75	74C02	.35
4021	.79	74C04	.35
4022	.79	74C08	.35
4023	.29	74C10	.35
4024	.65	74C14	.59
4025	.29	74C20	.35
4026	1.65	74C30	.35
4027	.45	74C32	.39
4028	.69	74C42	1.29
4029	.79	74C48	1.99
4030	.39	74C73	.65
4034	1.95	74C74	.65
4035	.85	74C76	.80
4040	.75	74C83	1.95
4041	.75	74C85	1.95
4042	.69	74C86	.39
4043	.85	74C89	4.50
4044	.79	74C90	1.19
4046	.85	74C93	1.75
4047	.95	74C95	.99
4049	.35	74C107	.89
4050	.35	74C150	5.75
4051	.79	74C151	2.25
4053	.79	74C154	3.25
4060	.89	74C157	1.75
4066	.39	74C160	1.19
4068	.39	74C161	1.19
4069	.29	74C162	1.19
4070	.35	74C163	1.19
4071	.29	74C164	1.39
4072	.29	74C165	2.00
4073	.29	74C173	.79
4075	.29	74C174	1.19
4076	.79	74C175	1.19
4078	.29	74C192	1.49
4081	.29	74C193	1.49
4082	.29	74C195	1.39
4085	.95	74C200	5.75
4086	.95	74C221	1.75
4093	.49	74C373	2.45
4098	2.49	74C374	2.45
4099	1.95	74C901	.39
14409	12.95	74C902	.85
14410	12.95	74C903	.85
14411	11.95	74C905	10.95
14412	12.95	74C906	.95
14419	7.95	74C907	1.00
14433	4.18	74C908	2.00
4502	.95	74C909	2.75
4503	.65	74C910	9.95
4508	1.95	74C911	8.95
4510	.85	74C912	8.95
4511	.85	74C914	1.95
4512	.85	74C915	1.19
4514	1.25	74C918	2.75
4515	1.79	74C920	17.95
4516	1.55	74C921	15.95
4518	.89	74C922	4.49
4519	.39	74C923	4.95
4520	.79	74C925	5.95
4522	1.25	74C926	7.95
4526	1.25	74C928	7.95
		74C929	19.95

74S00

74S00	.32	74S163	1.95
74S02	.35	74S168	3.95
74S03	.35	74S169	3.95
74S04	.35	74S174	.95
74S05	.35	74S175	.95
74S08	.35	74S181	3.95
74S09	.40	74S182	2.95
74S10	.35	74S188	1.95
74S11	.35	74S189	6.95
74S15	.35	74S194	1.49
74S20	.35	74S195	1.49
74S22	.35	74S196	1.49
74S30	.35	74S197	1.49
74S32	.40	74S201	6.95
74S37	.88	74S225	7.95
74S38	.85	74S240	2.20
74S40	.35	74S241	2.20
74S51	.35	74S244	2.20
74S64	.40	74S251	.95
74S65	.40	74S253	.95
74S74	.50	74S257	.95
74S85	1.99	74S258	.95
74S86	.50	74S260	.79
74S112	.50	74S274	19.95
74S113	.50	74S275	19.95
74S114	.55	74S280	1.95
74S124	2.75	74S287	1.90
74S132	1.24	74S288	1.90
74S133	.45	74S289	6.89
74S134	.50	74S301	6.95
74S135	.89	74S373	2.45
74S138	.85	74S374	2.45
74S139	.85	74S381	7.95
74S140	.55	74S387	1.95
74S151	.95	74S412	2.98
74S153	.95	74S471	4.95
74S157	.95	74S472	4.95
74S158	.95	74S474	4.95
74S161	1.95	74S482	15.25
74S162	1.95	74S570	2.95
		74S571	2.95

INTERFACE

8T26	1.59
8T28	1.89
8T95	.89
8T96	.89
8T97	.89
8T98	.89
DM8131	2.95
DP8304	2.29
DS8835	1.99
DS8836	.99

MISC.

ULN2003	2.49
3242	7.95
3341	4.95
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MC3480	9.00
11C90	13.95
95H90	7.95
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VOLTAGE REGULATORS

7805T	.75	7905T	.85
7808T	.75	7908T	.85
7812T	.75	7912T	.85
7815T	.75	7915T	.85
7824T	.75	7924T	.85
7805K	1.39	7905K	1.49
7812K	1.39	7912K	1.49
7815K	1.39	7915K	1.49
7824K	1.39	7924K	1.49
78L05	.69	79L05	.79
78L12	.69	79L12	.79
78L15	.69	79L15	.79
78H05K	9.95	LM323K	4.95
78H12K	9.95	UA78S40	1.95

T = TO-220 K = TO-3
L = TO-92

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ICL7106	9.95
ICL7107	12.95
ICL7660	2.95
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9000

9316	1.00
9334	2.50
9368	3.95
9401	9.95
9601	.75
9602	1.50
96S02	1.95

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TANTALUM

	6V	10V	15V	20V	25V	35V	50V
.22uf						.40	
.27						.40	
.33						.40	.45
.47				.35			.50
.68						.45	.50
1.0			.40	.40	.45	.45	
1.5				.45		.50	.60
1.8							.75
2.2		.35	.40	.45		.65	.85
2.7		.40	.45				.90
3.3		.45	.50	.55	.60	.65	.90
3.9		.45					
4.7	.45	.55		.60	.65	.85	.90
6.0			.60				
6.8			.70		.75		
8.2							1.00
10	.55	.65	.80	.85	.90	1.00	
12	.65		.85	.90			
15	.75	.85	.90				
18			1.25				
22		1.00	1.35				
27			2.25				
39		1.50					
47	1.35						
56	1.75						
100		3.25					
270	3.75						

DISC

10pf	50V	.05	470	50V	.05
22	50V	.05	560	50V	.05
25	50V	.05	680	50V	.05
27	50V	.05	820	50V	.05
33	50V	.05	.001uf	50V	.05
47	50V	.05	.0015	50V	.05
56	50V	.05	.0022	50V	.05
68	50V	.05	.005	50V	.05
82	50V	.05	.01	50V	.07
100	50V	.05	.02	50V	.07
220	50V	.05	.05	50V	.07
330	50V	.05	.1	12V	.10
			.1	50V	.12

MONOLITHIC

1uf-mono	50V	.18	.47uf-mono	50V	.25

ELECTROLYTIC

RADIAL			AXIAL		
.47uf	50V	.14	1uf	50V	.14
1	25V	.14	4.7	16V	.14
2.2	35V	.15	10	16V	.14
4.7	50V	.15	10	50V	.16
10	50V	.15	22	16V	.14
47	35V	.18	47	50V	.20
100	16V	.18	100	15V	.20
220	35V	.20	100	35V	.25
470	25V	.30	150	25V	.25
2200	16V	.60	220	25V	.30
			330	16V	.40
			500	16V	.42
			1000	16V	.60
			1500	16V	.70
			6000	16V	.85

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26.000uf	30V	3.95

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4N26	1.00	MCA-7	1.50
4N27	1.10	MCA-255	1.75
4N28	.69	IL-1	1.25
4N33	1.75	ILA-30	1.25
4N35	1.25	ILQ-74	2.75
4N37	1.25	H11C5	1.25
MCT-2	1.00	TIL-111	1.00
MCT-6	1.50	TIL-113	1.75

DIODES

1N751	5.1 volt zener	.25
1N759	12.0 volt zener	.25
1N4148	(1N914) switching	25/1.00
1N4004	400PIV rectifier	10/1.00
KBP02	200PIV 1.5amp bridge	.45
KBP04	400PIV 1.5amp bridge	.55

MUFFIN FANS NEW UN-USED

4.68" Square	14.95
3.125" Square	14.95

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SPDT mini-toggle	1.25
DPDT mini-toggle	1.50
SPDT push-button	1.49

TRANSISTORS

2N918	.50	MPS3706	.15
MPS918	.25	2N3772	1.85
2N2102	.50	2N3903	.25
2N2218	.50	2N3904	.10
2N2218A	.50	2N3906	.10
2N2219	.50	2N4122	.25
2N2219A	.50	2N4123	.25
2N2222	.25	2N4249	.25
PN2222	.10	2N4304	.75
MPS2369	.25	2N4401	.25
2N2484	.25	2N4402	.25
2N2905	.50	2N4403	.25
2N2907	.25	2N4857	1.00
PN2907	.125	PN4916	.25
2N3055	.79	2N5086	.25
3055T	.69	PN5129	.25
2N3393	.30	PN5139	.25
2N3414	.25	2N5209	.25
2N3563	.40	2N6028	.35
2N3565	.40	2N6043	1.75
PN3565	.25	2N6045	1.75
MPS3638	.25	MPS-A05	.25
MPS3640	.25	MPS-A06	.25
PN3643	.25	MPS-A55	.25
PN3644	.25	TIP29	.65
MPS3704	.15	TIP31	.75
		TIP32	.79

HEAT-SINKS

TO-3 style	.95
TO-220 style	.35

IC SOCKETS

	1-99	100
8 pin ST	.13	.11
14 pin ST	.15	.12
16 pin ST	.17	.08
18 pin ST	.20	.18
20 pin ST	.29	.27
22 pin ST	.30	.27
24 pin ST	.30	.27
28 pin ST	.40	.32
40 pin ST	.49	.39
64 pin ST	4.25	call

ST = SOLDERTAIL

8 pin WW	.59	.49
14 pin WW	.69	.52
16 pin WW	.49	.49
18 pin WW	.99	.90
20 pin WW	1.09	.98
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
40 pin WW	1.99	1.80

WW = WIREWRAP

16 pin ZIF	6.75	call
24 pin ZIF	9.95	call
28 pin ZIF	10.95	call

ZIF = TEXTOOL
(Zero Insertion Force)

DIP SWITCHES

4 POSITION	.85
5 POSITION	.90
6 POSITION	.90
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8 POSITION	.95

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	1-99	100-up
Jumbo Red	.10	.09
Jumbo Green	.18	.15
Jumbo Yellow	.18	.15

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HP 5082-7760	.6"	CC	1.29
MAN 72	.3"	CA	.99
MAN 74	.3"	CC	.99
FND-357 (359)	.375"	CC	1.25
FND-500 (503)	.5"	CC	1.49
FND-507 (510)	.5"	CA	1.49

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.01 UF DISC	100/6.00
.1 UF DISC	100/8.00
.1 UF MONOLITHIC	100/15.00

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¼ WATT 5% CARBON FILM ALL STANDARD VALUES
FROM 1 OHM TO 10 MEG OHM

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Circle 84 on Reader Service card.

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OSBORNE/MC GRAW-HILL

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68000 Assembly Language Programming	16.99
CBASIC User Guide	15.00

SYBEX

Your First Computer	8.95
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The PASCAL Handbook	18.95
Microprocessor Interfacing Techniques	17.95

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2.6VAC	2amp	4.95
2.6VAC CT	2amp	5.95
2.6VAC CT	4amp	7.95
2.6VAC CT	8amp	10.95
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2VAC	250ma	3.95
2VAC	500ma	4.95
2VAC	1amp	5.95
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9, 12 VDC selectable with universal adapter 8.95

NOTE: Please include sufficient amount for shipping on above items.

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TANDON

TM100-1 5¼" (FOR IBM) SS/DD	229.00
TM100-2 5¼" (FOR IBM) DS/DD	295.00

SHUGART

SA 400L 5¼" (40 TRACK) SS/DD	199.95
SA 400 5¼" (35 TRACK) SS/DD	189.95

SIEMENS

FD100-8 8" SS/DD (801 REPLACEMENT)	259.00

PERTEC

FD-200 5¼" SS/DD	179.95
FD-250 5¼" DS/DD	199.95

MPI

MP-52 5¼" (FOR IBM) DS/DD	295.00

NOTE: Please include sufficient amount for shipping on above items.

CABINETS FOR 5¼" DISK DRIVES

CABINET #1 $29.95

- ★ DIMENSIONS 8⅝ x 5 15/16 x 3 15/16"
- ★ COLOR MATCHES APPLE
- ★ FITS STANDARD 5¼" DRIVES, INCL. SHUGART
- ★ INCLUDES MOUNTING HARDWARE AND FEET

CABINET #2 $79.00

- ★ COMPLETE WITH POWER SUPPLY, SWITCH, LINE CORD, FUSE & STANDARD POWER CONNECTOR
- ★ DIMENSIONS: 11½ x 5¾ x 3 15/16"
- ★ +5V @ 1 AMP, +12V @ 1.5 AMP
- ★ FITS STANDARD 5¼" DRIVES
- ★ PLEASE **SPECIFY** GRAY OR TAN

NOTE: Please include sufficient amount for shipping on above items.

JDR SPRING SPECIALS

SA400 $189.95

- ★ 35 TRACKS
- ★ REPEAT OF A SELLOUT
- ★ LIMITED SUPPLY (AGAIN)
- ★ MODIFY FOR USE IN APPLE (EXPERIENCED TECHNICIANS)
- ★ USE WITH CABINET #1 TO MAKE A BEAUTIFUL APPLE COMPATIBLE DRIVE

MODIFICATION INSTRUCTIONS $1.00

34 PIN EDGE CARD CONNECTOR MATES TO RIBBON CABLE $3.25

MEMORY SALE

2114 450NS (TMS4045)	8/9.95	100 FOR .99 ea.
2114 250NS (TMS4045)	8/10.95	100 FOR 1.99 ea.
2102L-4 LOW POWER 450NS	.55 ea.	100 FOR .49 ea.

4164 200NS	5.95	Z80A-CPU 4MHZ	4.95
HM6116-4 200NS	4.75	8080 2MHZ	3.95
TMM2016 200NS	4.15	8085 3MHZ	5.95
2732 450NS	4.95	8086 5MHZ	29.95
TMS2532 450NS	5.95	6800 1MHZ	3.95
2764 450NS	9.95	68000 8MHZ	59.95

COMPONENTS

LM1488 or LM1489 .69 ea.	7805T or 7812T .75 ea.
16 PIN LOW PROFILE ST IC SOCKETS	100/8.00
16 PIN TOOLED WIRE WRAP IC SOCKETS	.49 EA.

SPRING SPECIALS ARE GOOD ONLY UNTIL MAY 31, 1983

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MODEL 2 $39.95

MOUNTED ON PC BOARD MANUFACTURED BY CONVER

+5 VOLT 4 AMP
±12 VOLT 1 AMP

NOTE: Please include sufficient amount for shipping on above items.

CONNECTORS

RS232 MALE	2.50
RS232 FEMALE	3.25
RS232 FEMALE RIGHT ANGLE	5.25
RS232 HOOD	1.25
S-100 ST	3.95
S-100 WW	4.95
44 pin ST	2.95
44 pin WW	4.95
72 pin ST	6.95
72 pin WW	7.95

RIBBON CABLE

CONTACTS	SINGLE COLOR 1'	SINGLE COLOR 10'	COLOR CODED 1'	COLOR CODED 10'
10	.50	4.40	.83	7.30
20	.65	5.70	1.25	11.00
26	.75	6.60	1.32	11.60
34	.98	8.60	1.65	14.50
40	1.32	11.60	1.92	16.80
50	1.38	12.10	2.50	22.00

D-SUBMINIATURE

DESCRIPTION	SOLDER MALE	SOLDER FEMALE	RIGHT ANGLE SOLDER MALE	RIGHT ANGLE SOLDER FEMALE	RIBBON CABLE MALE	RIBBON CABLE FEMALE	HOODS BLACK	HOODS GREY
ORDER BY	DBxxP	DBxxS	DBxxPR	DBxxSR	IDBxxP	IDBxxS	HOOD-B	HOOD
CONTACTS 9	2.08	2.66	1.65	2.18	3.37	3.69	---	1.60
15	2.69	3.63	2.20	3.03	4.70	5.13	---	1.60
25	2.50	3.25	3.00	4.42	6.23	6.84	1.25	1.25
37	4.80	7.11	4.83	6.19	9.22	10.08	---	2.95
50	6.06	9.24	---	---	---	---	---	3.50

For order instructions see "IDC Connectors" below.

IDC CONNECTORS

DESCRIPTION	SOLDER HEADER	RIGHT ANGLE SOLDER HEADER	WW HEADER	RIGHT ANGLE WW HEADER	RIBBON HEADER SOCKET	RIBBON HEADER	RIBBON EDGE CARD
ORDER BY	IDHxxS	IDHxxSR	IDHxxW	IDHxxWR	IDSxx	IDMxx	IDExx
CONTACTS 10	.82	.85	1.86	2.05	1.15	---	2.25
20	1.29	1.35	2.98	3.28	1.86	5.50	2.36
26	1.68	1.76	3.84	4.22	2.43	6.25	2.65
34	2.20	2.31	4.50	4.45	3.15	7.00	3.25
40	2.58	2.72	5.28	4.80	3.73	7.50	3.80
50	3.24	3.39	6.63	7.30	4.65	8.50	4.74

ORDERING INSTRUCTIONS: Insert the number of contacts in the position marked "**xx**" of the "order by" part number listed. **Example:** A 10 pin right angle solder style header would be IDH**10**SR.

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Circle 84 on Reader Service card.

SPRING APPLE SALE!

FD-35 DISK DRIVE
By MA Systems

- ★ Direct **Replacement** for **Apple Disk II**
- ★ Compatible with Apple Controller or other Apple compatible controllers
- ★ Specially designed electronics with **low power consumption**
- ★ DOS 3.3 and 3.2 compatible
- ★ Owner's Manual and Warranty Card included
- ★ 90-day Warranty

NEW INTRODUCTORY OFFER **$229.95**

CONTROLLER CARD $89.95

NEW IMPROVED JDR COOLING FAN
FOR YOUR APPLE II

- ★ Easy modification — no modification of Apple required
- ★ Eliminates overheating problems
- ★ Switch on front controls fan, Apple, and extra outlet
- ★ Rotron whisper fan is the quietest, most reliable on the market

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$69.95

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For Apple II*

- ★ Expand your 48K Apple to 64K
- ★ Fully compatible with Apple Language System — Use in place of Apple Language card
- ★ Provides extra memory for Visicalc™
- ★ Run PASCAL, FORTRAN, Integer Basic with appropriate software
- ★ Highest quality card features: gold edge connector, sockets for all IC's

NOW WITH 2 YEAR WARRANTY

ASSEMBLED & TESTED WITH WARRANTY	$44.95
KIT — INCLUDES ALL PARTS & INSTRUCTIONS	$40.95
BARE PC CARD WITH INSTRUCTIONS	$14.95

APPLE II KEYBOARD $99.95
From the Keyboard Co.

- ★ Brand New Rev. 7 keyboard — NOT an imitation
- ★ Special Purchase — Supply very limited
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APPLE COMPATIBLE POWER SUPPLY $99.95

- ★ Compact Switching Design
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- ★ Complete with Apple-type plug-in power cord
- ★ Apple Compatible — Yet higher output allows more disk drives and cards without overheating
- ★ +5V @ 5A, +12V @ 3A, -5V @ .5A, -12V @ .5A
- ★ Shielded enclosure: 10¾" x 3½" x 2 3/16"

INTERFACE CARDS
By Perisoft

PRINTERLINK $79.00

- ★ Centronics Standard Parallel Interface for Apple II
- ★ Simple to use — Yet supports custom driver applications from ROM or Disk
- ★ Includes card, cable and user's manual
- ★ 1 Year Warranty

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5¼" DISKETTES

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1/2" Aluminum Hexagon Spacers w/Screws 12/1.00 100/6.00

4116 - 250N.S. 8/9.00

6100 - CMOS - 12 Bit - CPU ... 3.95

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We bought a large lot of PRIME controllers! Production quantities available. '80, '81 date codes. Manufactured by SMC.
SPECIAL 6.95 ea 10/60.00

8 position dip switch ..... .75
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7912 - TO3 ..... .75
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8212 ..... 1.10
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.22uf/10v Disk
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1702A 256X8 1 us	2.00
2708 1KX8 450 n.s.	2.20
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EPROM SPECIAL

We bought a large quantity of 2708s from a computer manufacturer who redesigned their boards. We removed them from sockets, erased and verified them, and now we offer the savings to you. Complete satisfaction guaranteed.

2708
$1.49 or 10/$12.00

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Low Profile SOLDER TAIL

8 Pin	13/1.00
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BUY $10
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TMS4046 450 n.s.	1.00
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4K STATIC RAMS
LESS THAN 50¢ EACH

MK4104J-4 - 250 N.S. 18 Pin Ceramic Computer Mfg. Surplus. PRIME. Fully Static. Easy to Use. Has Same Pin Out as TMS4044, but slightly different timing. With Specs. (Mostek)

8 for 5.00 32 for 15.95
VERY LOW POWER!

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74LS

LS00	.24	LS30	.24	LS125	.45	LS163	.50	LS241	.80	LS298	.89
LS02	.24	LS32	.36	LS132	.50	LS164	.60	LS242	.90	LS299	1.60
LS03	.24	LS42	.49	LS133	.49	LS166	.99	LS243	.90	LS366	.45
LS04	.24	LS51	.24	LS138	.50	LS169	1.25	LS244	.90	LS367	.40
LS05	.24	LS74	.30	LS139	.50	LS174	.50	LS245	1.50	LS368	.40
LS08	.24	LS85	.60	LS151	.50	LS175	.50	LS257	.45	LS373	.99
LS10	.24	LS86	.39	LS153	.50	LS181	1.99	LS258	.45	LS374	.75
LS11	.24	LS90	.50	LS154	1.75	LS191	.90	LS266	.50	LS375	1.19
LS12	.30	LS93	.55	LS155	.50	LS192	.80	LS273	1.25	LS377	1.49
LS14	.50	LS109	.39	LS156	.55	LS193	.80	LS279	.45	LS378	.85
LS20	.24	LS112	.39	LS157	.60	LS195	.65	LS283	.60	LS390	1.19
LS21	.25	LS123	.75	LS161	.60	LS221	.80	LS290	.85	LS393	1.19
LS27	.24	LS124	2.75	LS162	.65	LS240	.75	LS293	.85	LS399	.99

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PRICE CUT!

$59.95

USES 2716's

Blank PC Board - $34

ASSEMBLED & TESTED ADD $30

SPECIAL: 2716 EPROM's (450 NS) Are $4.95 Ea. With Above Kit.

KIT FEATURES

1. Uses +5V only 2716 (2Kx8) EPROM's
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible
4. Addressable as two independent 16K blocks
5. Cromemco extended or Northstar bank select
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7. Any or all EPROM locations can be disabled
8. Double sided PC board solder-masked silk-screened
9. Gold plated contact fingers
10. Unselected EPROM's automatically powered down for low power
11. Fully buffered and bypassed
12. Easy and quick to assemble

64K S100 STATIC RAM

$269.00 KIT

NEW!

LOW POWER!

RAM OR EPROM!

BLANK PC BOARD WITH DOCUMENTATION $55

SUPPORT ICs + CAPS $17.50

FULL SOCKET SET $14.50

FULLY SUPPORTS THE NEW IEEE 696 S100 STANDARD (AS PROPOSED)

FOR 56K KIT $219

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FEATURES:

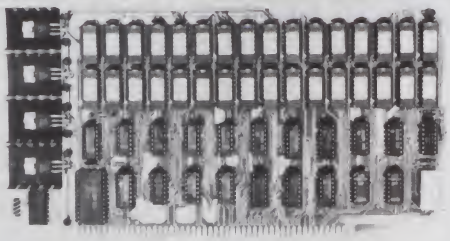
- Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
- Fully supports IEEE 696 24 BIT Extended Addressing.
- 64K draws only approximately 500 MA.
- 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
- 2716 EPROMs may be installed in any of top 48K.
- Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
- Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
- BOARD may be partially populated as 56K.

16K STATIC RAM KIT-S 100 BUSS

PRICE CUT!

$119.95 KIT

FOR 4MHZ ADD $10



KIT FEATURES

1. Addressable as four separate 4K Blocks
2. ON BOARD BANK SELECT circuitry (Cromemco Standard!) Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams
4. ON BOARD SELECTABLE WAIT STATES
5. Double sided PC Board with solder mask and silk screened layout Gold plated contact fingers
6. All address and data lines fully buffered
7. Kit includes ALL parts and sockets
8. PHANTOM is jumpered to PIN 67
9. LOW POWER under 1.5 amps TYPICAL from the +8 Volt Buss
10. Blank PC Board can be populated as any multiple of 4K

BLANK PC BOARD W DATA-$33

LOW PROFILE SOCKET SET-$12

SUPPORT IC'S & CAPS-$19.95

ASSEMBLED & TESTED-ADD $35

OUR #1 SELLING RAM BOARD!

64K SS-50 STATIC RAM

$199.00 (48K KIT)

NEW!

LOW POWER!

RAM OR EPROM!

BLANK PC BOARD WITH DOCUMENTATION $52

SUPPORT ICs + CAPS $18.00

FULL SOCKET SET $15.00

56K Kit $249

64K Kit $299

ASSEMBLED AND TESTED ADD $40

FEATURES:

- Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
- Fully supports Extended Addressing.
- 64K draws only approximately 500 MA.
- 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- Board is configured as 3-16K blocks and 8-2K blocks (within any 64K block) for maximum flexibility.
- 2716 EPROMs may be installed anywhere on Board.
- Top 16K may be disabled in 2K blocks to avoid any I/O conflicts.
- One Board supports both RAM and EPROM.
- RAM supports 2MHZ operation at no extra charge!
- Board may be partially populated in 16K increments.

STEREO! S-100 SOUND COMPUTER BOARD

NEW!

At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's. Allows you under total computer control to generate an infinite number of special sound effects for games or any other program. Sounds can be called in BASIC, ASSEMBLY LANGUAGE, etc.

COMPLETE KIT! $69.95 (WITH DATA MANUAL)

BLANK PC BOARD W/DATA $31

KIT FEATURES:

- TWO GI SOUND COMPUTER IC'S
- FOUR PARALLEL I/O PORTS ON BOARD
- USES ON BOARD AUDIO AMPS OR YOUR STEREO
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- ALL SOCKETS, PARTS AND HARDWARE ARE INCLUDED
- PC BOARD IS SOLDERMASKED, SILK SCREENED WITH GOLD CONTACTS
- EASY, QUICK, AND FUN TO BUILD WITH FULL INSTRUCTIONS
- USES PROGRAMMED I/O FOR MAXIMUM SYSTEM FLEXIBILITY

Both Basic and Assembly Language Programming examples are included

SOFTWARE:

SCL™ is now available! Our Sound Command Language makes writing Sound Effects programs a SNAP! SCL™ also includes routines for Register-Examine-Modify, Memory-Examine-Modify, and Play-Memory. SCL™ is available on CP/M* compatible diskette or 2708 or 2716. Diskette - **$24.95**. 2708 - **$19.95**. 2716 - **$29.95**. Diskette includes the source. EPROM'S are ORG at E000H. **(Diskette is 8 Inch Soft Sectored)**

NEW! G.I. COMPUTER SOUND CHIP

AY3-8910. As featured in July, 1979 BYTE! A fantastically powerful Sound & Music Generator. Perfect for use with any 8 Bit Microprocessor. Contains: 3 Tone Channels, Noise Generator, 3 Channels of Amplitude Control, 16 bit Envelope Period Control, 2-8 Bit Parallel I/O, 3 D to A Converters, plus much more! All in one 40 Pin DIP. Super easy interface to the S-100 or other busses. **$9.95** **PRICE CUT!**

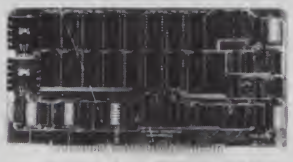
SPECIAL OFFER: ~~$14.95~~ each Add $3 for 60 page Data Manual.

32K S100 EPROM/STATIC RAM

NEW! FOUR FUNCTION BOARD! **NEW!**

EPROM II FULL EPROM KIT $60.00

A&T EPROM ADD $35.00



BLANK PC BOARD WITH DATA $39.95

SUPPORT IC'S PLUS CAPS $23.00

FULL SOCKET SET $18

We took our very popular 32K S100 EPROM Card and added additional logic to create a more versatile EPROM/RAM Board.

FEATURES:

- This one board can be used in any one of four ways:
  - A. As a 32K 2716 EPROM Board
  - B. As a 32K 2732 EPROM Board (Using Every Other Socket)
  - C. As a mixed 32K 2716 EPROM/2K x 8 RAM Board
  - D. As a 32K Static RAM Board
- Uses New 2K x 8 (TMM2016 or HM6116) RAM's
- Fully Supports IEEE 696 Buss Standard (As Proposed)
- Supports 24 Bit Extended Adressing
- 200 NS (FAST!) RAM'S are standard on the RAM Kit
- Supports both Cromemco and North Star Bank Select
- Supports Phantom
- On Board wait State Generator
- Every 2K Block may be disabled
- Addressed as two separate 16K Blocks on any 64K Boundary
- Perfect for MP/M* Systems
- RAM Kit is very low power (300 MA typical)

32K STATIC RAM KIT — $139.95

For RAM Kit A&T - Add $40

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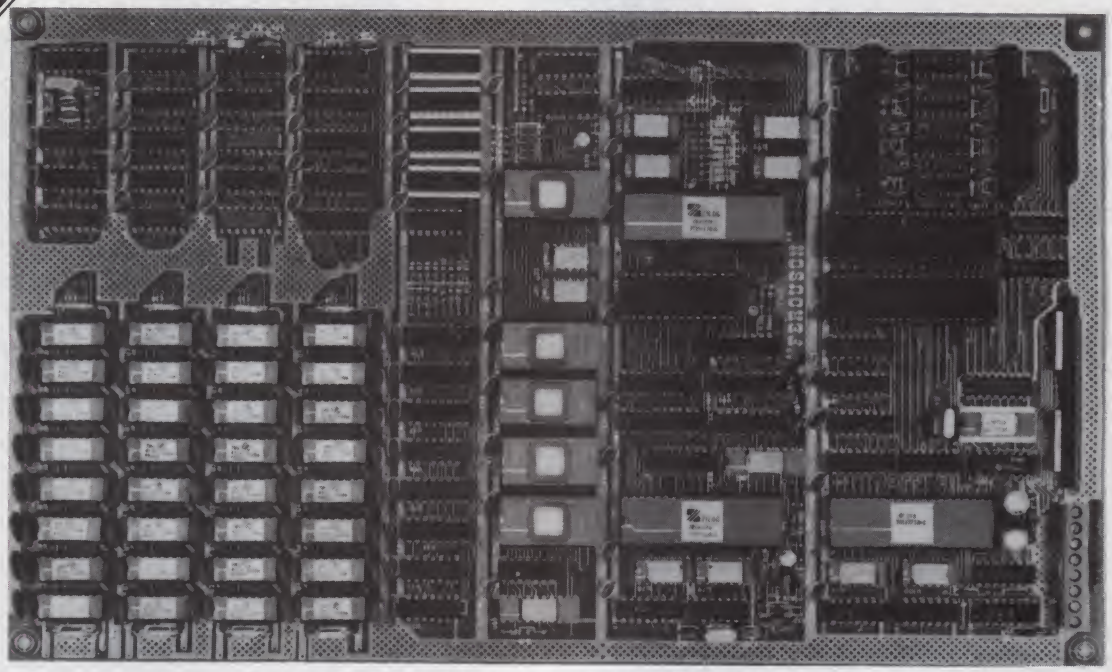

WANT MORE INFO? Full Documentation and Schematics — $5.

THE BIG BOARD PROJECT: With thousands sold worldwide and over two years of field experience, the Big Board may just be one of the most reliable single board computers available today. This is the same design that was licensed by Xerox Corp. as the basis for their 820 computer.

The Big Board gives you the right mix of most needed computing features all on one board. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed.

$319.00 ** (64K KIT BASIC I/O)

SIZE: 8½ x 13¾ IN.
SAME AS AN 8 IN. DRIVE.
REQUIRES: +5V @ 3 AMPS
+ - 12V @ .5 AMPS.

FULLY SOCKETED!

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM's. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 int. Price for all parts and connectors: $39.95

BASIC I/O

Consists of separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

BLANK PC BOARD — $119

The blank Big Board PC Board comes complete with full documentation (including schematics), the character ROM, the PFM 3.3 MONITOR ROM, and a diskette with the source of our BIOS, BOOT, and PFM 3.3 MONITOR.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true. 5 x 7 Matrix - Upper & Lower Case.

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2.

TWO PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. Uses selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $19.95

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Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $9.95

CP/M* 2.2 FOR BIG BOARD

The popular CP/M* D.O.S. to run on Big Board is available for $139.00.

BIG BOARD SOFTWARE SPECIAL — $149

Through special arrangement with CDL we offer a powerful package of TDL Z-80 software that has a suggested retail of almost $600. Includes: Extended Disk Business Basic, ZEDIT text editor, MACRO II Macro Assembler, LINKER, DEBUG I and DEBUG II. Supplied on 8 in. diskette with extensive manual.

PFM 3.3 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.3 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search PFM occupies one of the four 2716 EPROM locations provided. Z-80 is a Trademark of Zilog.

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TERMS: Shipments will be made approximately 3 to 6 weeks after we receive your order. VISA, MC, cash accepted. We will accept COD's (for the Big Board only) with a $75 deposit. Balance UPS COD. Add $4.00 shipping.

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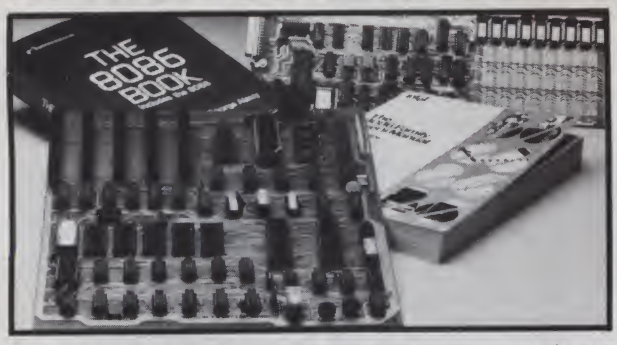
NETRONICS NEW 16 BIT EXPLORER 88-PC ... $399.95 IBM COMPATIBLE



LEARN 16 BIT TECHNOLOGY IN EASY LOW-COST STEPS. This 2-board system features (1) an 8088 mother board with a 5-slot expansion bus that will accept any hardware designed for the IBM personal computer and (2) a 64K (expandable to 256K) memory board that also features an IBM compatible RS 232 communications part. All circuits are functionally equivalent to the IBM except for the cassette ROMS. This means that all programs written in basic designed to run in an IBM can be compiled to run in this system and that any disk-operating system that will run on an IBM will work directly in the EXPLORER 88-PC. The system monitor ROM included in the Starter's system features a user-friendly operating system that allows easy program generation and debugging. The commands include display/modify memory... display/modify registers...input/output data to 1/0 ports...block moves...single-step trace mode...go/run with optional breakpoint and register reports...cassette load/save with file labels...plus a complete system test program that tests and reports conditian of ROM, RAM, cassette interface, timer, DMA controller, interrupt controller, and the communicatians port. These test programs not only allaw easy debugging of software but they serve as hardware and software learning tools.

The EXPLORER 88-PC STARTER'S KIT includes a mother board, memory/ I/O board, all components needed, sockets far IC's used, ane 62-pin bus connectar and complete assembly/test instructions. All you need is a soldering iron, salder, a +5 valt @ 3 amps & -5 & +/- 12 valt @.5 amp power supply, and a standard RS 232 terminal (Netronics has 2 low-cost ones to choose from).

☐ Explorer 88-PC Starter's Kit ...$399.95 + 10.00 p&i (wired & tested, add 100.00).
☐ Extra 62-pin connectars @ 4.25 ea. + 1.00 p&i.

If you da not own a terminal you may want to consider using our IBM compatible keyboard (see photo) in conjunction with an IBM compatible calar graphics board. This cambination, although not necessary at the introductory level, may be desirable if you plan to expand the EXPLORER 88-PC to be fully IBM campatible. These items require additional power and are only available wired and tested as follaws:

☐ IBM compatible keyboard.. $299.95 + 10.00 p&i
☐ IBM compatible color board...$299.95 + 10.00 p&i
☐ Additional ROM required...$35.00

The EXPLORER 88-PC can be expanded at any pace you decide. Invest and learn at a pace that is comfortable for you. Netronics is dedicated to supplying the finest hardware and software to make this a meaningful learning experience. Hard disks, built-in modem board, eprom burner, print buffer system plus more will be available shortly. The following items are available naw:

Deluxe heavy-duty steel cabinet that houses either twa 5¼" flappies or a 5¼" hard disk with one floppy. This cabinet features a brush-finish front ponel and a wood-grained sleeve that gives the unit a real professional look.

☐ EXPLORER 88-PC Cabinet.. $199.95 + 18.00 p&i.

A heavy-duty apen frame power supply with fan that can be used in your awn cabinet or installed inta the Netranic cabinet is available as follaws:

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☐ IBM compatible disk controller board. Controls four 5¼" floppy drives (w 2 drive cable)
☐ Available wired and tested only...$250.00 + 8.00 p&i.
☐ The monitors and BIOS source listings are available on either disk or hard copy at $35.00. Please specify format and system required.
☐ INTEL 8086/8088 user manual...$15.00 + 1.50 p&i.
☐ THE 8086 BOOK by RECTOR & ALEX...$16.00 + 1.50 p&i.
☐ Special IBM compatible system: with keyboard, color graphics board, floppy disk controller, 64K RAM, cabinet, standard power supply and a single 5¼" floppy drive...$1899.95 + 25.00 p & i.

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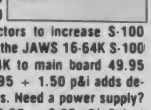
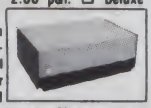
EXPLORER 85

Learn computing from the ground up. Start with the Explorer/85 Level 'A' kit which includes an expandable mother board. The Kit includes the 8085 CPU, 2K Monitor program used to enter, test, run and save programs plus the parts to allow you to start programming. Just add a power supply and terminal or hex keyboard. ☐ LEVEL A Terminal version or ☐ Hex Keypad version 129.95 + 3.00 p&i. Add ☐ Level 'B' 49.95 + 2.00 + two 100 pin connectors @4.85 ea. and have a powerful S-100 computer. Add ☐ Level 'C' 39.95 + 2.00 p&i + five 100 pin connectors to increase S-100 slots to 6. Add memory using the JAWS 16-64K S-100 board or add ☐ Level 'D' 4K to main board 49.95 + 2.00 p&i. ☐ Level 'E' 5.95 + 1.50 p&i adds decoding for 8K of 2716 eproms. Need a power supply? Use the ☐ 5 amp AP-1 at 39.95 + 2.00 p&i. Select one of our low-cost terminals or use the ☐ Hex keypad w/display at 69.95 + 2.00 p&i. ☐ Deluxe system cabinet 49.95 + 3.00 p&i. ☐ Optional tan 16.50. Now add ☐ Microsoft 8K basic & a powerful ☐ Text editor/assembler in ROMS, just 99.95 ea. Add ☐ 8" floppy 499.95 + 12.00 p&i. ☐ Floppy controller board 199.95 + 2.00 p&i. ☐ Floppy cabinets & power supply 69.95 + 3.00 p&i. ☐ Two drive cable 29.95 + 1.50 p&i. Hard disk also available (see insert.)





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☐ **Beginner Pak** (Save $26.00) - You get Level A (Terminal Version) with Monitor Source Listing ($25 value) AP-1 5-amp power supply, Intel 8085 Users Manual...(Reg. $199.95) SPECIAL $169.95 plus $4 p&i.

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JAWS MEMORY BOARD. Features the INTEL 8202 for invisible refresh. Designed to be used with 8080, 8085 and Z80 CPU's. Works in all well designed S-100 computers, 10 day refund (or exchange wired unit for a Kit) on wired units.

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*Add $2.00 p&i to all above.

4 DRIVE 8" FLOPPY CONTROLLER BOARD ☐ Single density (single or double sided) controller using the WD 1771. Includes two serial ports. Plugs into any S-100 computer.

8K 2716 EPROM BOARD. ☐ addressable on 8K page boundaries complete with sockets 69.95 + 2.00 p&i.

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Use 90 preprogrammed words or generate your own words using phonems. Perfect for any project that needs speech or for speech development system. Connects to any RS 232 serial or 8 bit parrallel port or can be used in a stand alone mode. ☐ Speakeasy (board only) 159.95 + 3.00 p&i. ☐ Cabinet and power transformer 25.00 + 2.00 p&i.

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FASTERM 64 ☐ 199.95 + 3.00 p&i. Display format: 64 or 32 char/16 lines...96 ASCII characters (u/l case)...8 baud rates, 150 to 19,200...line output: RS 232-C or 20 ma loop...video output: 1V P/P ...cursor modes: home & clear screen, erase to end of line, erase cursor line, cursor up and down, auto carriage return/line feed at ends of line and auto scrolling...reverse video ...blinking cursor...parity: off, even, or odd...stop bits: 1, 1.5, 2...data bits per character: 5, 6, 7 or 8... printer output: prints all incoming data...1k on-board RAM...2k on-board ROM...complete with power supply, cabinet & 56-key ASCII encoded keyboard. ☐ Optional graphics mode: includes 34 Greek & math plus 30 special graphic characters: 19.95 prepaid.

☐ **FASTERM VIDEO BOARD:** 99.95 + 3.00 p&i.

SMARTERM 80 ☐ 299.95 + 3.00 p&i. Display format: specify either 80 by 24 or 40 by 16...128 ASCII characters (u&l case)...8 baud rates: 110 to 19,200...line output: RS232/C or 20 ma current loop...video output: 1V P/P...editing features: insert/delete line, insert/delete character, forward/back tab...line or page transmit...page print function...cursor positioning: up, down, right, left, plus absolute cursor positioning with read back... visual attributes: underline, blink, reverse video, half intensity & blank...graphics: 12,000 pixel resolution block plus line graphics...on-screen parity indicator... parity: off, even or odd...stop bits: 110 baud 2, all others 1...printer output...60 or 50 Hz vertical refresh ..blinking block cursor...2k on-board RAM... ASCII encoded keyboard: 56 keys, 128 characters... 4k on-board ROM...complete with power supply & cabinet.

☐ SMARTERM VIDEO BOARD: 199.95 + 3.00 p&i
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Add up to four 6 or 12 megabyte hard disks to your S-100 system. Automatically installs itself to any standard CPM 2.2 BIOS. ☐ 6 megabytes 2495.00 + 15.00 p&i. ☐ 12 megabytes 2995.00 + 15.00 p&i. ☐ Disk to test your system compatibility 5.00.

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We are distributors for all Systems Plus & Micro pro software. Call for prices. ☐ CP/M 2.2 150.00 ☐ Microsoft disk basic 325.00. ☐ Special Business Pac includes CP/M, BASIC, GL, AR, AP & Payroll 699.95 (save 625.00).

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Maxell FD2 8"	$44.95
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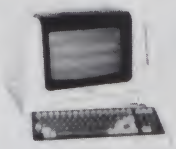

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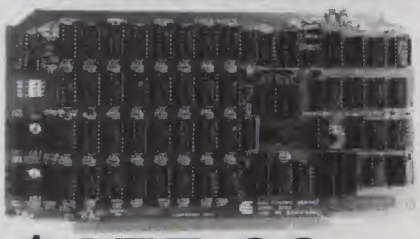

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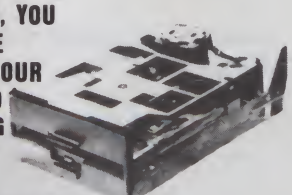

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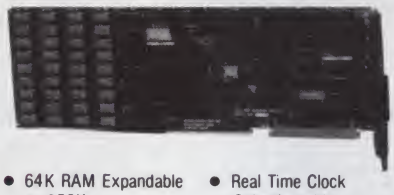

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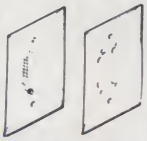

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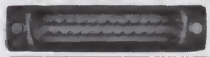

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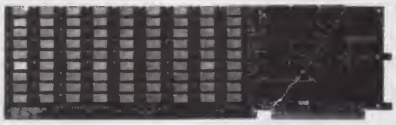

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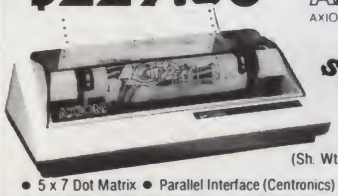

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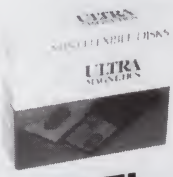

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7412	21	7450	18	7495	45	74160	85	74195	75
7413	21	7451	18	74107	30	74161	85	74197	80
7414	32	7454	18	74109	38	74164	89	74221	1.10
7416	25	7472	23	74110	45	74165	89	74279	85
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74LS00	21	74LS55	25	74LS139	50	74LS194	85	74LS299	1.95
74LS02	24	74LS73	38	74LS145	1.15	74LS195	85	74LS323	4.55
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74S

74S00	30	74S32	40	74S138	85	74S194	1.25	74S280	1.75
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74S08	30	74S64	35	74S181	1.75	74S244	2.95	74S373	2.45
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RAMS

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2101	1.95	2111	2.95	4118-200NS	8/11.95	4184-200NS	8.25		

6500-6800

6502	5.95	6800	8.25	6810	2.95	6845	12.50	6852	5.25
6522	8.75	6802	7.75	6821	3.00	6847	11.95	6860	9.50
6532	10.25	6809	12.50	6840	10.50	6850	3.25		

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LM309K	1.25	LM1889	1.55
LM310	1.45	LM4501	1.50
LM311	.50	LM4558	.75
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LM318H	1.45		
LM322	1.55		
LM323K	4.95		
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Circle 297 on Reader Service card.

READER SERVICE

This card is valid until June 30, 1983

My vote for the best advertisement in this issue goes to _____(company) whose Reader Service number is_____.

A. When did you first purchase your microcomputer?
- ☐1. Less than 1 year ago
- ☐2. 1-2 years ago
- ☐3. 2-3 years ago
- ☐4. 3-4 years ago
- ☐5. 4 or more years ago
- ☐6. Don't own a microcomputer

B. How many computers do you own?
- ☐1. 0
- ☐2. 1
- ☐3. 2
- ☐4. 3
- ☐5. 4
- ☐6. 5 or more

C. Which of the following best describes your interest in portable computers?
- ☐1. Not interested
- ☐2. Mildly interested
- ☐3. Very interested
- ☐4. Plan on purchasing one
- ☐5. Already own one

D. If you plan to buy a printer during the next year, how much do you expect to spend?
- ☐1. Under $500
- ☐2. $500-$750
- ☐3. $751-$1,000
- ☐4. $1,001-$1,500
- ☐5. $1,501-$2,000
- ☐6. Over $2,000

E. If you plan to buy a plotter during the next year, how much do you expect to spend?
- ☐1. Under $750
- ☐2. $750-$1,000
- ☐3. $1,001-$1,500
- ☐4. $1,501-$2,000
- ☐5. $2,001-$2,500
- ☐6. Over $2,500

F. If you plan to buy a modem during the next year, how much do you expect to spend?
- ☐1. Under $250
- ☐2. $250-$500
- ☐3. $501-$750
- ☐4. $751-$1,000
- 5. $1,001-$1,500
- 6. Over $1,500

G. If you plan to buy a hard disk during the next year, how much do you expect to spend?
- ☐1. Under $800
- ☐2. $800-$1,200
- ☐3. $1,201-$1,600
- ☐4. $1,601-$2,000
- ☐5. $2,001-$2,400
- ☐6. Over $2,400

H. *Microcomputing*'s coverage of games in the magazine is:
- ☐1. Insufficient
- ☐2. Just right
- ☐3. Too much

I. How thoroughly do you read the articles in *Microcomputing*?
- ☐1. I read almost all articles thoroughly.
- ☐2. I skim almost all articles.
- ☐3. I read some thoroughly, skim others.
- ☐4. I just put it on the shelf.

L. On a scale of 1 (no interest) to 5 (great interest), please rate your interest in the following regular features:
- ___1. Dial-up Directory
- ___2. What's New, Big Blue?
- ___3. PET-pourri
- ___4. Micro Software Digest
- ___5. Game Reviews
- ___6. Conversions
- ___7. Hardware Reviews
- ___8. Software Reviews

M. If you are not a subscriber, please circle 500.

vertised in this issue. Refer to the ad. You will find numbers near the logo of each advertiser. Each represents the advertiser's individual Reader Service number. Circle the corresponding numbers on one of the cards on this page, include your name, address & zip, and drop in a mailbox. In 4–6 weeks you'll hear from the advertiser directly.

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S-100 MEMORY BOARDS

64K STATIC RAM - Jade

Uses new 2K x 8 static RAMs, fully supports IEEE 696 24 bit extended addressing, 200ns RAMs, lower 32K or entire board phantomable, 2716 EPROMs may be subbed for RAMs, any 2K segment of upper 8K may be disabled, low power typically less than 500ma.

MEM-99152B *Bare board* — **$49.95**
MEM-99152K *Kit less RAM* — **$99.95**
MEM-32152K *32K kit* — **$199.95**
MEM-56152K *56K kit* — **$289.95**
MEM-64152K *64K kit* — **$299.95**
Assembled & Tested — **add $50.00**

256 RAMDISK - SD Systems

ExpandoRAM III expandable from 64K to 256K using 64K×1 RAM chips, compatible with CP/M, MP/M, Oasis, & most other Z-80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software.

MEM-65064A *64K A & T* — **$474.95**
MEM-65128A *128K A & T* — **$574.95**
MEM-65192A *192K A & T* — **$674.95**
MEM-65256A *256K A & T* — **$774.95**
SFC-55009000F *RAMDISK sftwr CP/M 2.2* — **$44.95**
SFC-55009000F *RAMDISK with EXRAM III* — **$24.95**

LETTER QUALITY PRINTERS

LETTER QUALITY PRINTER - COMREX

Uses standard daisy wheels and ribbon cartridges, 16 CPS bi-directional printing, semi-automatic paper loader (single sheet or fan fold), 10/12/15 pitch, up to 16" paper, built-in noise suppression cover.

PRD-11001 *Centronics parallel* — **$899.95**
PRD-11002 *RS-232C serial model* — **$969.95**
PRA-11000 *Tractor Option* — **$119.95**

380Z by Data Terminals & Communications

Based on the same quality mechanism as the Comrex printer the 380Z contains electronic enhancements that allow it to print at speeds up to 32 CPS. Other features include a 48K buffer, proportional spacing, and Diablo 1640/1650/630 compatible protocol. Comes with printwheel, ribbon and users manual. Serial, parallel, and IEEE 488 interfaces standard.

PRD-11300 *380Z printer* — **$1295.00**
PRA-11000 *Tractor option* — **$169.95**
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Printers From JADE

OKIDATA 82 *10" 120 CPS* — **CALL**
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OKIDATA 93 *15" 160 CPS* — **CALL**
OKIDATA 83 *15" 120 CPS* — **CALL**
OKIDATA 84 *15" 200 CPS* — **CALL**
OKIDATA 2350 *15" 350 CPS* — **CALL**
OKIDATA 2410 *15" 350 CPS* — **CALL**
DAISYWRITER 2000 *48K Daisywheel* — **$1395.00**
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GEMINI 15 *15" with Graphics* — **$499.95**

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ULTRA-VIOLET EPROM ERASERS

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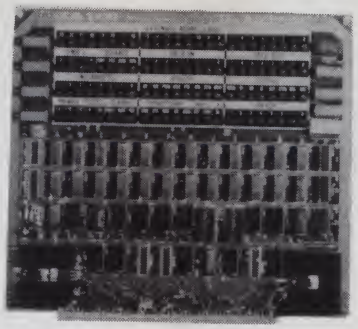

S-100 I/O BOARDS

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Inexpensive S-100 Diagnostic Analyzer

TSX-200B *Bare board* — **$59.95**
TSX-200K *Kit* — **129.95**
TSX-200A *A & T* — **$159.95**

I/O-4 - SSM Microcomputer

2 serial I/O ports plus 2 parallel I/O ports.

IOI-1010B *Bare board w/manual* — **$35.95**
IOI-1010K *Kit with Manual* — **$179.95**
IOI-1010A *A & T* — **$249.95**

I/O-5 - SSM Microcomputer

Two serial & 3 parallel ports, 110-19.2K Baud

IOI-1015A *A & T* — **$289.95**

INTERFACER 4 - CompuPro

3 serial, 1 parallel, 1 Centronics parallel.

IOI-1840A *A & T* — **$314.95**
IOI-1830C *CSC* — **$414.95**

S-100 EPROM BOARDS

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer.

MEM-99510K *Kit with manual* — **$154.95**
MEM-99510A *A & T with manual* — **$219.95**

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with softrware.

MEM-99520K *Kit with software* — **$189.95**
MEM-99520A *A & T with software* — **$249.95**

NEW! CP/M PLUS 3.0

CP/M 3.0 is Didital Research's latest version of the industry standard disk operating system. It features many performance improvements, such as intelligent record buffering, improved directory handling, "HELP" facility, time date stamping of files and many more improvements. AND A TREMENDOUS INCREASE IN SPEED!!!, it is fully CP/M 2.2 compatible and requires no changes to your existing application software. Available only to Versafloppy II owners with CBC-200 CPU's.

SFC-55009057F *CP/M 3.0 8" with manual* — **$200.00**
SFC-55009057M *CP/M 3.0 Manual* — **$40.00**

FREE CP/M 3.0 With SD Board Set!!!

DUAL DISK SUB-SYSTEMS

Disk Sub-Systems - Jade

Handsome metal cabinet with proportionally balance flow system, rugged dual drive power supply, power kit, power switch, line coard, fuse holder, cooling fan, n mar rubber feet, all necessary hardware to mount 2-8" drives, power supply, and fan, does not include signal c

Dual 8" Sub-Assembly Cabinet

END-000420 *Bare cabinet* — **$**
END-000421 *Cabinet kit* — **$1**
END-000431 *A & T* — **$2**

8" Sub-Systems - Single Sided, Double Density

END-000423 *Kit w/2 Siemens FD100-8Ds* — **$6**
END-000424 *A & T w/2 Siemens FD100-8Ds* — **$6**
END-000433 *Kit w/2 Shugart SA-801Rs* — **$9**
END-000434 *A & T w/2 Shugart SA-801Rs* — **$11**

8" Sub-Systems - Double-Sided Double Density

END-000426 *Kit w/2 Qume DT-8s* — **$12**
END-000427 *A & T w/2 Qume D-8s* — **$142**
END-000436 *Kit w/2 Shugart SA-851Rs* — **$12**
END-000437 *A & T w/2 Shugart SA-851Rs* — **$147**

8" SLIMLINE SUB-SYSTEMS

Dual Slimline Sub-systems - Jade

Handsome vertical cabinet with scratch resistant be enamel finish, proportionally balanced air flow system, c cooling fan, rugged dual drive power supply, power cal power switch, line cord, fuse holder, cooling fan, necessary hardware to mount 2-8" slimline disk drives, c not include signal cable.

Dual 8" Slimline Cabinet

END-000820 *Bare cabinet* — **$5**
END-000822 *A & T w/o drives* — **$17**

Dual 8" Slimline Sub-Systems

END-000823 *Kit w/2 SS DD* — **$91**
END-000824 *A & T w/2 SS DD* — **$94**
END-000833 *Kit w/2 DS DD* — **$114**
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S-100 CPU BOARDS

SBC-200 - SD Systems

4 MHz Z-80A CPU with serial & parallel I/O, 1K RAM ROM space, monitor PROM included.

CPC-30200A *A & T* — **$32**

THE BIG Z - Jade

2 or 4 MHz switachable Z-80 CPU board with serial accommodates 2708, 2716, or 2732 EPROM, baud rates f 75 to 9600.

CPU 30201B *Bare board w/manual* — **$3**
CPU-30201K *Kit with Manual* — **$14**
CPU-30201A *A & T with Manual* — **$19**

2810 Z-80 CPU - C.C.S.

2 or 4 MHz Z-80 CPU with serial IO port & on board mon PROM, front panel compatible.

CPU-30400A *A & T with PROM* — **$28**

CPU-Z CompuPro

2 or 4 MHz Z80A CPU, 24 bit addressing.

CPU-30500A *2/4 MHz A & T* — **$27**
CPU-30500C *3/6 MHz CSC* — **$37**

8085/8088 - CompuPro

Both 8 & 16 bit CPUs, standard 8 bit S-100 bus, up to 8 M accesses 16 Megabytes of memory.

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51001 _____ $219.95 ea 2 for **$199.95 ea**

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04000 _____ $234.95 ea 2 for **$224.95 ea**

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551002 _____ $294.95 ea 2 for **$269.95 ea**

FD55A *single-sided double-density 40 track*
660551 _____ *$299.95 ea 2 for* **$239.95**

5¼" Cabinets with Power Supply
000216 *Single cab w/power supply* _____ **$69.95**
000226 *Dual cab w/power supply* _____ **$94.95**

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ilent, simple and on sale - a better motherboard.

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061B *Bare board* _____ **$22.95**
061K *Kit* _____ **$39.95**
061A *A & T* _____ **$69.95**

12 Slot (9¾" x 8⅝")

121B *Bare board* _____ **$34.95**
121K *Kit* _____ **$69.95**
121A *A & T* _____ **$109.95**

18 Slot (14½" x 8⅝")

181B *Bare board* _____ **$54.95**
181K *Kit* _____ **$99.95**
181A *A & T* _____ **$149.95**

DISK DRIVES

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201120 _____ *$274.95 ea 2 for* **$249.95 ea**

art SA801R *single-sided double-density*
10801R _____ $394.95 ea 2 for **$389.95 ea**

art SA851R *double-sided double-density*
10851R _____ $554.95 ea 2 for **$529.95 ea**

e DT-8 *double-sided double-density*
750080 _____ $524.95 ea 2 for **$498.95 ea**

on TM848-1 *Single-sided double-den thin-line*
-558481 _____ *$379.96 ea 2 for* **$369.95 ea**

on TM848-2 *double-sided double-den thin-line*
-558482 _____ *$494.95 ea 2 for* **$484.95**

FD1165 *double-sided double-density ½ high*
-851165 _____ *$485 ea 2 for* **$449.95**

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1200 and/or 300 baud, direct connect, automatic answer or originate selection, auto-answer/auto-dial on deluxe models. 9v battery allows total portability, full one year warranty.

IOM-5600A *300 baud direct connect* _____ **$89.95**
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IOM-5650A *300 baud for Osborne* _____ **$119.95**
IOM-5630A *300 baud card for IBM* _____ **$269.95**

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing. RS-232C interface, programmable.

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IOM-5400A *Smartmodem 300* _____ **$224.95**
IOK-1500A *Hayes Chronograph* _____ **$218.95**
IOM-1100A *Micromodem 100* _____ **$368.95**
IOM-2010A *Micromodem II w/ Term prgm* _____ **$329.95**
IOM-2012A *Terminal program for MMII* _____ **$89.95**

1200 BAUD SMART CAT - Novation

103/212 Smart Cat & 103 Smart Cat, 1200 & 300 baud, built-in dialer, auto re-dial if busy, auto answer/disconnect, direct connect, LED readout displays mode, analog/digital loop-back self tests, usable with multi-line phones.

IOM-5241A *300 baud 103 Smart Cat* _____ **$229.95**
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8" or 5¼" DMA disk controller, single or double density, single or double sided, 10MHz.

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Double density disk controller for any combination of 5¼" and 8" single or double sided, analog phase-locked loop data separator, vectored interrupts. CP/M 2.2 & Oasis compatible, contro/diagnostic software PROM included.

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High reliability double density disk controller with on-board Z-80A, auxiliary printer port, IEEE S-100 can function in multi-user interrupt driven bus.

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Totally Apple compatible, 143,360 bytes per drive on DOS 3.3, full one year factory warranty, half-track capability reads all Apple software, plugs right into Apple controller as second drive, DOS 3.3, 3.2.1, Pascal, & CP/M compatible.

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MSM-123100 *Controller* _____ **$99.95**

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Expand your Apple II to 64K, use as language card, full 1 year warranty. Why spend $175.00 ?

MEX-16700A *Save over $115.00* _____ **$49.95**

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Two computers in one, Z-80 & 6502, more than doubles the power and potential of your Apple, includes Z-80 CPU card CP/M 2.2 and complete manual set, Pascal compatible, utilities are menu-driven, one year warranty.

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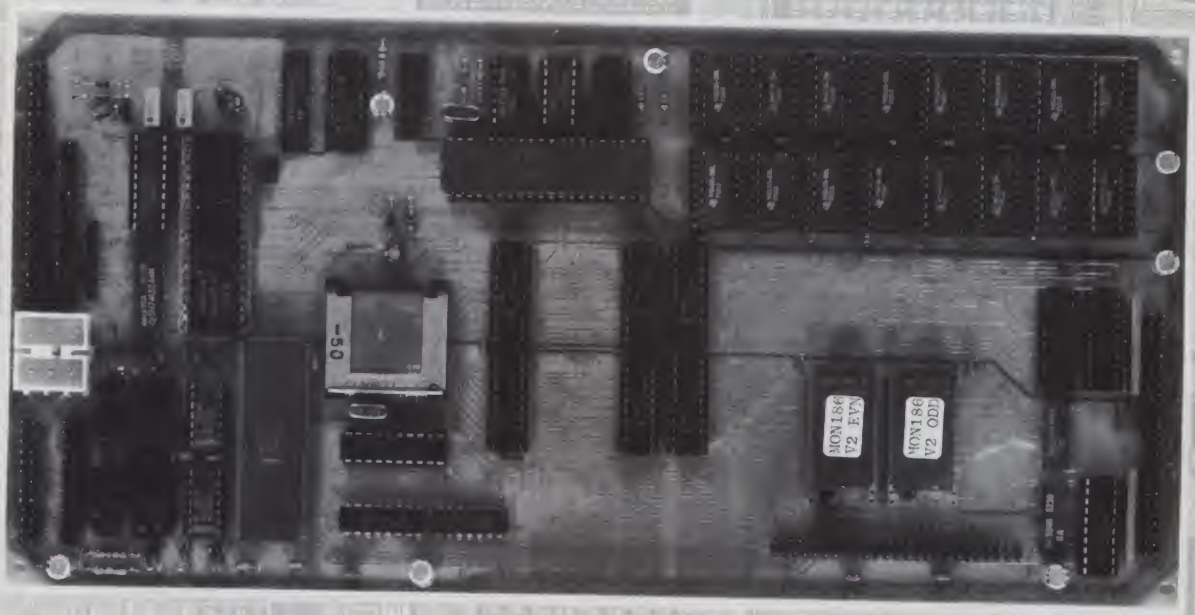
Circle 48 on Reader Service card.

Circle 113 on Reader Service card.

STEP UP TO A 16-BIT POWERHOUSE!

"THE SLICER"



The "SLICER" is a HIGH PERFORMANCE single board computer based on the new, highly advanced Intel 80186 CPU. The board has these advanced features:

- *Full 8Mhz 16-bit microprocessor having complete software compatability with the 8086 and 8088 (as used in the IBM PC).*
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- 12 inch P4 phos
- 24 × 80 characters
- 5 × 8 dot matrix, block cursor
- 95 displayable ASCII characters
- White on black background, two intensities, blink or blank
- 2048 × 8 Random Access Memory
- EIA RS232C at 110, 300, 600, 1200, 1800 2400, 4800 or 9600 baud (switch selected)
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- 12 inch P4 phos
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- Dual Intensity
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  24 lines × 80 or 132 characters (plus 25th status line)
- 80 × 24: 7 × 8 dot matrix plus 2 lower case descender in a 9 × 12 window
  132 × 24: 5 × 7 dot matrix plus 2 lower case descenders in a in a 7 × 12 window
- Cursor is switch selectable as block or blinking underline
- EIA RS232C, Asynchronous
- 110, 300, 1200, 1800, 2400, 4800, 9600 or 19,200 baud, switch selectable
- Even, odd, 1, 0 switch selectable

Standard featurs include: Anti-glare screen; nonreflective working surfaces; color coded, contoured keyboard; convenient contrast control, reverse video and blinking fields; variable intensity; upper and lower case characters; line drawing graphics.

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- 300 cps-dot matrix
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- Centronics parallel
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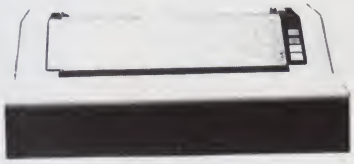

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Circle 205 on Reader Service card.

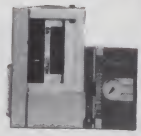
Portable Speakers For "Walkman" Style Stereos

Portable Stereo Speakers with Carrying Case

After skating, skiing, jogging or any other outside activity, just plug these portable stereo speakers into your stereo and you and your friends can enjoy your favorite tapes reproduced by these full range speakers. Great for motel rooms, the beach, or in your car. They weigh just 3 lbs. and measure 5¾"H x 4¼"W x 2¾"D. This unit uses 3" x 5" 8ohm speakers with a 3 oz. magnet. Speaker system includes two speakers, a carrying case, auxiliary speaker connector cable, and signal connector cable. Uses 8 "AA" batteries. Can be used with both portable stereos shown below, and is compatible with most mini-portable stereo cassettes and FM stereo units.

Part No. TSU-012 . . . . . **$29.95**
AM3-8 8 AA Alkaline Batteries . . . . . 8 for $7.90

Stereo Cassette Player with FM Stereo Tuner Pack



- Lightweight Headphones
- Cr02/Metal/Normal Tape Selector
- Anti-Rolling Mechanism

FEATURES: • Blue carrying case, shoulder strap, belt strap, lightweight headphones, FM stereo tuner pack & instruction manual • Talkline • Tone selector • Cr02/Metal/Normal tape selector • LED operation indicator • Built-in microphone • Stop/eject, play, rewind/review, fast forward/cue, tape/radio selector functions • Vol. control • Ext. power input jack • Headphone jack • Auto-stop mechanism (shuts off player when tape ends) • Anti-rolling mechanism (prevents sound from quivering when walking, jogging, etc.) • Weight: 13 oz. • Requires 4 AA batteries (not included) • Size: 6"L x 4"W x 1-1/8"H

Model TWF-802 . . . . . **$69.95**
AM3-4 AA Alkaline Batteries . . . . . 4/$3.95

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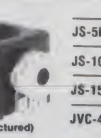
World's Thinnest Stereo Hi-Fi

This is a pocketable AM/FM stereo radio with a folding stereo headphone. It weighs just 5 oz. and measures 4¼"L x 2¾"W x ¼"Thk. Comes complete with radio, headphones and headphone case. Uses two AAA batteries (not included).

Part No. TCR-809 . . . . . **$29.95 each**



JS-5K (Pictured)

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JS-5K	5K Linear Taper Pots	$5.25
JS-100K	100K Linear Taper Pots	$4.95
JS-150K	150K Linear Taper Pots	$4.75
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JS KNOB Knob for JS5K,100K,150K . . . . . **$.99 ea.**
JVC KNOB Knob for JVC-40 . . . . . **$.99 ea.**

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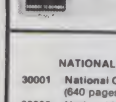
JSP (2) . . . . . $4.95 pair



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Used on Atari. Cosmetically blemished. 100% functional.
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30001	National CMOS Data Book (1983) (640 pages) 74C, CD4000, and A/D Converters	$8.95
30002	National Interface Data Book (1980) (704 pages) DP, DS8000, DS3600, DS5700, etc.	$6.95
30003	National Linear Data Book (1982) (1376 pages) LM, LF, ADC, DAC, LH Series	$11.95
30005	National TTL Logic Data Book (1981) (624 pages) 7400,LS,L,H,S, and DM8000 Series	$9.95

30006 Above (3) 30001,3,5 as set . . $24.95

30008	National Memory Data Book (1980) (464 pages) RAMs, ROMs, PROMs, EPROMs Series	$8.95
30009	Intersil Data Book (1983) (1356 pages) Complete line.	$9.95
30010	National Audio/Radio Handbook (1980) (240 pages) Pre-Amps, AM, FM & FM Stereo, Power Amps	$5.95
30011	National Linear Application Handbook (1980) (736 pages) Application Notes, Linear Briefs, etc.	$15.95
30012	National PAL Data Book (1982) (176 pages) Data Sheet, PAL Design	$5.95
30013	Zilog Data Book (1983) (641 pages) Microprocessors and Support Chips	$7.95
010400	Intel Component Data Book (1982) (1405 pg.) Full data sheets for Intel's products incl. mem. devices, microproc., periph. & ind./mil. products	$14.95
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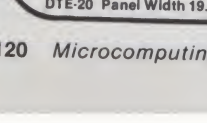
Universal Computer Keyboard Enclosures



"DTE" Blank Desk-Top Enclosures are designed for easy modification. High strength epoxy molded end pieces in mocha brown finish. Sliding rear/bottom panel for service/component access. Top/bott. panels .080" thick alum. alodine type 1200 finish (gold tint color) for best paint adhesion after modification. Vented top & bottom panels for cooling efficiency. Rigid construction provides unlimited applications. Assembly instructions included.

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DTE-14 Panel Width 13.5" **$29.95**
DTE-20 Panel Width 19.25" **$34.95**

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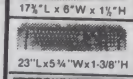
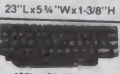
17¾"L x 6"W x 1¾"H

DATANETICS 73-KEY KEYBOARD (ASCII) *Apple Compatible*
Data Entry Keyboard uses MM5740 BEE/N encoder chip (included). 73-Key Keyboard features 11-key numeric keypad, SPST switching, 24-pin edge card connection. Includes pin-out.
Part No. KB261 (Fits DTE-20 Enclosure) . . . . . **$49.95 each**



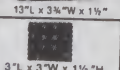
23"Lx5¾"Wx1-3/8"H

MICRO SWITCH 85-KEY KEYBOARD
Word Processing Keyboard, 26 Pin Edge Card Connection. Supply Voltage +5VDC. Main Keyboard is QWERTY. Additional Key Pads for Cursor and word processing functions.
Part No. 85SD18-1 . . . . . **$29.95 each**



13"L x 3¾"W x 1½"

STACKPOLE 62-KEY KEYBOARD
SPST switching, mechanical, monolithic housing, charcoal gray keycaps. Keyboard is not mounted on circuit board (each key is individually accessible).
Part No. K-62 (Fits DTE-14 Enclosure) . . . . . **$34.95 each**



3"L x 3"W x 1½"H

HI-TEK 14-KEY NUMERIC KEYPAD
SPST switching. Charcoal gray keycaps, matches HI-TEK K-5B Keyboard (above). Mounted on printed circuit board.
Part No. K-14 . . . . . **$9.95 each**

9¾"L x 4½"W x 1¾"H

ALPS 29-KEY CALCULATOR KEYBOARD
Features one 8-position decimal select switch, one 3-position switch, and two 2-position switches, mechanical SPST switching, 22-pin edge card connection. Pin-out included.
Part No. KB29704D (Fits DTE-11 Enclosure) . . . . . **$4.95 each**

POWER SUPPLY +5VDC @ 1 AMP REGULATED *Transaction Tech*
Output +5VDC @ 1A (also +30VDC) reg. Input 115VAC 60Hz. 2-tone (black/beige) self-enclosed case. 6 ft., 3 cond. black power cord. 6½"W x 7"D x 2¼"H. Wt. 3 lbs. Data sheet incl.
Part No. PS51194 . . . . . **$19.95 each**

POWER SUPPLY +5VDC @ 3 AMP REGULATED *Deltron*
Input: 115VAC, 47-440Hz. Output: 5VDC Adjustable @ 3 amp, 6VDC @ 2.5 amp. Adjustable current limit. Ripple & Noise: 1MV rms, 5MV p-p — 2 mounting surfaces. UL recognized. Size: 4"W x 4½"L x 2-7/16"H - wt. 2 lbs. Data sheet included.
Part No. QPS-1 . . . . . **$29.95 each**

POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING
Input: 115VAC, 50-60Hz @ 3 amp/230VAC, 50Hz @ 1.5 amp. Fan volt./power supply select switches (115/230VAC). Output: 5VDC @ 7.5 amp, 12VDC @ 1.5 amp. 8 ft. blk. pow. cord. 11½"W x 13¼"D x 3¼"H. Wt. 6 lbs.
Part No. PS94VO . . . . . **$49.95 each**

POWER SUPPLY 4-Channel Switching - Apple Compatible
Microprocessor, mini-computer, terminal, medical equipment and process control applications. Input: 90-130VAC 47-440Hz. Output: +5VDC @ 5A, -5VDC @ 1A; +12VDC @ 1A, -12VDC @ 1A. Line reg.: ±0.2%. Ripple: 30mV p-p. Load reg.: ±1%. Overcurrent protection. Adj. 5V main output±10%. 6-3/8"L x 1-7/8"W x 4-15/16"H. Wt. 1½ lbs.
Part No. FCS-604A . . . . . **$69.95 each**

POWER SUPPLY Adjustable Switching 4-24VDC to 5 Amps
Adj. 4-24VDC, 5VDC @ 5A, 6VDC @ 4.8A, 9VDC @ 4.1A, 12VDC @ 3.3A, 18VDC @ 1.9A, 24VDC @ .5A. Overvoltage Protection. Input: 115VAC 50/60Hz. Output variations within 20mV. 8.25"L x 4.25"W x 2.25"H. Wt. 3.25 lbs.
JE224 Kit . . . . . **$79.95 each**
JE224A Assembled & Tested . . . . . **$99.95 each**

Custom Jumpers!

JUMPER AND CABLE ASSEMBLIES

Custom Cables!

STANDARD DIP JUMPERS

All jumpers use low profile dip plugs with heavy duty pins for repeated disconnect applications.

JAMECO Part No.	AP Cross Reference	No. Pins	Description	Wire Length	Price
DJ14-1	924102-12	14	single end	12"	$1.79
DJ14-2	924102-24	14	single end	24"	2.05
DJ14-3	924102-36	14	single end	36"	2.35
DJ14-1-14	924106-12	14	double end	12"	2.95
DJ14-2-14	924106-24	14	double end	24"	3.19
DJ14-3-14	924106-36	14	double end	36"	3.49
DJ16-1	924112-12	16	single end	12"	1.89
DJ16-2	924112-24	16	single end	24"	2.19
DJ16-3	924112-36	16	single end	36"	2.59
DJ16-1-16	924116-12	16	double end	12"	2.95
DJ16-2-16	924116-24	16	double end	24"	3.29
DJ16-3-16	924116-36	16	double end	36"	3.59
DJ24-1	924123-12	24	single end	12"	2.99
DJ24-2	924122-24	24	single end	24"	3.19
DJ24-3	924122-36	24	single end	36"	3.59
DJ24-1-24	924126-12	24	double end	12"	4.49
DJ24-2-24	924126-24	24	double end	24"	4.95
DJ24-3-24	924126-36	24	double end	36"	5.39

STANDARD DB25 SERIES CABLES

Now you can order DB25 P or S connectors with the cable necessary to fit your application. Choose from our standard flat cable in 4-foot lengths. **Call today.**

STANDARD CABLES

Part No.	Cable Length	Connectors	Price
DB25P-4	4 feet	1-DB25P	$7.95
DB25S-4	4 feet	1-DB25S	8.49
DB25P-4-P	4 feet	2-DB25P	13.49
DB25P-4-S	4 feet	1-DB25P/1-DB25S	13.75
DB25S-4-S	4 feet	2-DB25S	13.95

BUG BOX™ — 30 individual compartments • Stores 60 8-pin or 30 14- or 16-pin DIPs • Bug rugs not included • Clear plastic cover slides & locks • Cover marked w/numbers 1-30 • Compartment size: 1" x 3.75" x .5" deep • Box size: 4.9" x 3.3" x .6" • Weight: 1.75 oz.

BUG BOX™

Please specify color code: (B) Blue, (R) Red, (W) White, (Y) Yellow

Part No./Color Code	QTY	PRICE
BGX-001-( )	1	$ 2.29
BGX-010-( )	10	19.99
ANTI-STATIC		
BGX-001-( )AS	1	$ 3.29
BGX-010-( )AS	10	28.89

BUG CAGE™ — 12 locations store Bug Boxes, Big Bug Boxes or Bug Trays • Modular and interlocking • Heavy duty injection molded plastic • Each cage has 6 slip-on locations • 2 cages per pkg. • Cage size: 5-1/8" x 5" x 3-7/8" • 4 colors available — please specify color code: (B) Blue, (R) Red, (W) White, (Y) Yellow

Part No./Color Code	Price
BGC-001-( ) 2 Cages (6 loc. ea.)	$11.95/pkg.

BUG TRAY™ — Stores in Bug Cage • Molded plastic • Three styles: Open (1 compartment 3.05" x 4.6" x .6"); Vertical (5 compartments .5" x 4.6" x .6"); and Horizontal (8 compartments .4" x 3.95" x .6") • Ideal for tools, hardware, components, etc. • Tray size: 3.55" x 5.05" x .6" • Black color only

PART NO.	DESCRIPTION	PRICE
BTH-001	Horizontal Bug Tray	$1.95
BTV-001	Vertical Bug Tray	1.95
BTO-001	Open Bug Tray	1.95
BTX-003	1 of each Bug Tray (3)	4.98

BUG RUG™ — Static discharge protection for CMOS and MOSFET devices • Pre-cut to dimensions of BUG BOX (1" x .35")

Part No.	Description	Price
BRG-030	30 foam rectangles for Bug Box	$1.98
BBR-036	6 foam rec. for LSI Big Bug Box	1.98

CAGE KEEPER™ — Pins column of Bug Boxes in Bug Cage

		Price
CKP-005	5 inch	$4.98/pkg.
CKP-010	10 inch	6.98/pkg.

BUG BOX™ STORAGE SYSTEMS

BUG CAGE™ (BGC-001-____) with Bug Boxes

LSI BIG BUG BOX™ — Designed to store large IC's, Resistors, Capacitors and Diodes • Divided into three compartments measuring 1" x 4.15" x .5" deep • Three vertical and three horizontal dividers included • Bug Rugs not included • Box size: 4.9" x 3.3" x .6" • Weight: 1.75 oz.

LSI BIG BUG BOX™

Please specify color code: (B) Blue, (R) Red, (W) White, (Y) Yellow

PART NO./COLOR CODE	QTY	PRICE
BLX-001-( )	1	$ 3.29
BLX-010-( )	10	28.79
ANTI-STATIC		
BLX-001-( )AS	1	$ 4.29
BLX-010-( )AS	10	37.80

BACK PACK™ — Self-adhesive labels for the back of ICs • Shows exact internal logic in relation to IC pins • 532 labels in each package (including several blank labels) • Each package for 8, 14, 16, 24, 28 and 40-pin ICs • Combo package includes 1,068 labels for TTL and CMOS ICs • Microprocessor package contains 744 labels

Part No.	Description	Price
BPT-012	TTL	$7.95
BPC-012	CMOS	8.95
BPM-012	Combo	14.95
BPU-012	Microprocessor	9.95

BUG TAGS™ — Self-adhesive, easy-to-read labels for marking Bug Box and LSI Big Bug Box • Most popular components

PART NO.	DESCRIPTION	QTY.	PRICE
BTT-200	TTL	200	$4.98
BTC-200	CMOS	200	4.98
BTK-200	LS Schottky	200	4.98
BTS-200	Special	200	4.98
BTM-800	Mixer	800	13.95

MORE BUG TAGS AVAILABLE!

★ ★ ★ **BUG BOX SYSTEMS INTRODUCTORY SPECIAL** ★ ★ ★

Your choice: regular or anti-static. Includes 2-Bug Cages (12 locations); 8-Bug Boxes; 3-LSI Big Bug Boxes; 1-Horizontal Bug Tray; 1-open Bug Tray; 1-vertical Bug Tray; 1 package Bug Rug for regular Bug Boxes; 1 package Bug Rug for LSI Big Bug Boxes; 1 package Mixer Labels (800 each). Color: Bug Boxes and Cages - Blue, Bug Trays - Black.

SP-BUG Regular (Retail value $59.45) . . . . . *Sale Price $49.95*
SP-BUG-AS Anti-Static (Retail value $67.45) . . . . . *Sale Price $59.95*

$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6½% Sales Tax
Shipping — Add 5% plus $1.50 Insurance
Send S.A.S.E. for Monthly Sales Flyer!

Spec Sheets — 30¢ each
Send $1.00 Postage for your *FREE 1983 JAMECO CATALOG*
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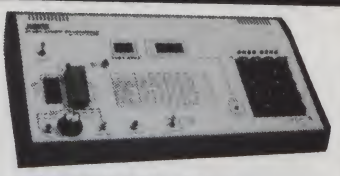
8K, 16K, 32K, 64K EPROM Programmer



2708,2716,2732 & 2764 EPROM Programmer

JE664 EPROM PROGRAMMER
8K TO 64K EPROMS — 24 AND 28 PIN PACKAGES
Self-Contained — Requires No Additional Systems for Operation

• Programs, validates, and checks for properly erased EPROMs • Emulates PROMs or EPROMs • RS232C Computer Interface for editing/program loading • Loads data into RAM by keyboard • Changes data in RAM by keyboard • Loads RAM from an EPROM • Compares EPROMs for content differences • Copies EPROMs • Power input: 115VAC, 60Hz, ~8 10W power consumption • Enclosure: Color-coordinated, light tan panels w/molded mocha brown end pieces • Size: 15-5/8"L x 5¾"D x 3½"H • Wt.: 5¾ lbs.

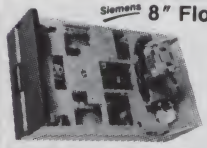
JE664-A EPROM Programmer **$995.00**
Assembled & Tested (Includes JM16A Module)

JE665 — RS232C INTERFACE OPTION — The JE665 RS232C Interface Option implements computer access to the JE664's RAM. Sample software written in BASIC provided for TRS-80® Model I, Level II Computer. Baud rate 9600. Word Lgth. 8 bits - odd parity. Stop bits 2. Option may be adapted to other computers.

JE664-ARS EPROM Prog. w/JE665 Option **$1195.00**
Assembled and Tested (includes JM16A Module)

EPROM JUMPER MODULES — The JE664's JUMPER MODULE (Personality Module) is a plug-in Module that pre-sets JE664 for proper programming pulses to the EPROM & configures EPROM socket connections for that particular EPROM

Part No.	EPROM	EPROM MANUFACTURER	PRICE
JM08A	2708	AMD, Motorola, National, Intel, TI	$14.95
JM16A	2716,TMS2516	Intel, Motorola, National, NEC, TI	$14.95
JM16B	TMS2716	Motorola, TI (+5,-12, +12)	$14.95
JM32A	TMS2532	Motorola, TI	$14.95
JM32B	2732	AMD, Fujitsu, NEC, Hitachi, Intel	$14.95
JM32C	2732A(21V)	Fujitsu, Intel	$14.95
JM64A	MCM68764, MCM68L764	Motorola	$14.95
JM64B	2764	Intel	$14.95
JM64C	TMS2564	TI	$14.95



Siemens **8" Floppy Disk Drive**

- Shugart 801R compatible
- Single-Sided
- 77 Tracks
- 400/800K Bytes Capacity
- Industry Standard

The **FDD100-8 8" Floppy Disk Drive** (Industry Standard) features single or double density. Recording mode: FM single, MFM double density. Transfer rate: 250K bits/sec. single density; 500K bits/sec. double density. The FDD100-8 is designed to work with the single-sided soft sectored IBM Diskette I, or eq. disk cartridge. Power: 115VAC @ 50-60Hz, +24VDC @ 1.7 amps max., +5VDC @ 1.2 amps max. Unit as pictured above (does not include case, power supply, or cables). Size: 8.55"W x 14"L x 4.5"H. Weighs 12 lbs. Incl. 96-pg. manual.

Part No.		Price
FDD100-8	Buy 1 for	$269.95 each
FDD100-8	Buy 2 for	$259.95 each
FDD100-8	*Buy 10 for*	*$249.95 each*

5¼" Mini-Floppy Disk Drive
FOR TRS-80 MODEL I (Industry Standard)

Pertec Computer Corp.

Features single or double density. Recording mode: FM single, MFM double density. Power: +12VDC (±0.6V) 1.6A max., +5VDC (±0.25V) 0.8A max. Unit as pic. at right (does not incl. case, power supply, cables). 30-pg. data book incl. Wt. 3½ lbs. Size: 5¼"W x 8"D x 3¼"H.

Part No.	*Limited Quantity!*	Price
FD200	Single-sided, 40 tracks, 250K bytes capacity	$179.95
FD250	Double-sided, 35 tracks, 438K bytes capacity	$199.95

EXPAND YOUR MEMORY

TRS-80 to 16K, 32K, or 48K

**Model 1 =	From 4K to 16K Requires (1) One Kit
Model 3 =	From 4K to 48K Requires (3) Three Kits
Color =	From 4K to 16K Requires (1) One Kit

**Model 1 equipped with Expansion Board up to 48K Two Kits Required — One Kit Required for each 16K of Expansion —

TRS-16K3 *200ns for Color & Model III **$12.95**
TRS-16K4 *250ns for Model I **$10.95**

TRS-80 Color 32K or 64K Conversion Kit

Kit comes complete with 8 each 4164-2 (200ns) 64K dynamic RAMs and conversion documentation. Converts TRS-80 color computers with D and E circuit boards, and all new color computers to 32K. Minor modifications of 32K memory will allow the use of all 64K of the dynamic RAM providing you have a FLEX DOS operating system.

TRS-64K2 . . . . . **$54.95**

Sprite-style Fan

- 36cfm free air delivery
- 3.125" sq. x 1.665" depth
- 10 yrs. cont. duty at 20°C
- 115V 50/60Hz

*Metal Frame

PWS2107U	Cleaned & tested (used)	$ 9.95 ea.
*PWS2107F	New	$14.95 ea.

Muffin-style Fan

- 105cfm free air delivery
- 4.68" sq. x 1.50" depth
- 10 yrs. cont. duty at 20°C
- Impedance protected, ambients to 70°C
- 115V 50/60Hz 14W Wt. 17 oz.

*Metal Frame

MU2A1-U	Cleaned & tested (used)	$9.95 ea.
*MU2A-1N	New	$14.95 ea.

Mostek DC/DC Converter
+5 VOLTS TO -9 VOLTS

Input: +5V. Output: -9V (regulated) @ 30mA. Printed circuit mounting. Specifications incl.
DC10 . . . . . **$2.95 ea. or 2/$4.95**

Circle 41 on Reader Service card.

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Altos, Eagle and M/ACOM-OSI business computer specialists. Serving greater Los Angeles area with all your business computer needs. In-house service, custom programming, terminals, printers, etc. Open 9 a.m.–6 p.m.. **Computer Challenge Corp., 9040 Telstar Ave., suite 107, El Monte, CA 91731. 572-7292.**

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We are the leading area computer store. We carry Cromemco, Apple, Vector Graphic; printers and terminals. We offer full software support including G/L, A/R, payroll and word processing. **Computer Centre, 909 S. Tamiami Trail, PO Box 130, Nokomis, FL 33555. 484-1028.**

Aurora, IL

Full line of Apple Computer and Fortune Computer. Hewlett-Packard Personal Computers, Calculators and Supplies. IDS Prism, SMC and Daisywriter Printers. **Farnsworth Computer Center, 1891 North Farnsworth Ave., Aurora, IL 60505 (851-3888) and 383 East North Ave., Villa Park, IL 60181 (833-7100).**

Newton, MA

Basic compiler for the Digital Research CP/M operating system. Incredibly low price. Includes an assembler and link editor. Free brochure. 8-inch 3740 disks only. **JV Software, PO Box 684, Newton, MA 02162.**

Akron, OH

Atari video game authorized independent servicenter. Games serviced by factory trained technicians. Fast turnaround. Dealer inquiries invited. We stock genuine Atari game and joystick parts. **Greensburg Electronics, 2618 Massillon Road, Akron, OH 44312. 644-3178.**

Vienna, VA

CONTRACT PROGRAMMER. Monthly newsletter for contract programmers. Contains advice on managing your free-lance programming business, plus hundreds of solid leads to programming contracts. Free sample. **Contract Programmer, Box 813-D, Vienna, VA 22180.**

Dealers: Listings are **$15** per month in prepaid quarterly payments, or one yearly payment of **$150,** also prepaid. Ads include 25 words describing your products and services plus your company name, address and phone. (No area codes or merchandise prices, please.) Call Marcia at 603-924-9471 or write *Microcomputing*, Ad Department, Peterborough, NH 03458.

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Classified advertisements are intended for use by persons desiring to buy, sell or trade used computer equipment. No commercial ads are accepted.

Two sizes of ads are available. The $5 box allows up to 5 lines of about 35 characters per line, including spaces and punctuation. The $10 box allows up to 10 lines. Minimize use of capital letters to save space. No special layouts allowed. Payment is required in advance with ad copy. We cannot bill or accept credit.

Advertising text and payment must reach us 60 days in advance of publication (i.e., copy for March issue, mailed in February, must be here by Jan. 1). The publisher reserves the right to refuse questionable or inapplicable advertisements. Mail copy with payment to **Classifieds, *Microcomputing*, Peterborough, NH 03458**. Do not include any other material with your ad as it may be delayed.

Used Heath H-8, S-100 BUS, and Wang Laboratories computer for sale. Memory board, I/O card, terminal, disk drive, software and complete system. Ten to 50 percent off list price. Send for free listing. D. Wong, Box 406, Croton Falls, NY 10519.

Wanted: New or used INTERACT-R and/or *INTERACT-R* hardware or software. Contact Dr. H.S. Frank, 817-573-8943 (home), 817-599-7131 (office) or write to: 904 S. Main St., Weatherford, TX 76086.

Classified Ads Get Results!

OSI C8PDF 8-inch floppies, 48K RAM, Kybd, monitor, 6502, software, Epson printer; complete $2200 or best. Blake, PO Box 485, Peoria, AZ 85345; 602-979-6330 or 602-935-3874.

Kilobaud Microcomputing: Complete set, #1 to present. Will consider selling separately. BEST OFFER. Dave Repsher, 1915 Verde St., Bakersfield, CA 93304. 805-324-6180.

Timex/Sinclair users: Write for information concerning the Z-WEST (SDTSUG) newsletter publication. SASE or stamp appreciated. SDTSUG/Z-WEST, PO Box 2411, Vista, CA 92083.

CLUB NOTES

Sorcerer Newsletter

ISIS, the International Sorcerer Information Service, is a non-profit monthly newsletter starting up with the June issue to fill the gap created by the dissolution of Sorcerer user groups.

If interested, contact ISIS by writing Maurice Dow, 84 Camberley Crescent, Brampton, Ont. Canada L6V 3L4, or telephone 416-451-9452.

Ontario FORTH Group

The Southern Ontario Chapter of the FORTH Interest Group announces its meeting schedule as June 4, September 10, December 3, 1983, and March 3, 1984.

For more information, call Dr. N. Solntseff at McMaster University in Hamilton; telephone 416-525-9140, Ext. 2065.

MUMPS Meeting

The 12th annual MUMPS User's Group meeting will be held May 31–June 4 at the San Francisco Hilton Hotel in San Francisco. For more information on registration, write Charles White, Professional Associates, 2012 Big Bend Blvd., St. Louis, MO 63117.

Commodore Software Library

The Folklife Terminal Club, a Commodore users group, is making its software library of over 5000 public domain programs available to other Commodore users.

For details, write the Folklife Club, Box 2222, Mt. Vernon, NY 10551.

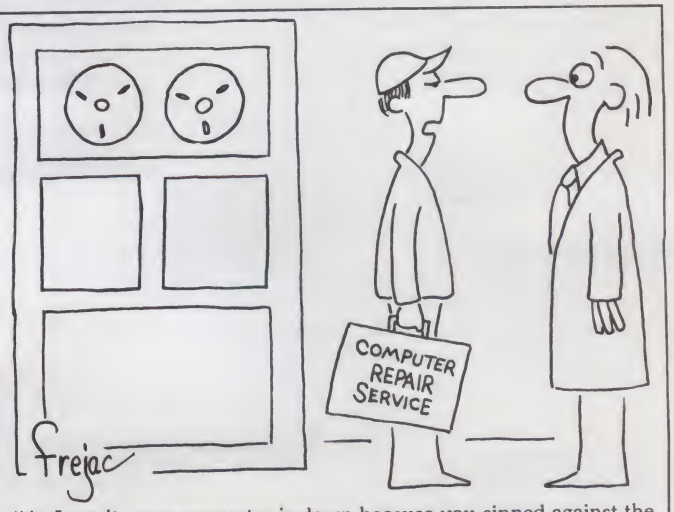
San Diego Timex/ Sinclair Group

The San Diego Timex/ Sinclair Users Group meets the last Wednesday of each month at Advanced Engineering Enterprises, Pacific Highway, San Diego. The group may be contacted through Gordon Young, PO Box 2411, Vista, CA 92083.

Free-Lance Programmers

The National Association of Free-Lance Programmers (NAFLP) announces the Software Market Letter, a newsletter for members that includes a Directory of Software Buyers and much other information of interest to programmers.

Membership in NAFLP is $48 annually and includes subscription to the Letter. The address is Box 813P, Vienna, VA 22180.



"As I see it, your computer is down because you sinned against the computer gods. You must offer a virgin data terminal during the next full moon in order to make amends."

BOOK REVIEWS

Edited by Larry Canale

A 17-Book Series on Theories
A Step-by-Step Guide to IBM Basic
What Can the Atari Do For You?
Pascal and Practicality

The Systems Programming Series

(Titles, authors listed below.)
Addison-Wesley, 1982
Reading, MA 01867

The Systems Programming Series is perhaps the finest and most comprehensive set of computer-theory books I've ever seen.

It's refreshing even to be able to use the word "fine" in regard to computer literature. The current microcomputer explosion and the spate of books following in its wake have had some dubious side effects.

It's become the norm to see mass-produced, poorly edited paperbacks (and even hardbacks) crawling out of the woodwork. In too many cases, mediocre layouts and a get-it-out-the-door approach to publishing have made it more (rather than less) difficult to gain any worthwhile knowledge.

This 17-book series on operating systems, however, couldn't be further from that image, and it's that fact that made me want to review them.

So what are these books that have so impressed me? What are they trying to put across?

Although it's a series on computer systems theory, it keeps practical applications firmly in mind. The books are not "pure thoughtwave" computer theory—they really do teach topics that will be of use in real life.

By digesting the contents of each and every one of these books, you'd be the Albert Einstein (or maybe I should say Alan Turing) of computerdom. That eventuality is most unlikely, however; the computer user more likely would pick two or three particular subjects from within the series and make those his specialties.

That's one of the points that should be made—the books are useful either as an ongoing series (Addison-Wesley is still adding to it), or individually—as treatises on specific aspects of systems programming.

Regarding the question of Addison-Wesley's intention, each book has the same foreword, which explains the raison d'etre of the whole series. I quote verbatim:

"The field of systems programming primarily grew out of the efforts of many programmers and managers whose creative energy went into producing practical, utilitarian systems programs needed by the rapidly growing computer industry. Programming was practiced as an art where each programmer invented his own solutions to problems with little guidance beyond that provided by his immediate associates.

"In 1968, the late Ascher Opler, then at IBM, recognized that it was necessary to bring programming knowledge together in a form that would be accessible to all systems programmers. Surveying the state of the art, he decided that enough useful material existed to justify a significant codification effort.

"On [Opler's] recommendation, IBM decided to sponsor The Systems Programming Series as a long-term project to collect, organize and publish those principles and techniques that would have lasting value throughout the industry.

"The series consists of an open-ended collection of text-reference books. The contents of each book represent the individual author's view of the subject area and do not necessarily reflect the views of the IBM corporation. Each is organized for course use but is detailed enough for reference.

"Further, the series is organized in three levels: broad introductory material in the foundation volumes, more specialized material in the software volumes and very specialized theory in the computer science volumes. As such, the series meets the needs of the novice, the experienced programmer and the computer scientist.

"Taken together, the series is a record of the state of the art in systems programming that can form the technological base for the systems programming discipline."

The greatest of aspirations. The noblest of intents. Somehow, that comes across in this series; IBM and (posthumously) Ascher Opler deserve our thanks for inaugurating this project—and let's not forget Addison-Wesley.

As I'm from a systems programming background (an ex-Honeywell 6000er y'know), the foreword rings true. I was that programmer practicing my art, inventing my own solutions and, worst of all, constantly reinventing the wheel. I could have used these books a long time ago.

If you can afford the whole series, you'll have an encyclopedia of computing. I personally feel that much of this work applies beyond systems programming and into the field of computing—or microcomputing—as a whole.

This may be true, or I may be speaking as a biased systems programmer who considers systems theory to be a superset of all general programming theory. That view is what makes me regard the information contained in these volumes as highly as I do.

If you learn this material, you simply have to think downwards to reach most other levels of programming. (All systems programmers will naturally agree—the rest will probably want to lynch me.)

If you can't afford the whole series, each book does indeed stand on its own merit. You'll have plenty of subjects if you want to get your feet wet before inevitably becoming hooked as a systems programmer. A list of currently available titles follows (but remember that it's a continually growing series):

- *The Program Development Process*, J. D. Aron ($28.95).
- *Mathematical Foundations of Programming*, F. S. Beckman ($26.95).
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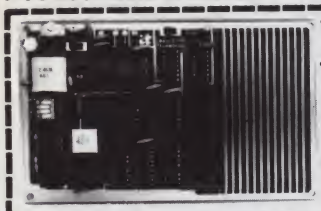

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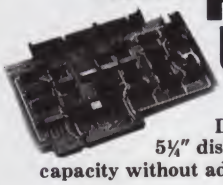

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- *Database Security and Integrity*, E. B. Fernandez, R. C. Summers & C. Wood ($22.95).
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- *Compiler Design Theory*, P. M. Lewis II, D. J. Rosenkrantz & R. E. Stearns ($29.95).
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- *Coded Character Sets, History & Development*, C. E. MacKenzie ($26.95).

Most of the el cheapo, mass-produced books to which I've already alluded only skim the topics, as compared to the above books.

The authors of this series show a great flair for communicating their subjects, which means that you won't find quite the consistency of, say, a set of encyclopedias. But it pays dividends in that it allows each author's talents to come to the foreground rather than being buried in some ill-conceived editorial format. Also, it makes sense to learn from a true expert who can communicate the state of his art in his field.

As Harold Lorin points out in his treatise on *Sorting and Sort Systems*, a programmer must continually peruse the literature in his field if he's to keep his knowledge up to date. I couldn't agree more.

Finally, these are *real* books. You see, in this respect I'm an old-fashioned guy. Glossy, colorful paperback covers are OK, but give me real books . . . hard covers, heavy in your hand, pages lying flat, professionally laid out with a typeface that entices you to read—the kind that makes you feel like you should wash your hands before reading. They bring an old-fashioned pleasure to learning and keeping abreast of a new-fangled subject.

Jake Commander
Technical Consultant
Microcomputing

Learning IBM Basic (For the Personal Computer)

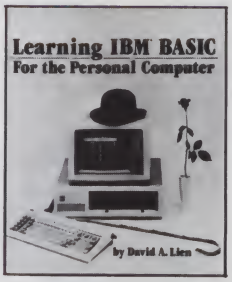
David A. Lien
Compusoft Publishing, 1982
PO Box 19669
San Diego, CA 92119
Softcover, 423 pp., $19.95

Here's a book for anyone who wants to learn IBM Basic but just can't seem to get started. Surprises are kept to a minimum, jargon has been eliminated and learning is broken into a series of miniscule steps in *Learning IBM Basic*.

If you can't learn Basic using this book, maybe you should give up.

Learning IBM Basic might be considered a clone of an earlier Compusoft book, *Learning Level II Basic*; much of the book is copied verbatim. After all, For-Next loops are pretty much the same, whether they're done on a TRS-80 or an IBM PC.

Of course, the IBM book does have some new sections. Features exclusive to the PC have been incorporated, and each chapter in the new book concludes with several study questions. (And the price is $5 higher.)



IBM owners and users new to programming are most likely to benefit from this book. But, if you're looking for a refresher course in Basic or an explanation of the unusual features of IBM Basic, you might be better off choosing a more advanced guide.

The 400-plus page length of *Learning IBM Basic* is deceiving. At first glance I thought it would be a great reference manual. The information, however, is broken down so finely and completely interweaved with analogies that it has little value as a quick reference.

For example, there is a description of arrays that would make sense to a bright elementary-school student. But nowhere does the author tell you just how big an array can be. (I've found IBM's own Basic manual better for answering this kind of question, but it's next to useless as a tutorial for beginners.)

The biggest drawback of *Learning IBM Basic* is its exclusion of many sophisticated commands and functions, including those related to graphics.

Perhaps *Learning IBM Basic*'s strongest selling point is responsible for another of its drawbacks. It's proficient in such a graduated manner that it may be difficult for some readers to see the light at the end of the tunnel.

By the time a reader works all the way through the book, he will have mastered the syntax of Basic, but I doubt that he'll be ready to write his "own custom software," as the cover suggests. It's one thing to learn to saw a board or hammer a nail, and something quite different to build a house.

Learning IBM Basic doesn't represent anything new in the way of teaching Basic or in the art of programming. However, its techniques are time-proven, making the book a strong candidate for IBM owners who want a once-over, light treatment of Basic.

Timothy Daniel
Oxford, OH

Atari Sound and Graphics

Herb Moore, Judy Lower and
Bob Albrecht
John C. Wiley & Sons, Inc., 1982
605 Third Ave.
New York, NY 10158
Softcover, 234 pp., $9.95

Atari Sound and Graphics is an excellent guide for new Atari 400/800 owners who need help in understanding the capabilities of their systems. The book also presents many fundamental ideas and concepts associated with writing programs in Atari Basic while concentrating on practical examples concerning sound and graphics generation.

Please note that I said this is a good book for *new* Atari owners. It's especially useful to those who may be having difficulty understanding Atari manuals and need to have the same things said another way.

If you already know Atari Basic, you probably can skim through several areas of this book and *concentrate on the* sound and graphics material itself. If you already understand the Atari manuals, then you're not going to learn anything new from this book.

The material in each chapter is presented in short sections that teach you something new about Atari Basic while going further into sound and graphics control. The material is always building on what was previously covered and is presented in an easy-to-manage, self-instructional format.

Each section is followed by review questions with answers and challenges for the reader to write short programs using the newly presented ideas.

Atari Sound and Graphics starts out with simple ideas on how to generate sounds, then graphics and then both combined. During this introductory section, you progress from entering simple Basic commands to actually writing small programs.

As programs are built or changed during the discussions, a new listing is always presented. It's easy to stop and start just about anywhere in the book, without having to retrace page after page of instruction to find out where you are.

The sections on sound generation cover such topics as multiple voices, pitch, attack and decay, and loudness. Graphics control coverage includes discussions of the various graphics modes (with and without text windows), color

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Atari Sound and Graphics is well-written and includes plenty of illustrations. Screen displays and program listings are typeset and easy to read without special graphics characters.

The authors include no detailed, in-depth discussions on the internal workings of the system; instead, they emphasize interaction and exploration with your computer. They try to guide you, pointing out areas of interest and suggesting ideas to explore on your own.

Ultimately, *Atari Sound and Graphics* is an ideal resource to aid Atari owners in getting the most out of their machines.

Robert W. Baker
Atco, NJ

Some Common Pascal Programs

Osborne/McGraw-Hill, 1982
630 Bancroft Way
Berkeley, CA 94710
Paperback, 235 pp., $14.99

Any similarities between this book and *Some Common Basic Programs* (Osborne/McGraw-Hill), edited by Lon Poole & Mary Borchers, is strictly intentional. This is a rewrite into Pascal of the Basic programs contained in that earlier volume.

Some Common Pascal Programs includes 76 Pascal-language programs covering routines in finance, business, statistics, mathematics and home budgeting. The suggestion is for the user to type them into his machine as needed.

The book's gem comes at the end—the last routine, "Alphabetize." It contains a coding of the Quicksort algorithm, which is the brainchild of C.A.R Hoare. Quicksort, since it is recursive, can be coded handily in Pascal but it is not amenable to Basic. And code for Quicksort isn't that easy to find.

Appendixes A and B contain 18 common tools and implementations that also are not to be found in the original Poole & Borchers volume. These short modules of code are used to perform such chores as reading data and dates, prompting for user input, stopping for the user to read the screen, rounding and truncating, raising numbers to exponents, performing calendar functions and reading characters and numbers.

The first 20 programs deal with financial subjects: future value of investments, annuities, deposits and withdrawals, interest rates, depreciation and salvage, loans, discounting and mortgages.

The next 27 deal with mathematics of interest to scientists, engineers and other technically oriented users: geometric and trigonometric computations, vectors, plotting, interpolation, integration, derivatives, roots of polynomials and matrix computations. (Algorithm 44 is a coding of the simplex algorithm for linear programming and should itself be worth the price of the book to anyone who has need of it.)

Statistical procedures are covered in the next 20 routines: distributions, tests, standard statistics, regressions, correlations and system reliability.

A potpourri of nine routines completes the set: taxes, check-writing, recipe cost, survey map-checking, calendar and metric conversion.

All in all, the volume should be useful to those who are coding in Pascal and don't want to waste time reinventing the wheel. It's an attractive, well-done book with clear printing and clarity of exposition.

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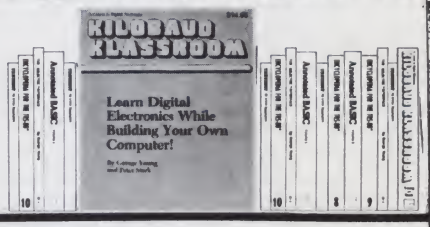

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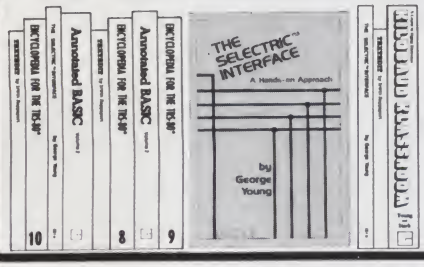

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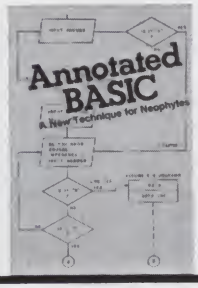

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CALENDAR

Panama City, Florida, Fair

A computer fair, called Interface '83, will take place at the Panama City Mall, Panama City, FL, April 29–30 and May 1. The fair, sponsored by the Panama Computer Society, is designed for the average person and hobbyist.

In addition to hardware and software exhibits, Interface '83 will include amateur and user group demonstrations and displays on computer uses in education, word processing, home budgeting and security. For more information, call Troy Strait at 904-785-9587.

Two Trade Shows in Canada

May 9–13 are the dates for the National Industrial Production and Machine Tool Show in the Coliseum and Industry Buildings at the CNE in Toronto.

International Computer Show/Salon International de l'Ordinateur will be held May 10–12 in the Velodrome, Olympic Site, Montreal.

For information on both shows, call Jim Steinhart, 416-787-2138.

Two Portland Oregon Conventions

May 10–12 are the dates for Northcon/83 High-Technology Electronics Exhibition and Convention and Mini/Micro Northwest, both to be held concurrently in the Portland, OR Coliseum.

For details, call Eileen Algaze, 213-772-2965.

COMPUTA 83 in Singapore

For readers living in or visiting southeast Asia, the COMPUTA 83 exhibition will take place May 11–15 in Singapore at the World Trade Center.

The exhibition will include a wide spectrum of hardware and software, with systems ranging from micros to mainframes. For details, contact Kallman Associates, 5 Maple Court, Ridgewood, NJ 07450; telephone 201-652-7070.

Applefest in Boston

The third annual Applefest/Boston will be held May 13–15 in Boston's Bayside Exposition Center.

Sponsored by the Boston Computer Society, the show features virtually every Apple-compatible hardware and software product. For more information, call Northeast Expositions, 800-841-7000 from outside Massachusetts, or 617-739-2000 from instate.

Penn State Compufair '83

The Northeastern Pennsylvania Computer Club will offer its second annual Compufair on May 14 at the Hazleton campus of Penn State University, Hazleton, PA.

Compufair '83 will feature workshops, vendor booths and displays. For more information, call George Lee at 717-454-8731.

Boston Area Educators' Conference

The fifth annual Computer Conference for Educators, sponsored by Lesley College and the Computer Education Resource Coalition, will be held May 14 at Lesley College, Cambridge, MA.

Sessions will include presentations and workshops. For registration or other information, contact Susan Friel or Nancy Roberts at Lesley College, 29 Everett St., Cambridge, MA 02238; telephone: 617-868-9600.

Pet User's Conference in Toronto

The second annual Toronto Pet User's Group Conference will be held May 14–15 at the Casa Loma Campus of George Brown College in Toronto.

The Conference will feature disk copy sessions, speakers, Butterfield Machine Language Workshop, exhibitions and a trader's corner. For information, call Chris Bennett, 416-782-9252.

National Computer Conference In California

The 1983 National Computer Conference will be held May 16–19 in the Anaheim and Disneyland Hotel Convention Centers in Anaheim, CA.

The Conference will include an extensive technical program, professional development seminars and more than 600 exhibits. The various program tracks will address communications, social and computing issues. For more information, call Ann-Marie Bartels, 703-558-3612.

Houston Exposition

The Computer Showcase Expo will be held May 19–22 in Houston, TX. For more information, call The Interface Group, 800-225-4620.

Iona College Conference

Iona College will hold its third annual Computer Conference on May 18–19 at its campus in New Rochelle, NY, just northeast of New York City. The focus of the conference will be on the educational and business uses of microcomputers and an exploration of latest developments.

Also featured will be exhibits by major computer companies. For more information, call Joseph McCallion, 914-636-2100.

Accounting Show in Chicago

Computer hardware and software applications in the accounting profession will be one feature of the 1983 Midwest Accounting Show, to be held May 18–20 at the Merchandise Mart Expocenter in Chicago.

A full range of educational programs is planned, and over 100 exhibits are expected. For further information, contact Thomas Nelson Associates, 70 W. Hubbard St., Chicago, IL 60610; telephone 312-644-2622.

Texas Educational Conference

Texas Tech University is sponsoring the Sunbelt Educational Computing Conference, to be held June 1–4 on the University campus in Lubbock, TX. The theme of the conference will be Practical Applications and Current Issues in Educational Computing.

Short summary proposals for presentations at the conference should be sent by May 1 to Dr. Cleb Maddux, College of Education, Texas Tech University, PO Box 4560, Lubbock, TX 79409.

Computer Faire in Boston

The East Coast Computer Faire will take place in Hynes Auditorium in Boston on June 3–5. The Faire will feature computer hardware, software and services for educational, entertainment and home applications.

For more information, call 800-343-2222 or 617-739-2000.

Minnesota Swapfest

North Area Repeater Association will again sponsor Minnesota's largest swapfest and exposition of personal computers and software on June 4 at the Minnesota State Fairgrounds, located on Snelling Ave., north of I-94 in Hopkins, MN. For information, call 612-420-6000.

National Educational Conference—Baltimore

The 5th Annual National Educational Computing Conference will be held June 6–8 in Baltimore, MD. The host institution for this year's conference is Towson State University. The purpose of the conference is to explore all aspects of computer use in education. Many colleges and universities will be represented, and 19 computer-related societies are cooperating in the conference organization.

For further information, contact Doris K. Lidtke, NECC-83 General Chairman, Department of Mathematics and Computer Science, Towson State University, Baltimore, MD 21204.

A/E Systems '83—Dallas

A/E Systems '83, the largest conference/trade show designed specifically for architects and engineers, will be held June 8–10 at Market Hall in Dallas, TX. There will be nearly 80 speakers and numerous tutorials, many dealing with computer use in the design professions.

Some 400 exhibits are expected, and over 6000 architects and engineers will attend. For more information, contact Michael R. Hough, PO Box 11318, Newington, CT 06111; telephone 203-666-9487.

New Jersey Show and Fleamarket

The fourth annual New Jersey-New York-Connecticut Microcomputer Show and Fleamarket will be held June 11 in the Meadowlands Hilton Hotel at the New Jersey Sports Complex (exit 16W of the NJ Turnpike).

The show will feature commercial exhibitors, fleamarket sellers and hardware and software for all the popular systems. For more information, call the Kengore Corporation at 201-297-2526.

IBM PC in San Francisco

PC '83/West will be held June 17–19 in San Francisco's Brooks Hall/Civic Center Complex. PC '83 will bring together users, developers, distributors and retailers of PC-compatible products.

For further information, contact Northeast Expositions, 826 Boylston St., Chestnut Hill, MA 02167; telephone: 800-841-7000 or 617-739-2000.

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All replies will be acknowledged immediately and held in the strictest confidence.

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Wisconsin Educational Conference

The 1983 Microcomputers in Education Conference will be held at the University of Wisconsin in Madison on June 18. The Conference will explore issues and applications pertaining to microcomputers in elementary and secondary education.

For more information, contact Suzanne L. Zemke, Wisconsin Center for Educational Research, Room 785A, 1025 West Johnson St., Madison, WI 53706; telephone 608-263-4200.

Toronto Computer Show

The annual Toronto Computer Show will be held June 22–23 in the Automotive Building, Exhibition Place, Toronto, Ontario. For more information, call Laurie Whitsed, 416-967-6200.

DC Microcomputer Symposium

Microcomputer Systems: Tools or Toys? is the theme of the 22nd annual Technical Symposium of the Washington DC chapter of the Association for Computing Machinery. This conference will take place June 23 at the National Bureau of Standards in Gaithersburg, MD.

The conference is an opportunity for users, students, specialists and scholars to exchange ideas on the theme. For registration or other information, call Lorraine Lynch Nagy at 301-972-4739 (home) or 202-676-0037 (office).

EastCon in New Jersey

The EastCon gaming organizations convention will take place June 24–26 at Glassboro State College in Glassboro, NJ. Computer games are one of the features of the convention. For further information, send a SASE to EastCon, PO Box 139, Middletown, NJ 07748.

Chicago Graphics Conference

NCGA '83, a conference sponsored by the National Computer Graphics Association, will take place June 26–30 in McCormick Place, Chicago.

For more information, contact Nancy LeFebvre, NCGA, 8401 Arlington Blvd., Fairfax, VA 22031; telephone 703-698-9600.

Design Automation—Miami

The 20th Design Automation Conference sponsored by IEEE and ACM will be held June 27–29 at the Fontainebleau Hilton in Miami Beach, FL. For more information, call Paul Losleben at 202-694-5037.

Videotex '83 in New York

Videotex '83, a conference and exhibition devoted to the technology and uses of videotex, will be held June 27–29 at the New York Hilton.

If interested in attending, call Pam Fendel at London Online, Inc., 1133 Avenue of the Americas, 33rd Floor, New York, NY 10036; telephone 212-692-9003.

CE '83 at Rutgers

A conference on computers in education will be held June 27–29 at Rutgers University in New Brunswick, NJ. This will be a component of Computers in Education '83, a summer institute for educators, which will run from June 20 through July 15.

For further information, call Dr. Mitchell Batoff at the Institute for Professional Development, 245 Nassau St., Princeton, NJ 08540; telephone 609-924-8333.

CORRECTIONS

In our April issue, we inadvertently left off the ending of Margaret Morris's program listing ("Apple Gets Optimal," pp. 60–64). We apologize for the inconvenience. Here is the remainder of the program.

```
1830  PRINT : PRINT "VARIABLE ";MTRX(ROW,VAR + CNS + 1);" IS ";MTRX(ROW,VA
      R + CNS)
1840  NEXT ROW
1850  PRINT : PRINT "ALL OTHER VARIABLES & SLACK VARIABLES"
1860  PRINT "ARE EQUAL TO ZERO"
1870  IF OPT$ = "MIN" THEN MTRX(CNS,VAR + CNS) = MTRX(CNS,VAR + CNS) * -
      1
1880  PRINT : PRINT "OPTIMUM SOLUTION: ";MTRX(CNS,VAR + CNS)
1890  RETURN
1900  REM
1910  REM     **ELEMENTARY ROW OPERATIONS**
1920  REM
1930 MTRX(PROW,VAR + CNS + 1) = MTRX(CNS + 1,PCOL)
1940 PIVOT = MTRX(PROW,PCOL)
1950  FOR COL = 0 TO VAR + CNS
1960 MTRX(PROW,COL) = MTRX(PROW,COL) / PIVOT
1970  NEXT COL
1980  FOR ROW = 0 TO CNS
1990  IF ROW = PROW THEN  GOTO 2040
2000 NEG = MTRX(ROW,PCOL) *  - 1
2010  FOR COL = 0 TO VAR + CNS
2020 MTRX(ROW,COL) = MTRX(ROW,COL) + NEG * MTRX(PROW,COL)
2030  NEXT COL
2040  NEXT ROW
2050  RETURN
```

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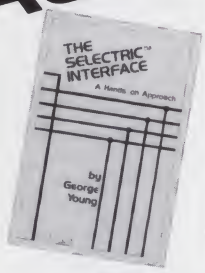

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NEW PRODUCTS

Edited by Dan Muse

The NEC Trek PC-6000 combines color, sound and educational capabilties.

The NEC Trek Boldly Goes . . .

The NEC Trek PC-6000 is designed to combine color, sound and educational capabilities into a versatile personal computer.

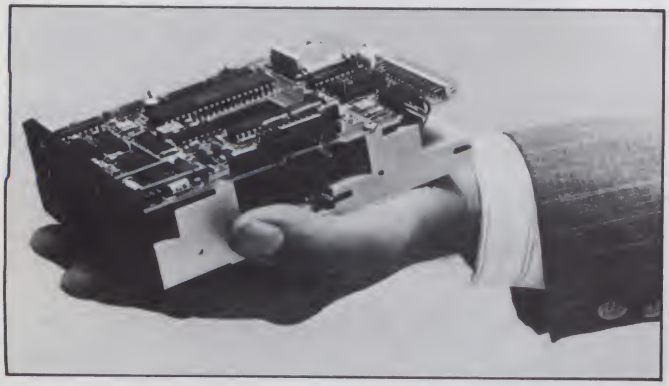
The PC-6000 comes with 16K of RAM and 16K of ROM, expandable to 32K with optional cartridge PC-6006. The computer also has three independent sound-generators with an eight-octave range, allowing you to play and compose music.

The NEC Trek PC-6000 has a 71-key typewriter keyboard, featuring five function keys which can activate ten user-defined routines. It also features nine colors for text and graphics; Microsoft Basic to enhance graphics and sound capabilities; RS-232C interface to allow access to national bulletin boards; high-resolution graphics; 256 × 192 dots in monochrome, 128 × 192 dots in limited color and 64 × 48 dots in nine colors. Up to four screens may be superimposed and independently controlled.

The computer sells for under $350. NEC Home Electronics (USA), Inc., Personal Computer Division, 1401 Estes Ave., Elk Grove Village, IL 60007. Reader Service number 496.

Micro Disk Drive

Tabor Corp. (Lyberty Way, Westford, MA 01886) has introduced a single-sided microfloppy disk drive that uses 3¼-inch disks.



Tabor Corporation's TC 500 Drivette is a 3¼-inch single-sided microfloppy disk drive. It has the same 500K storage capacity as standard 5¼-inch disk drives.

Called the TC 500 Drivette, the unit offers the same 500K storage capacity of standard 5¼-inch disk drives at one-fourth the size, one-half the weight and 60 percent of the power.

The TC 500 Drivette is plug-to-plug compatible with 5¼-inch drives. Major components of the drive include a direct drive spindle motor, custom read/write electronics and large-scale integrated control logic, all built into a one-piece die-cast chassis.

The drive is priced at $315. Reader Service number 492.

Turn Your Terminal Into a CP/M Computer

The MicroMate is a new entry into the CP/M-computer field. The MicroMate converts any standard or intelligent terminal into a CP/M computer. The 390K disk drive and 128K RAM computer both fit into a 13-inch long case.

Since it can be carried from terminal to terminal, MicroMate is portable. The computer is small enough to fit in most briefcases.

The complete MicroMate with a terminal, CP/M 3.0 and the T/Maker software program costs $1495. It costs $995 without the terminal.

The MicroMate has excellent input-output capability with two serial ports, an eight-bit parallel port suitable for Winchester disks, a Centronics parallel printer port and a connector for up to three external 5¼-inch drives, providing a total capacity of over 1.5 megabytes.

The MicroMate is manufactured by Personal Micro Computers, Inc., 475 Ellis St., Mt. View, CA 94043. Reader Service number 491.

A Problem-Solving Computer

The MC100 is designed to solve three major problems that face prospective computer buyers: software availability, technical obsolescence and cost.

The MC100 uses a 16/32-bit MC6800 processor and a RAM

The MicroMate, from Personal Micro Computers, Inc., is a new entry into the CP/M-computer market.

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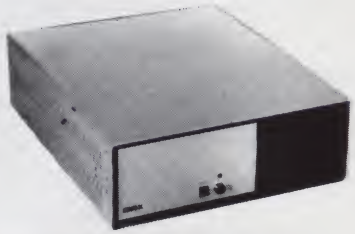

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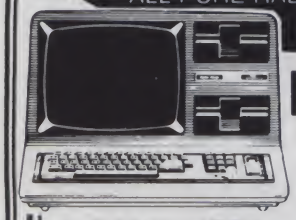

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Quick Share, from Wolsten's Computer Devices, allows four Atari 400, 800, or 1200 computers to share up to four disk drives, one printer and one software program.

memory system expandable from 128K to 16 megabytes. With this, plus an emulation hardware controller and multiple slave microprocessors, such as the Z-80, 6502 and 8088, it is possible, under software control, to create the environment of almost any computer. With the proper instruction set, the MC100 can perform as an Apple II or III, a TRS-80, an Osborne, a Cromemco and others.

The MC100 expansion options include direct memory expansion to 16 megabytes without paging, hard disk controllers to 2.4 gigabytes, programmable graphics controller to 1024 × 1024 pixels, multiple remote communications adapters and high-speed scientific and matrix processors.

MC100 is designed to allow the addition of new peripherals or processors as they become available. The basic computer system comes with a processor with 128K of RAM, two 5¼-inch disk drives, a high resolution monochrome monitor, a choice of CP/M or Pascal operating systems with word processing and spreadsheet software, and emulators for all Apple II and TRS-80 Model II software. The MC100 will be sold for under $5000.

The MC100 is manufactured by Micro Craft, 9995 Monroe Drive, Suite 203, Dallas, TX 75220. Reader Service number 495.

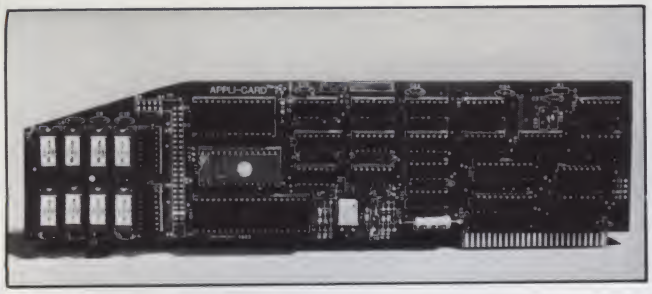
A Penny Saved . . .

Wolsten's Computer Devices, Inc. (99 Washington St., East Orange, NJ 07017), has introduced two money-saving products: Quick Share and Print Switch.

Quick Share lets up to four Atari 400, 800 or 1200 computers share one to four disk drives, one printer and one software program.

Quick Share lets you eliminate the need for three disk drives, three interface modules and three printers; also, you need only one software

PrintSwitch, from Wolsten's Computer Devices, allows any Centronics-type printer to be connected to any two Apple or Franklin Computers.



The Appli-Card, from Personal Computer Products, Inc., makes your Apple computer CP/M-compatible.

program to load four computers. You can connect up to four disk drives, giving you access to almost a half megabyte of storage. Quick Share includes all necessary cables and connectors needed to connect four computers, expansion module or disk drive together.

Print Switch is designed to cut printing costs in half. It lets any Centronics-type printer be connected to any two Apple or Franklin computers. To set up Print Switch, you plug the parallel interface printer card into each computer, connecting the cable to the Print Switch. The Print Switch plugs directly into any printer. The printer cable is supplied; no tools, wiring or modifications are needed.

Quick Share costs $595 and Print Switch costs $149.95. Reader Service number 480.

CP/M On-Board

The Appli-Card allows you to make your Apple computer compatible with the CP/M operating system.

The Appli-Card features 64K of on-board memory, 40-255 column horizontal scrolling, 70-column hi-res screen and a choice of either 4MHz or 6MHz Z-80 processor. By utilizing the on-board memory, the Appli-Card is able to execute CP/M programs two to three times faster than standard Z-80 cards which are required to use the Apple's memory.

Personal Computer Products, Inc. (16776 Bernardo Center Drive, San Diego, CA 92128), has also introduced a 64K or 128K RAM extender option. The RAM extender plugs into the Appli-Card and, using the Appli-Card's 64K and Appli-Disk software, functions as either a 128K or 192K RAM disk for Apple DOS, or a 64K or 128K RAM disk for CP/M. This capability is designed to eliminate the need for an additional disk drive.

Appli-Card supports all standard Apple peripherals as well as being fully compatible with the Apple IIe. The 4MHz Appli-Card with Appli-Disk software costs $295; the 4MHz Appli-Card with 64K RAM extender and 128K Appli-Disc software costs $395. Reader Service number 487.

PET to Parallel Printer Adapter

Connecticut microComputer, Inc. (36 Del Mar Drive, Brookfield, CT 06804), has announced the ADA 1800 printer adapter. The adapter is a simple-to-use interface designed to let Commodore PET and CBM computers output to parallel interface printers. Eight bits are supported. The ADA 1800 works with the Commodore disk drives and operates using Basic commands.

The ADA 1800 has a two-foot cable that plugs into the PET IEEE port. Another IEEE card-edge connector is provided for connecting disks and other peripherals to the PET. A four-foot cable with a standard 36-pin Centronics connector is also provided.

A switch selects upper/lowercase, upper/lowercase reversed (needed for some Commodore machines), uppercase only for clearer program listings and graphics.

The ADA 1800 works with Wordpro, Basic and other software. No special programming is required. For example, to list a program on your printer, you would just type:

Circle 278 on Reader Service card.

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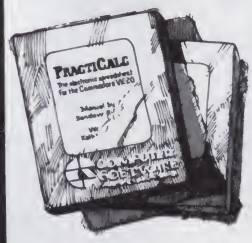
A comparative newcomer to the software market, PractiCalc has already elicited an overwhelming response. With PractiCalc, features that were once only associated with much larger computers are now available on the VIC-20 (with 16K Ram) and 64. PractiCalc's simple screen format allows easy entry and viewing of data, and its numerous mathematical functions allow for efficient solutions to the most advanced user problems. Easy to operate, PractiCalc offers an affordable alternative to large costly home computers.



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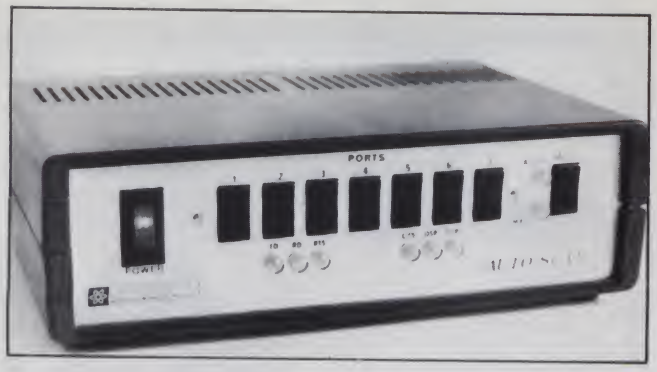
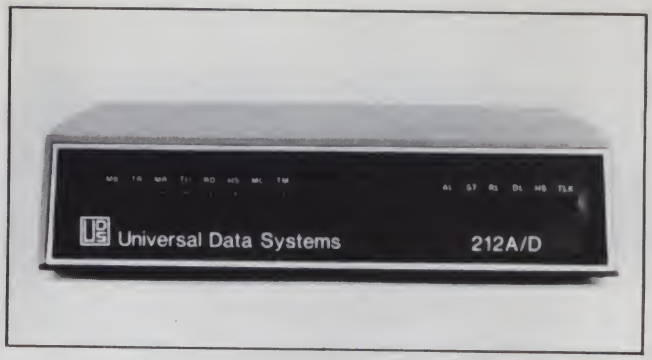


The Giltronix ASN is a switching device designed to facilitate the sharing of a common RS-232C device between computers.



The UDS 212 A/D is Universal Data Systems' newest addition to its line of modems.

```
OPEN 1,4
CMD 1
LIST.
```

The ADA 1800 comes complete, assembled and tested. The case measures 3½ × 5¾ inches. It costs $129. Reader Service number 497.

Sharing RS-232C

The Giltronix ASN (Automatic Scanner) is a switching device designed to facilitate the sharing of a common RS-232C device between numerous computers or other devices.

The ASN is controlled by an RS-232 signal, usually DTR or RTS. The switching device features automatic or manual operation, desktop or rack-mount versions, full compatibility with the company's ASU units, an ASU/ASN combination that offers a unique "Device Share" n × n matrix and front panel display of selected port.

The Giltronix ASN is available in three models: the ASN3, ASN5 and ASN7, offering three, five and seven ports, respectively.

The ASN3 costs $249; the ASN5 costs $349; and the ASN7 sells for $449. It can be purchased from Giltronix, Inc., 970 San Antonio Ave., Palo Alto, CA 94303. Reader Service number 483.

Top Your Ace With A Disk Drive

Franklin Computer Corp.(2138 Route 38, Cherry Hill, NJ 08002), has announced the ACE 1100, an add-on disk drive assembly for the ACE 1000 personal computer.

Offered with a controller and one or two disk drives, the unit replaces the cover of the ACE 1000 computer. Like other Franklin products, the ACE 1100 is Apple-compatible and reads and writes any Apple II disk.

The controller, which accommodates two drives, may be used with both DOS 3.2 and DOS 3.3, and includes a built-in disk drive exerciser. It plugs into one of the eight ACE 1000 peripheral connectors. There is no external cabling.

The single-drive model of the Ace 1100 is easily upgraded to dual drives. It is designed to accommodate the standard Franklin ACE 10 disk drive mechanism.

The single-drive ACE 1100 is sold for $699, including controller. The second drive is $399. Reader Service number 488.

The ACE 1100, Franklin Computer Corporation, is an add-on disk drive unit for the Franklin ACE 1000.

A Registered Modem

Universal Data Systems (5000 Bradford Drive, Huntsville, AL 35805) has announced the addition of the UDS 212A/D to its line of low, medium and high-speed modems.

The UDS 212A/D features all of the capabilities of the previously released UDS 212A modem, but includes an Integral Automatic Calling Unit. The built-in firmware of the UDS 212A/D allows entry and storage of up to five- to 30-digit numbers or operatives which can be recalled and executed with simple keyboard commands. The on-board battery-backed memory will retain the stored numbers after power-down for three to five years.

The UDS 212A/D also features 0–300 bps and 1200 bps data rates, asynchronous or synchronous full-duplex operation, automatic answer, microprocessor design and extensive diagnostics. The modem is FCC registered for direct connection to the Public Switched Telephone Network and is compatible with all Bell-type 212A data sets.

The UDS 212A/D sells for $795. Reader Service number 484.

A Multifunction Card

Saturn Systems, Inc. (PO Box 8050, Ann Arbor, MI 48107), has introduced a multifunction card for the IBM Personal Computer. The board combines two serial ports (COM1: and COM2:), one parallel printer port (LPT1:, LPT2:, or LPT3:), a time-of-day/date clock (with battery backup), a hard disk interface and up to 576K of RAM in a package that requires only one system bus slot.

The software package included with the Saturn board are Pseudo-Disk, a fast RAM disk emulator; Pseudo-Print, which allows simultaneous printing and processing; a hard disk support program (using the SASI interface on the card); and a support program for the time-of-day clock, which eliminates typing in the system date and time during system start-up.

Hardware and software user's manuals are provided, giving step-by-step installation and operating instructions. The manuals are sized to allow insertion in the IBM system binders.

The Saturn multifunction board, with 64K of RAM installed, costs $795. The Saturn software package requires an IBM PC with at least 64K of memory, one floppy disk drive and the PC DOS operating system. Reader Service number 490.

Circle 92 on Reader Service card.

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**TRS-80 Color Computer is a trademark of Radio Shack, a division of Tandy Corp.*

NEW SOFTWARE

Edited by Dan Muse

Backing Up CP/M

Amanuensis, Inc. (RD #1, Box 236, Grindstone, PA 15442), has released a disk-backup software package for CP/M 2.2. The product, called Qbax, is an intelligent, incremental backup program that operates without patches to the operating system.

Qbax will detect, within a few seconds, exactly which files have been rewritten since the last backup, and will only back up those files. With Qbax, hard disk users do not have to endure the agony of backing up an entire logical drive onto numerous floppies. Floppy disk users will find Qbax valuable, because instead of copying an entire disk, only the files that need backups are copied.

Qbax also includes options for reporting which files need a backup and for changing the backup status of files. The package costs $30. Reader Service number 461.

Taking Inventory

SSR Corporation (Micro Computer Software, 1600 Lyell Ave., Rochester, NY 14606) has announced that Infotory, the company's inventory management system, is now available for the Commodore 8032 Professional Computer and the Apple III with Profile.

Infotory for the Commodore 8032 offers an item capacity of 4000 inventory items with 38 fields of information for each item, including three pricing levels.

The Apple III version offers up to 20,000 inventory items and 36 fields of information for each item.

Infotory is designed to satisfy the requirements of inventory accounting and provides unlimited reporting capabilities through its database management subsystem, AnyReport.

AnyReport gives you flexibility in designing reports based on information associated with your inventory and provides the option to save those reports for future use.

Infotory cost $495. Reader Service number 473.

Speaking English

Teachers' Friend is a program that teaches English as a second language to students who can read English at the second-grade level. The 80-lesson curriculum was developed over a two-year period and sells for $15 per lesson.

Teachers' Friend doesn't need to be followed sequentially by the student. Each lesson can be used independent of the others, so a student can go right to the lesson he needs.

Teachers' Friend also serves as an anticipatory instructional device, allowing the student to prepare for difficult lessons in advance. For example, if a student is weak in verb conjugation, he can prepare before the class and reinforce learning after class.

Each lesson takes about ten or 15 minutes to complete; however, the computer will proceed at the student's rate of progress. Each Teachers' Friend lesson teaches a basic English skill, such as spelling, punctuation, parts of speech, verb tenses, syntax, pronunciation, drawing conclusions, making generalizations, developing vocabulary, alphabetical order and others.

Teachers' Friend is compatible with Apple and Radio Shack computers. Experience with microcomputers, or even the ability to type, is not necessary.

The lessons are available from The Soft Spot, Ltd., 800 East Arapaho, Suite 110, Richardson, TX 75081. Reader Service number 464.

Using Those Mind Tools

Howard W. Sams & Co., Inc. (A Division of ITT, 4300 West 62nd St., PO Box 7092, Indianapolis, IN 46206), has introduced the Sams Financial Planning Mind Tools—a software enhancement program developed for use with Multiplan, VisiCalc and SuperCalc electronic spreadsheets.

The enhancement program offers a series of 17 preset calculators that automatically superimpose correct formulas and column headings on each spreadsheet program. The Mind Tools are compatible with the TRS-80 Model II, the Apple II and IBM Personal Computer, and sell for $69.95 or $89.95, depending on the version.

Each Mind Tools package includes a disk, a complete instruction manual and an easy-to-read reference guide. Reader Service number 478.

Atari, Commodore Software

Eastern House Software (3239 Linda Drive, Winston-Salem, NC 27106) has released four new software products: 64-Rabbit, 64-MAE, 64 STCP and Monkey Wrench II.

64-Rabbit is a high-speed cassette interface on ROM cartridge that adds 12 commands to the Basic language. The Rabbit's save, load and verify commands operate five times faster than normal Basic commands. Other commands include load/run, test memory, decimal-to-hexadecimal conversion and hex-to-decimal conversion.

64-Rabbit is available for the Commodore-64, VIC-20, and PET 4001, 8001 and 8032. It costs $39.95.

The 64-MAE, designed for the Commodore-64, is a macro assembler and text editor written in machine language. 64-MAE features 38 error codes, 27 commands, 26 pseudo ops, and five conditional assembly operators; built-in software UART (110–9600 baud); macro, conditional assembly and interactive assembly capability; and optionally created executable object code on disk. Text editor features include auto-line numbering, find, exchange string, copy, move, renumber, delete lines and append. Word processor features include left and right justification, center, set margins, define text body shape, headers and footers. It sells for $99.95.

Monkey Wrench II is a ROM cartridge that plugs into the right-hand slot of your Atari 800. It provides 18 new Basic commands and 16 machine-language commands, including a format program list command that separates and prints to the screen or printer each command appearing on a Basic multiple command line.

64-STCP (Standard Terminal Communications Package) turns a Commodore-64 into a sophisticated and smart terminal.

The package is controllable from Basic or machine-language programs. Included with the software is an ACIA-based hardware interface board that will work with an inexpensive or intelligent RS-232 modem. STCP is also available for PET series computers. It costs $129.95. Reader Service number 465.

Enhancing Basic

EnBasic enhances Basic, while retaining all of the current Basic features. With EnBasic, spelling and typing errors can be automatically indicated; character-by-character error feed-back is given for missing, extra or wrong letters, inverted letter order, errors in accenting, capitalization, sub- or superscripting.

Display features of EnBasic include—

- Lowercase characters.
- Proportional spacing, superscripts, subscripts, underlining and automatically backspaced diacritic marks in text.
- Rewrite, erase, overstrike and inverse modes can be set at will.
- Regular or double-size characters may be displayed anywhere you wish on screen.
- All displays are in high-resolution.

The EnBasic package contains a 94-page manual, a pocket guide to EnBasic commands and a master disk that contains:

- The EnBasic augmentation program.
- Six ready-character sets (four sizes of English letters plus Cyrillic and Greek).
- A display editor, a standard key assignment table and a key assignment editor.
- A transfer program that places EnBasic, character set and key assignment tables on your disks.

EnBasic is manufactured by COMPress, A Division of Van Nostrand Reinhold, 286 Congress St., Boston, MA 02210. The product sells for $150. Reader Service number 469.

Apple, Meet IBM

Direct Connect is a software package that supports communication between the Apple II and an IBM Personal Computer, using only the standard hardware supplied with each computer—no communications adapter or serial interface is required.

Direct Connect uses the cassette port on the IBM PC and the built-in I/O facilities of the Apple II. A cable is supplied with the software, connecting the two machines. This approach permits data transfer rates of 10,000 bits per second. The software automatically checks for errors during file transfer.

The Remote Commander feature allows both computers to be controlled from the IBM PC. The program can be operated using only one display. Other Apple programs that use standard keyboard input and display may also be run from the IBM PC.

Direct Connect supports transfer of Basic programs or text files, including VisiCalc models. In addition to transferring files, virtually any Apple-generated output can be sent to the IBM PC and saved on disk. Also, a Pascal interface is included in the package.

Direct Connect is available from Trax (8948 W. 24th St., Los Angeles, CA 90045) for $170. Reader Service number 470.

Going Abroad?

Island Software (Box 300, Lake Grove, NY 11755) has announced a French and Spanish language series for the Commodore Pet, Commodore 64 and Apple II Plus. The programs utilize graphics to present oversized words and diacritical marks.

The Pet and C-64 version can be purchased as four separate cassettes at $20 each. The first program has nouns grouped in convenient topic areas; the second uses verbs grouped according to ending types; the third uses numbers, colors, months and other useful words; the fourth cassette allows the teacher to create customized word lists.

The Apple version comes with all four programs on a single disk, selling for $80. The C-64 version is also available on disk for $80. Reader Service number 466.

APL Power for the PC

STSC, Inc.'s (2115 East Jefferson St., Rockville, MD 20852) APL*Plus/PC brings the inherent power of APL and STSC's proprietary system enhancements to the IBM Personal Computer.

The APL*Plus/PC is functionally compatible with STSC's other APL*Plus systems running on IBM mainframes, Digital Equipment Corporation's VAX computer series and the TRS-80 Model III microcomputer.

The APL*Plus/PC system offers all APL language primitive functions and operators; STSC's business report formatting feature; error-trapping features; STSC's Sharefile system; system functions for space management and for interface with non-APL programs; and 106 system functions and variables.

The system operates under PC DOS and requires at least 128K of RAM and one disk drive. The system includes a custom character ROM, which enables the Personal Computer to display the APL character set.

The APL*Plus/PC package is composed of the APL language processor software, APL character ROM and complete documentation, including a 400-page programmer's reference manual, an introductory APL tutorial and an APL textbook. It costs $595. Reader Service number 471.

IBM Smartens Up

PC/InterComm transforms your IBM Personal Computer into a "smart" terminal, allowing you to talk to any manufacturer's computer (even another IBM). You can access more than 1000 data services for up-to-the-minute business and financial information.

With PC/InterComm, you can do accounting and financial applications, word processing and data entry directly on the remote machine—with instant video feedback.

You can read data from your files and forward the information along to any other computer, or you can receive data for storage. Once you have set up protocols to communicate with other computers, you don't have to reenter them or make other selections. Just boot the PC/InterComm and your PC is ready to talk.

Circle 363 on Reader Service card.

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Evaluate NAMOR for 30 days. If you are not satisfied, just send it back for a full refund of the purchase price. Also ask about the new NAMOR NEWSLETTER sent FREE to all those interested in list management.

Software package includes NAMOR disk, Training/Demo disk and manual, $150. Manual and Demo alone $25. Available for CP/M® systems in 8" SD and most popular 5¼" formats including Apple, Heath, North Star, Osborne and Xerox.

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PC/InterComm requires an IBM PC with at least 64K, one disk drive, DOS, an asynchronous serial port and the monochrome display adapter. It costs $99. Reader Service number 472.

Simplifying Apple Pascal

Smart Systems, Inc. (499 Sulky Lane, Frederick, MD 21701), has developed Smartscreen for use with Apple Pascal. Smartscreen is a utility designed to simplify the development and use of screen-oriented software.

Smartscreen features easy form creation—you type the desired form on the screen and it appears in the application; great field flexibility; total flexibility in defining edit masks for each input field; a one-stroke help screen for each field; ability to read a field as either integer, real or string; single procedure to blink or reverse either a field or a screen area; and the ability to print what is on the screen with one keystroke.

Smartscreen supports either 40- or 80-character display and requires only 5K, plus the storage necessary for the developed screens. Smartscreen comes complete with documentation and a hands-on teaching routine. It costs $75. Reader Service number 474.

IBM Gets Speed

Daystar Systems (10511 Church Road, Suite L, Dallas, TX 75238-9990) has released the UltraFast Software Utility Package. The package contains three programs: UltraFast, a flexible disk RAM emulator; UltraTrap, a parity error-handling utility; and UltraBoot, a dynamic memory allocation utility.

The UltraFast program is designed to let a portion of the IBM PC's memory emulate up to four double-sided, 40-track disk drives. This high-speed emulation provides startling performance improvements. For example, the average seek time is 1500 times faster than a typical drive. Data transfer is six times faster.

The entire UltraFast package requires only 8K RAM of space to operate. The package costs $39.95 or is available free with the purchase of a 512K IBM-PC memory board. Reader Service number 476.

New and Improved

Abacus Data, Inc. (1920 San Marco Blvd., Jacksonville, FL 32207), has announced an enhanced version of Informa X, an information management system. The new version is written in Pascal, and features cross-file data sharing, multiple file reporting, multiple screens per record, far broader application capabilities, increased speed and security, and far greater data file capacity than earlier versions.

Informa X can now run on any eight- or 16-bit system with Z-80, 8085, 8086 or 8088 processors, operating CP/M-80, 86, or any multi-user system using TurboDOS, Mmmost or dpc/OS. Versions for MS-DOS, PC-DOS, N-Star and MPM will soon be available.

Informa X is designed to simply and quickly handle all of a business's computing requirements, including payroll, personnel, accounts receivable and payable, general ledger, inventory and direct mail.

The single-user version of Informa X costs $795. The multi-user version costs $995. Reader Service number 477.

Number Cruncher

Number Cruncher is a business productivity tool that blends text editing and calculating capabilities to create a flexibly-formatted modeling program.

Number Cruncher does not use fixed column and row arrangements, freeing you to design a report format to suit your needs. The program also lets you assign easy-to-remember names to variables—for example, "taxes" instead of a code name like "B3."

Math commands like "Multiply Gross X Sales Tax Giving Total" are used instead of math codes. Number Cruncher lets you place numbers to be used for calculations anywhere in lines of text. The system can add, subtract, multiply or divide these numbers, and display the result anywhere on the page.

Standard row and column math functions are provided along with block commands, which let you add, subtract, multiply or divide entire blocks of rows and columns, producing a single result/total.

The Number Cruncher system includes commands that enable you to calculate internal rate of return, modified rate of return, amortization and depreciation schedules.

Number Cruncher also provides text editing for models, reports and business letters. Full editing controls aid in text layout design; a special display lets you know where you are on the page at all times.

Number Cruncher is designed for the IBM Personal Computer and DECmate computers; an Apple version is scheduled to be released in the near future. The system requires 64K and runs on either floppy or hard disks. It costs $395.

Number Cruncher is manufactured by Pyramid Data, Ltd., PO Box 10116, Santa Ana, CA 92711. Reader Service number 462.

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(From p. 146)

and common BDOS ERR—which could mean almost anything.

I would guess that the technical support from Ellis is excellent. I say "guess" because I have had no reason to use it. I was able to configure the Edit program on the first try and have had no trouble using the supplied documentation. If the technical support is of the same caliber as the rest of the product, it must be superb.

Summary

Ellis Computing's Edit is a well-thought-out product with excellent documentation and an astoundingly low price ($29.95). This editor's ability to be customized for each user and its ease of use should make it a great product for cases such as program editing, when advanced text processing features are not needed. (*Ellis Computing, 600 41st Ave., San Francisco, CA 94121; $29.95.*)

Terry A. Ward
Cedar Falls, IA

Memory/Shift

An innovative program
For the multitask-minded
Computer user

Memory/Shift is a program that could radically change the use of microcomputers. The program lets you subdivide your IBM Personal Computer's memory (of 128K or more) into two or more partitions, each of which can hold a resident program.

Why is Memory/Shift needed? The answer is elementary. It lets you work on many things concurrently. Up to now, the microcomputer hasn't been able to do this. If you were using a spreadsheet package and wanted to use a word processor, the former had to be closed out and the latter opened. Interactivity between the two was impossible. Reference to one by the other, without benefit of hardcopy printout, has also been impossible. Memory/Shift will change that.

As a writer, this package provides the ability to work with the software in Partition #1 and write about it in Partition #2.

If a question should arise as an article is being written, there is no need to close out the word processing document and reload the software. They are both resident and all that is required is the pressing of a combination of keys.

Those needing to use the microcomputer for two or more tasks in relative concurrency will find Memory/Shift to be a major convenience.

How It Works

Version 1.0 of Memory/Shift divides memory into two partitions. After DOS and system programs are loaded, five options for partitioning exist:

- Each partition receives 50 percent of the available memory—this is the default.
- Partition #1 receives 64K, balance to Partition #2.
- Partition #1 receives 96K, balance to Partition #2.
- Partition #1 receives 128K, balance to Partition #2.
- You can specify the size of each partition.

All this assumes, of course, that you have the necessary resources.

Versions of Memory/Shift that will take the partitioning options first to nine partitions and then to an unlimited number are slated for release. The programs capability will only be limited by the memory and media facilities committed to the IBM PC.

> Memory Shift is a program that could radically change the use of microcomputers.

A software package such as Memory/Shift is bound to increase the sale of memory boards and hard disks.

What Are Convenience Programs?

With many partitions, and with many programs in parallel residency, switching from task to task and back again will make an abundance of minor resident reference programs possible. These programs are called "convenience programs."

The convenience-programs market is largely untapped, because no single package of this nature has had the impact of some of the major software many microcomputer owners have purchased. Let's face it—many microcomputers have been purchased on the basis of one application alone. Memory/Shift makes convenience programming a viable software market.

Memory/Shift is not multitasking software. Its total capability is to let you load several programs and move among them as your needs dictate. For example, if you use Memory/Shift while building a VisiCalc model, you do not need to download it to review a WordStar document.

In short, if you need to use your micro for several different things, you can now do so with programs in parallel residency, moving to them and back again in microseconds.

North American Business Systems will be distributing Memory/Shift. The package costs $99. Information on the software and details on their subscription plan, which will allow registered users to obtain inexpensive updates and allied services, may be obtained by contacting North American Business Systems, 677 Craig Road, St. Louis, MO 63141, or by calling 1-800-IBM-DEMO.

Kenniston W. Lord, Jr.
Winchendon, MA

Screenwriter II

All in all, this
Is a superior
Apple word processor

The ads sounded good—an Apple word processor that could display text on the screen in full upper- and lowercase and in 70-column width, without any extra hardware. It could spool using a disk drive, use Macros, generate indices and do proportional spacing as well.

The price for the software was $129.95 from OnLine Systems (36575 Mudge Ranch Road, Coarsegold, CA 93614). That seemed good, but when I saw it for $79.95 from Ark Computing (PO Box 2025, Corona, CA 91720) I could resist no longer, and ordered my first word processor.

When I received Screenwriter II, I was greeted with a looseleaf binder containing massive and thoroughly professional documentation and two copies of an (apparently) unprotected master disk with two command reference cards—one an abbreviated version of the other.

All in all, the manual is good, much above the average for the computer products I have seen. That alone would put Screenwriter II in a category by itself.

When the master disk is booted, the first program executed is a short machine-language routine called Start. This sets up a few pointers and then runs an Applesoft program called "Applesoft." If you do not have this language in ROM, it will be necessary to obtain the alternate version called Integer. This can be done by writing OnLine Systems, or you could convert the program by capturing it as a text file, changing languages, EXECing it back, and then resaving it under the new name. (This latter possibility is not mentioned in the manual.)

In any case, the Basic program exists only to provide the menu of choices for what to do next. You may enter the Editor or the Runoff module, configure the system for your particular needs and

hardware, or exit back to Basic. By the way, if you decide to do the latter by issuing a Cntrl C to list the program, remember to do an FP before carrying on in Basic, as this program is run at a relatively high memory position.

The Editor and Runoff packages both come in two versions (all machine language, of course). Either will run in a RAM card of a nonRAM card version. The former option allows both programs to reside in memory at the same time—a convenience if you're to be switching back and forth a lot. However, if you're in for a long editing session on a large file, there will be much less disk access and therefore less chance of dropping information from the file if you use the nonRAM-card version. Also, if you do have a card, there is then a great deal more memory available.

Moving and deleting text is fast and easy; once a block of text has been copied or deleted into the Get buffer, it can be written out once or several times anywhere in the file. There is also a global-search-and-replace facility. Any number, or all, of the occurrences of one word or phrase can be replaced by another word or phrase. Smaller amounts of text can also be deleted a word or a character at a time.

By using virtual memory on an output disk, file size is available up to 64K characters, an ample amount for most applications. It is important not to remove the output disk from the drive unless instructed to do so, as disturbance of the virtual memory can result in trashed files.

A recommended hardware configuration would involve a RAM card and two to four drives (one each for Library, Output, Spooling, and Text file storage). This is not necessary, however, as the program will work fine on only one drive, without the extra memory (but all that disk swapping!).

I like the fact that most of the DOS commands are available in almost all program modes. This allows the user to catalog, delete and perform other housekeeping chores on the disk containing Library or active text files either during an editing session or while preparing for a runoff.

On the initial entry, when the user is being asked for an input file, it is nice to be able to answer C and get a numbered list of all text files available. You can then select the desired file by number, instead of by name, an option that is also available when filling in the list of files for the Runoff module to print.

I have no doubt that Screenwriter II is a superior product. It can do all that OnLine Systems advertises and more. In fact, after a few weeks, I made the rounds of the local computer stores to make some comparisons. The competing products, in general, lacked many of the features I have mentioned so far, and typically had far fewer formatting commands. (Screenwriter II has more than 80 such embedded commands.(My general impression is that most software documentation is still at a much lower level than Screenwriter II's.

Typical of author David Kidwell's attention to detail is the fact that up to four titles, the date and the page number (Arabic or Roman) can be placed anywhere outside the text body and can be changed at any time, allowing various headings for different chapters, or even each page of a chapter. Up to four indices of various types can be generated by placing the appropriate tokens in the text.

I have no doubt that Screenwriter II is a superior product. It can do all that OnLine Systems advertises and more.

Full provision is also made to take advantage of the special features of various printers to achieve boldfacing and underlining, as well as to spool using a disk drive while continuing to edit using another drive.

While on the subject of printers, I should note that it is possible to list the file to the printer from Edit mode. This can be useful.

The 70-column feature is there, and it works. In Edit mode you switch back and forth by using the commands 40c and 70c. In Runoff mode, the command T will give a test print of the left-most 70 columns on the screen. Naturally, a monitor is needed to make the results legible; on a television they are not.

Cursor control is convenient and fast in Edit, Insert, and Change modes; a software buffer ensures that you cannot overtype the 40-column screen, even if the disk drive is also operating, though this may be possible for a much faster typist than myself.

It is easy to overtype the 70-column screen, as the screen refresh takes a long time. Indeed, writing out a Get buffer with the cursor near the top of the screen could take what seems like forever. If this happens, scrolling the cursor to the bottom of the screen will cut down on the portion of the screen rewritten after each keypress and therefore speed up entry.

All in all, Screenwriter offers many positive features, enough for the general writing needs of even the most prolific and eclectic of authors.

No product is perfect, however, and this one has its share of shortcomings. (Well, what did you expect from someone who has yet to give any program unqualified approval?)

At the time this review is being written, there is no graphics editor, though there is a promise that one will be forthcoming. For some, that is a must and will be the determining factor in a purchase decision.

More seriously, for a mathematician like myself, there is no math capability. Even if you enter a simple chart, all the totals will also have to be entered by hand—surely this will be improved. In the meantime, I produce charts with VisiCalc. Fortunately, Screenwriter II does make provision to leave space for such things.

There is a devious protection scheme implanted in three of the main programs—a fact which is not mentioned in the advertising, in the manual or on the outside cover of the package (where all such things should be boldly announced). Although all other supplied software can be copied, the programs RUNOFF.OBJ0, EDITOR RAM.OBJ0, and EDITOR.OBJ0 can only be run from the master disk.

Personally, I find this annoying and inconvenient. I have a paranoia about writing anything (including configurations) on any program disk for which I have paid good money. It is false advertising to do such a thing and not tell the prospective buyer, let alone the user. Furthermore, I wanted to configure several disks differently for different writing purposes. I was unable to produce a working copy with COPYA, Locksmith or Super Copy 2, despite the fact that the normal DOS would read from, and supposedly write to, the master without any problems.

It is, of course, possible to defeat the scheme. That does not mean that I advocate software piracy, but a user should be able to make a reasonable number of traceable, serial-numbered backups.

For the machine-language buff who wants to see an interesting variation on the protection game, the routine is located at $7F00 in the first two of these programs and at $6D00 in the third. I will not tell you how to defeat the lock (believe me, I am tempted!), but be careful if you do try; you may see some trashed files before you're finished, especially if you do the most obvious thing.

The procedure for entering printer initialization codes could be improved. If this advice is followed for ESC codes, the results may be surprising, to say the least. Add 128 to all the numbers mentioned. That is, use the table on p.15 of the Apple Reference Manual and take the values from 128 and up for this purpose. A better method would be to enter the Apple monitor by typing Call-151 from Applesoft. Then create the sequence of printer codes in machine language, starting at $1FF0. Remember to end the sequence with a zero. When done, type BSAVE PRINT1, A$1FF0,L$0B.

As many different printer initialization schemes as you want can be entered this way; you can then type BLOAD PRINT1 (or whatever name) when in Runoff to switch

codes. The new ones can be saved as part of the default parameters if you wish.

If you do use ESC codes to change character sets on a Centronics printer, remember to put them in the initialization string first, as the switch to or from standard characters must be the first thing on a line or it will not work.

All other ESC codes can be entered into the text in the same way as control characters—by pressing Cntrl X before the escape key. This fact is not mentioned in the manual.

A number of commands were left off the reference card, including those for Help, Merge and Save, some of the search parameters, and the character set switching commands I mentioned earlier.

I didn't like the fact that whenever I deleted a word, any immediately following punctuation also vanished and had to be reentered. I could not delete from the end of the word backwards, but had to position the cursor at the beginning. It is nice, though, to be able to undelete the most recently deleted characters or words.

When using the RAM card version of the Editor, the amount of disk access was enormous; this really slows down cursor moves.

Speaking of the disk, there were problems with the spooler for large files. I suspect that this was caused by speed problems in my drives. Remember that spooling cannot be interrupted once it has started. If you can afford it, purchase a printer interface with a spooling buffer. It works much faster.

Another problem is that the screen does not reflect such things as boldface or underlining while editing, except by the presence of the tokens or control characters you have inserted in the text to cause these to be invoked. However, that is a problem with all strictly screen-oriented editors. Also, packing or saving the file, or changing screen type always scrolls the cursor to the top of the file, a possible annoyance since there is no screen indicator to tell you what page you have been editing.

The users of some word processors will be disappointed to discover that there is no indicator of the current screen's position in the overall file kept on the screen. A line or page counter would be useful in moving to other parts of the file easily.

I had hoped that the presence of a Centronics driver in the supplied software meant that I could use the proportional character set supplied on my 737, but such was not to be the case. Proportional spacing is available, but only for fixed-width characters; I must admit that I have not yet used that feature.

Some care must be taken if you do select a proportional character set, because the presence of many wide characters on one line would cause an unsightly run into the right margin and, of course, right justification would not work at all.

These are all minor quibbles. After all, a critic is supposed to be critical.

I have saved the worst for last. There is a bug and an attending error in the manual. It has to do with the fact that the two versions of the Editor store their Macro tables at different addresses. (RAM card version is at $7462 and nonRAM is at $693D.)

It would be all right if the program took this into consideration, but it does not.

Karel the Robot . . . is able to start neophytes, even those with computer phobia, off on the road to computer literacy.

The RAM card version BLOADS and BSAVES at $7464, not $7462 as it should. To correct this bug, which will only become apparent if you try to use Macros saved in one version while using the other one (and then—O joy!—all your control keys get redefined two bytes off), do the following:

```
From Applesoft
BLOAD EDITOR RAM.OBJ0
CALL-151
745B:B2
BSAVE EDITOR RAM.OBJ0,A$4000,L$4000
```

To complete the fix, turn to p. 155 of the documentation and change the lines near the top to:

```
7810PRINT D$"BLOAD MACRO.A$7462"
8810PRINT D$"BLOAD MACRO.A$693D"
```

Do not include line 9919, or you will have problems. Line 9800 is unnecessary, and may cause trouble. Cross it out.

Finally, delete all references to the latter two lines on the previous page.

Despite the one bug and the few drawbacks I have mentioned, this word processor is by far the best I have seen for general writing purposes. The addition of a graphics editor and mathematics capabilities would leave it with no realistic competition in Apple word processors. Even as it is, this program is a must buy; I strongly recommend it.

Rich Sutcliffe
Langley, B.C., Canada

Karel the Robot

A sugar-coated Approach to Learning Pascal

If a spoonful of sugar helps the medicine go down, a whole bowl of sugar should help anyone to swallow anything.

Karel the Robot qualifies as a big, seductive bowl of sugar. It is a simple game with a few simple rules and is able to start neophytes, even those with computer-phobia, off on the road to computer literacy.

Karel's world is the display tube of the Apple II. (IBM Personal Computer users have been promised their own version.) The left side is an impenetrable wall and so is the lower edge; the rest of the screen is streets (east-west) and avenues (north-south). Karel moves from street corner to street corner, one block per move, and can pick up or put down beepers at corners. He can also turn left.

He does well in the sensory capabilities; he can tell if he is facing north, south, east or west; he can determine if passage is clear ahead, to the left or to the right; he can hear beepers when they are on the same corner he is on; he can determine if his beeper-bag is empty.

The challenge is to navigate Karel about his world—populated with barricades and beepers—picking up or leaving beepers and generally avoiding barricades until his mission is complete and he is turned off. If he runs into a barricade before his mission is complete, he experiences an emergency turn-off. The program fails and the student must find out why.

It just happens that the instructions for Karel look suspiciously like Pascal. (A Language Card is indeed one of the requirements; another requirement is having at least one disk drive.) Presumably, the student never realizes that he is being indoctrinated in structured programming, a Pascal subset language, problem solving via computer programming, debugging programs and desk checking of programs.

Writing easy-to-read programs structured with blocks, indentations, punctuation and small programmer-defined procedures is necessary to "step-wise refine" a set of instructions to get that dumb Karel to do what he should. Karel has an annoying habit of doing exactly what he is told to do.

Karel the Robot is used at the beginning (first four days) of the elementary computer science class at Stanford University where Richard E. Pattis, the program's author, teaches. Karel is used in a similar manner at Berkeley and Carnegie-Mellon as well.

This game for computer-phobes is played by budding computer geniuses as well. Not surprisingly, Karel has been used to help high school students adept in Basic make the transition to Pascal without suffering trauma or future-shock.

Yes, your suspicions are correct. Karel the Robot is named after Karel Capek, the Czechoslovakian playwright who wrote a play entitled *R.U.R.* early in the 1920's. *R.U.R.* (Rossum's Universal Robots) was the introduction of the word "robot" into the English language; the Czech word "robota" means "forced labor."

The course includes no "robota." It

opens with Pattis' 106-page primer *Karel the Robot: a Gentle Introduction to the Art of Programming*. This is so gentle that it is perfectly painless, such a pleasure as a game that the programming principles are as hard to swallow as chocolate drops and jelly beans.

Karel-programmers learn If. . . Then, If. . . Then . . . Else, nested If, Iterate, While . . . Do instructions and variations. They also learn some subtleties such as test reversal of the If, bottom factoring, top factoring, and the dangling Else. The objective is to make programs smaller, simpler, more logical, and—above all—more readable.

The last topics covered with Karel are "beyond-the-horizon" situations and "stepwise refinement." Experienced programmers may know a lot about low-probability conditions that may be beyond their horizon when the code is written—not showing up until their program bombs at the worst possible time. They also know about stepwise refinement which means patching over program bugs as they are discovered. On page 98 Pattis says, ". . . programs we write by using stepwise refinement are especially susceptible to bugs caused by unsatisfied preconditions." Pattis does well in bringing his Karel-programmers to this point without arousing anxieties. This is Computer Aided Instruction at its best.

> Any youngster who gets his hands on Karel and works his way through it is likely to develop a fair competence in Pascal . . .

Four disks, compatible with the UCSD Pascal of the Apple II Language Card, contain all Karel the Robot (125 files in all) example programs and problem solutions. A 59-page booklet that comes with the disk contains the user's manual and all other documentation necessary to bring the system up on your Apple II, be it a one-disk drive system or a two-drive system.

Karel's documentation is easier to follow than the Apple-supplied documentation for the Language Card. Anyone who is really interested in this card, with the intent of learning and using Pascal, would do well to get the Karel package.

Any youngster who gets his hands on Karel and works his way through it is likely to develop a fair level of competence in Pascal and, with a sufficiency of talent, will have a grasp of the fundamentals necessary to become formidable.

Does the need to install the Language Card and set up for UCSD Pascal create a need to learn something about Apple Pascal before turning on Karel? Happily, the answer is a definite "no."

Following the instructions for the test and demonstration, the Karel Primer and the Karel user's manual should enable the user to go through the course with minimal reference to the Pascal documentation until after the Karel course is finished—or at least until he is well into it.

The disks I received with my copy of Karel have only given me two inconveniences. First, this version did not enable me to use the 80-column display furnished by my Videx card. Second, the KAREL2: disk was apparently misnamed KAREL:, a problem that is readily repaired; refer to the C(hange) disk name procedure in the Apple Pascal Reference Manual.

Karel should be expected to provide incentive and confidence for the student in dealing with Pascal.

James F. Derry
Akron, OH

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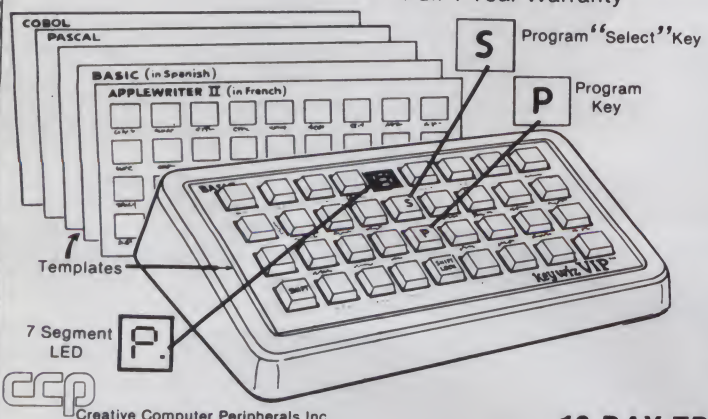

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"DISK ERROR FULL"—once again, I was foiled in my attempt to place a useful utility on my system disk. With my CP/M-based Osborne 1, I have a problem with small disk capacity. I suspect that everyone has small-disk size problems. You can never be too skinny or have too large a disk.

My system disk has a compiler (BDS C), some utilities (e.g., disk directory program and I/O system), and there is little room for the WordStar editor supplied with the Osborne. This editor consumes approximately 60K of disk space, so I am left with the task of switching from disk to disk to case with every compilation. There must be a better way.

So began my search for a smaller editor for the simple task of program creation and editing.

My first thought was the CP/M editor—ED. The line-orientation and its complex syntax immediately convinced me that ED's days were numbered.

I saw an ad for an editor . . . full-screen, modifiable, small and cheap—$29.95. There must be a typographical error, I thought: nobody sells software for less than $50. I was also certain that I had seen this program advertised for about $150. A check of other microcomputer magazines convinced me that the price was correct.

Ellis Computing had also reduced the prices on all its other software (Cobol, Fortran and Pilot, which was reviewed in *Microcomputing*, January 1983). So I purchased the Nevada Edit.

As delivered, the editor comes with an excellent 50-page manual and one disk. The disk is available in virtually any CP/M format desired.

As with any disk, the first step was to make a back-up copy of the original. This step is especially important with Edit, because you must configure the disk for your system. Any mistakes are correctable with a good original.

The hardware requirements for Edit are quite minimal and easily met. Any of the 8080/Z-80/8085 microprocessor family with 32K RAM, a disk drive, keyboard and video screen can use the system.

The thought of configuring a program for your system might scare you, but the Ellis documentation is excellent in guiding you through the procedure systematically.

The first part of the configuration procedure is the running of a program called NVEdit that presents you with a multitude of preconfigured choices. Ellis provides options ranging from the venerable Processor Technology Sol to the Heath or Apple models. Fortunately, the Osborne is listed right there, so the initial configuration was trivial: I pressed one key for system type, and was then directed to select a default file type.

In the unlikely event that your computer is not listed in the two screens of choices, Ellis provides a step-by-step procedure for configuration. Again, the thoroughness of the Ellis product is evident. All you have to do is answer a few questions concerning screen size and cursor positioning, and you will be ready to use the editor.

The program then creates your version of the editor and places it on the disk as EDIT.COM. If you want a slightly more customized editor, you can run a program called EDTKey that allows you to modify the control codes used by the editor.

Again, Ellis has simplified the task with an easy-to-follow set of menu choices. I ran this program to change the default tab settings and to make certain keys behave more like the editor I use at work. I thought there was no sense in learning two sets of command sequences. When completed, EDTKey modifies EDIT.COM to be your totally personalized editor.

Once this is done, you are finished and need to keep only the Edit file and the error message file on disk. Together, they take up only 14K of disk space, so there is still plenty of room for a compiler and some utilities—exactly as I had hoped. Now only one question remained: will it work? A small editor is no good if it's unuseable.

I am pleased to report that the editor has performed flawlessly from the day it was installed. I can now create, compile, correct and recompile programs without ever swapping disks.

The essential editing commands are all present in Edit. You can move the cursor around the screen, scroll through entire screens of information and even move blocks of program from one place to another.

The editor also has several interesting features. When you enter the editor and request a file that is nonexistent, it allows you to create it as you type. Also, the editor tells you how many characters are available for use and how large a program is.

The latter feature is a result of the editor's limitation—having to fit all the text into memory at one time. While you might consider this a serious limitation, I think that with the ability to compile separate portions of a program (as in C or Pascal) for later linkage and execution, this is no great handicap. Besides, how many 48K programs do you write at one sitting? Most of my programs easily fit into memory with the editor.

Ellis has even thought of the situation in which a large file is created. You do get an error message, but you do not lose anything! The editor has a safe exit procedure that allows you to create a continuation file. Even at this extremity of file size, the exception is handled well.

The editor also features an extensive set of understandable error messages. In my mind, FILE ALREADY OPEN is a definite improvement over CP/M's cryptic

(continued on p. 141)

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